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The ASB

BULLETIN

Volume 23, Number 1

January 1976



University of New Orleans Campus on Lake Ponchartrain

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

ASIH Business Meeting: 4 p.m. Friday
Banquet: 7 p.m. Friday
Field Trip: 8-12 a.m. Saturday
ASB Executive Committee Breakfast: 8:30
a.m. Saturday

ASB Banquet

Braniff Place, 7:30 Friday, April 23
\$8.15 inclusive
Tickets will be sold at registration

Paper Sessions

Paper sessions will be held Thursday and Friday from 8 a.m. to 5 p.m. Concurrent sessions will be running and, as a result, papers will begin and end on time. Do not expect to run over your requested time. If you are unable to give your paper for any reason, please inform Dr. Dee Dundee as soon as possible (504/288-3161-Ext. 310. Leave message).

Field Trip

Saturday, April 24. Dr. Stuart Bamforth, Tulane University, in charge. Sign-up during registration.

Family Activities During Sessions

Events are being planned for family members not attending the sessions. Sign-up for the various events will be done during registration.

Exhibits

Hall of the Americas just adjacent to registration.
Open: 8 a.m. to 5 p.m. Thursday
9 p.m. to 11 p.m. Thursday during
the Smoker
8 a.m. to 5 p.m. Friday

Please plan to visit and patronize our exhibitors. Remember that they are the backbone of financial support for these meetings.

Special Events

Smoker: Lobby near Hall of Americas adjacent to exhibits Thursday night 9-11 p.m.
Party: Friday night 9-12 p.m. (Dutch bar)
Place will be announced in program

Local Arrangements Committee

Dr. Dee S. Dundee, *Chairman*
Dr. Stuart Bamforth, Newcomb College, Tulane University — *Field Trip*
Mr. Bill Copeland, University of New Orleans Graduate Student — *Placement Service*
Dr. Dee S. Dundee, University of New Orleans — *Housing, Food, Program*
Dr. John H. Mullahy, Loyola University — *Social Activities*
Ms. Anna Paine and Ms. Maureen Mulino, University of New Orleans Graduate Students — *Registration*
Mr. Mike Rayle, University of New Orleans Graduate Student — *Projection Equipment and Projectionist*
Dr. Dempsey Thomas, University of New Orleans — *Exhibits*

Accommodations

The local committee requests that you plan to stay at Braniff Place for two reasons: (1) it will help your organization with Meeting costs since we get one meeting room free for every 50 guest rooms that we use; otherwise we pay for meeting rooms; (2) it will be easier and just as low cost as staying elsewhere and paying for parking. We are keeping costs as low as possible even though they are higher than when the meeting is on a campus, and we are holding all events at the hotel so that you don't have to go elsewhere. Your cooperation is appreciated.

Spouses — Family Activities

Tour 1 Breakfast at Brennan's
plus brief tour of French Quarter, City Park, New Orleans, Museum of Art and Cemeteries. Guided tour of bayou plantation home, and Longue Vue Gardens. 10:00 a.m.-3:00 p.m.
\$19/person

Tour 2 French Quarter Homes Tour
Guided Tour of Hermann Grima House, private home on Esplanade Avenue and former home of General Beauregard. 9:30 a.m.-12:30 p.m.
\$11/person

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Guest Lecturer for the 37th Annual Meeting of the Association of Southeastern Biologists

The association is fortunate to have Dr. Wes Jackson as guest lecturer for the General Session of the Annual Meeting in New Orleans. Dr. Jackson, Professor of Environmental Studies at California State University, is presently in his second year of a two year leave of absence taken for the specific purpose of carrying out a unique experiment. The chief objective, as he states it, is, "to conduct a broad family experiment in living a life style of low consumption on a near subsistence farm of 28 acres near Salina, Kansas." Such a project can be justified in several ways. As Dr. Jackson views it, "The need for an alternative agriculture is clear to all who have thought about the cost to environmental quality and to our natural resources for the maintenance of our current way of life. How possible such an alternative is without widespread social upheaval occurring is hard to know." The experiment involves a family of five, and the data collected reflect the whims and pleasures as well as the solid needs of two adults and three children ages 14, 12, and 7. The project has both a quantitative and a subjective side. Careful records are kept on the material and energy input for food production and preservation in addition to the human reactions to such work. Many of the recorded comments are decidedly negative. It has taken almost a year to set up the conditions for this experiment. The family now produces most of its food, and Dr. Jackson has experimented with two solar collectors, built a barn from old lumber, and repaired old and useless



machinery to adequate working order. In another 10 months, he expects to have more meaningful data as to whether this back-to-the-land experiment is indeed one of relatively low resource consumption.

Dr. Jackson's forthcoming lecture, entitled, "Toward an Ecological Ethic," has the promise of excitement. It certainly will be addressed to a common interest of the broad and diverse membership of ASB.

ASSOCIATION AFFAIRS

CONSERVATION COMMITTEE REPORTS

Response to the proposed inventory project on rare, endangered and threatened biota (RE&T Biota) of the Southeast has confirmed the appropriateness of this undertaking. Encouraged by membership replies received to date and with endorsement of the Executive Committee of ASB, the Conservation Committee has proceeded with efforts pursuant to its specified goals (January *ASB Bulletin*) including: identification of persons working on RE&T Biota of the Southeast, compilation of a list of state correspondents to the Conservation Committee, and planning of a special session on RE&T Biota for the April ASB meeting.

Over a hundred biologists actively working on RE&T Biota in the Southeast have been identified and over 40 publications lists of RE&T Biota have been received by the Committee. Lists of these biologists (with addresses and activities) and lists of the publications are available from the chairman upon request. Separate mailings of this information have already been made to the biologists included on the lists.

A system of state correspondents to the Conservation Committee (Table 1) is still being developed. Since interests in the area of conservation may be quite diverse, a given state may have multiple correspondents reporting to the Committee. This network of correspondents should improve communications among ASB members and increase awareness of regional and local issues. It has been suggested that the correspondents could (1) help with Committee projects, such as lists of RE&T Biota, (2) report news items on conservation or environmental conflicts for the *ASB Bulletin*, (3) generate resolutions or other items which should be brought to the attention of the ASB membership, and (4) generally maintain an environmental alert system for the ASB, enabling the association to be a more effective force in these matters.

Persons interested in volunteering their services or suggesting a candidate for one of the vacancies as state correspondent are urged to contact the chairman.

To acquaint the membership of the ASB with the scope of activities and level of efforts on matters affecting RE&T Biota and to provide scientists involved in these projects an opportunity to share their approaches and accomplishments, a special session at the April ASB meeting has been planned. Arrangements have been made for a half-day session of invited speakers Thursday April 22. A tentative list of speakers and their topics follows:

- Dr. James D. Williams, USDI, Office of Endangered Species: The Endangered Species Act of 1973: A Review and Explanation
- Dr. Gail S. Baker, USDI, Office of Endangered Species: Endangered and Threatened Plant Program of the U. S. Fish and Wildlife Service
- Dr. Anthony Rekas, Waterway Experiment Station: Rare, threatened and endangered species data and computer information systems developed by the Corps of Engineers
- Dr. Ralph Jordan, Tennessee Valley Authority: The Tennessee Valley Authority and Endangered Species: A summary of Program Development
- Mr. Tom Kitchings, Oak Ridge National Laboratory: Biogeographic Distribution of Endangered Animal Species in the Southeastern Region.
- Dr. James N. Layne, Archbold Biological Station: A Report on Work of the Florida Committee on Rare and Endangered Plants and Animals
- Dr. Billy Hillestad, University of Georgia: Summary of the Status of Endangered and Threatened Vertebrates in the Southeast

(Continued on page 8)

TABLE 1. — Directory of State Correspondents for ASB Conservation Committee.

Name and Address	Area
ALABAMA	
Vacant	
FLORIDA	
Vacant	
GEORGIA	
Dr. George E. Stanton Division of Sciences and Mathematics Columbus College Columbus, Georgia 31907	Georgia, Citizen Conservation Matters
Mr. George Vaught Law Engineering Testing Company 2749 Delk Road, S.E. Marietta, Georgia 30062	Georgia, emphasizing engineering and industrial relations and rare and endangered species, aquatic entomology
Dr. Billy Hillestad Institute of Natural Resources 204 Forestry Building University of Georgia Athens, Georgia 30602	Georgia, emphasizing relations with the Southeast Section of The Wildlife Society
ILLINOIS	
Dr. Robert H. Mohlenbrock Chairman, Department of Botany Southern Illinois University Carbondale, Illinois 62901	Illinois, rare and endangered species of plants in Illinois
KENTUCKY	
Dr. William H. Martin General Studies Science Program Central University College Eastern Kentucky University Richmond, Kentucky 40475	Eastern Kentucky, Red River Gorge Project
LOUISIANA	
Dr. Martin A. Piehl Department of Botany Louisiana State University Baton Rouge, Louisiana 70803	Louisiana, vascular plants
Dr. Mary G. Curry VTN Engineers Planners 2701 Independence Street Metairie, Louisiana 70002	Louisiana, rare, endangered and threatened biota
MISSISSIPPI	
Vacant	
NORTH CAROLINA	
Mr. David DuMond Rt. 2, Box 361 CCC Wilmington, North Carolina 28401	Southeastern North Carolina
Dr. Robert P. Teulings N.C. Department of Natural and Economic Resources P.O. Box 27687 Raleigh, North Carolina 27611	Research Triangle (= Central) North Carolina. Natural Areas Inventory
SOUTH CAROLINA	
Dr. Joseph N. Pinson, Jr. University of South Carolina Coastal Carolina Regional Campus Conway, South Carolina 29526	South Carolina

TENNESSEE

Dr. Ralph Jordan, Jr.
Wildlife Management and Planning Division of Forestry, Fisheries, and Wildlife Management
Tennessee Valley Authority
Norris, Tennessee 37828

East Tennessee, emphasizing ASB relations with TVA

Dr. Diane Nelson
Department of General Education
College of Education
East Tennessee State University
Johnson City, Tennessee 37601

Tennessee

Mr. Monty Halcomb
Cumberland Museum
800 Ridley Avenue
Nashville, Tennessee 37203

Tennessee, emphasizing Tennessee Heritage Program

VIRGINIA

Vacant

WEST VIRGINIA

Vacant

(Continued from page 6)

Dr. William H. Martin, Eastern Kentucky University: The Red River Gorge Controversy in Kentucky, A Case Study in Preserving a Natural Area

Dr. Monty Halcomb, Tennessee Heritage Program: The Tennessee Heritage Program, Contributions to Data Management of Endangered and Threatened Species.

The call for papers for the general meeting also included a section on "Rare and Endangered Species" as a means of accommodating ASB members who wish to contribute such papers.

The Conservation Committee urges you to make suggestions and to supply constructive critical comments regarding this project. The quality and usefulness of the inventory will depend largely upon the degree of cooperation and responsiveness of the ASB membership. Your participation and insights are solicited and welcomed. Contact the chairman today. — *C. E. Styron, Chairman, ASB Conservation Committee, Division of Mathematical, Natural and Health Sciences, St. Andrews Presbyterian College, Laurinburg, North Carolina 28352 (Tel: 919/276-3652, Ext. 351)*

MORE ON ASB TRAVEL AWARDS TO GRADUATE STUDENTS

At its October meeting in Atlanta, the ASB Executive Committee allocated \$1000 for the 1976 Travel Awards to help defray expenses of graduate student members who will be attending the New Orleans Meeting. The awards are intended primarily to help cover the cost of meals and lodging while the student is at the meetings. It is envisioned that travel of graduate students will usually be sponsored by faculty members from the same institution.

Time and Place of Future Meetings

1976	April 21-23	Braniff Place (formerly the Jung Hotel), New Orleans
1977	April 14-15	University of North Carolina, Raleigh
1978	April 13-15	University of Alabama, University, Alabama
1979		University of Tennessee, Chattanooga

ELTON CROMWELL COCKE

January 31, 1901 – January 23, 1975

Elton Cromwell Cocke was born at Rockville, Hanover County, Virginia, the son of Merton Ashley Cocke and Robertine (Tober) Cocke. He was a direct descendant of Richard Cocke, who came to Virginia from England before 1628. His undergraduate education was at the University of Richmond and the University of Virginia. After receiving his M. S. degree at the University of Virginia, he taught for one year at Radford College. He received the Ph.D. degree from the University of Virginia in 1931, and remained on the teaching staff there until he accepted a position at Wake Forest in 1938. Dr. Cocke taught at Wake Forest until his retirement in 1971, and remained active in the Department of Biology until his death.

Dr. Cocke saw the Biology Department of Wake Forest grow from two full time members to a faculty of sixteen. Much of this growth occurred under his able direction as department chairman. However, he always thought of himself primarily as a teacher. His courses were famous for their rigor, but his enthusiasm, thorough preparation, broad scholarship, and fairness won the loyalty and praise of his students, who numbered more than 12,000. His distinguished teaching was recognized in 1970 when he received the Meritorious Teaching Award of the Association of Southeastern Biologists.

Despite his heavy teaching and administrative responsibilities, Dr. Cocke maintained an active interest in research and scholarship throughout his career. His 1943 work, *Outlines of Lectures in General Biology*, went through six editions. His authoritative book *The Myxophyceae of North Carolina* appeared in 1967, and his *Trees and Shrubs of North Carolina*, written after he retired, was published in 1974. Primarily a botanist, Professor Cocke was trained in the broad tradition of Natural History and resisted compart-



mentation. His early studies dealt with fossil and extant pollen. His later interests were chiefly in the areas of phycology and dendrology. Equally at home with botanical and zoological materials in the classroom, he insisted on the broader synthesis rather than the narrow view.

Throughout his career, Dr. Cocke was active in regional and national professional organizations. He was a past president of the North Carolina Academy of Science, had been a member of the Virginia Academy of Science for 46 years, and was a frequent attendant at ASB meetings. With his passing, ASB has lost one of its ablest, most loyal and most valued members.

Dr. Cocke is survived by his wife, Virginia Webb Cocke, whom he married while they were students at the University of Virginia; two daughters, Virginia Cocke Bloch and Mary Gilmer Cocke Van Poole; a brother, and several grandchildren.

—WALTER S. FLORY AND MARGARET Y. MENZEL

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State Univ.
Florida — Position vacant
Georgia — Fred K. Parrish, Georgia State University
Kentucky — Gary E. Dillard, Western Kentucky University
Louisiana — Harry J. Bennett, Louisiana State University

Mississippi — Jon R. Fortman, Mississippi University for Women
North Carolina — Maurice Whittinghill, University of North Carolina at Chapel Hill
South Carolina — G. Thomas Riggan, Jr., Newberry College
Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Dr. Kenneth Lewis (Ph.D. Ohio University) has been appointed Assistant Professor of Biology in the Biology Department, University of Alabama, Huntsville. His areas of expertise are plant ecology, plant taxonomy and biosystematics.

Elizabeth R. Golden has joined the botany and microbiology faculty at Auburn University as an Instructor in the general biology program. Ms. Golden holds the M.S. degree in botany from the University of Tennessee. C. G. P. Pillai has been appointed as a Research Associate to conduct investigations on the fate and effects of atrazine in salt marsh ecosystems. Dr. Pillai received his Ph.D. degree in plant physiology from the Banaras Hindu University in Varanasi, India. A grant from the Research Corporation of Atlanta, Georgia has been awarded to Dr. John D. Weete of the Department of Botany and Microbiology, Auburn, to investigate "Regulation of Squalene Synthetase and 2,3-Oxidosqualene-Sterol Cyclase during Sporulation in *Rhizopus arrhizus*."

The following appointments have been made in the Department of Biology, University of Alabama in Birmingham: Dr. George B. Cline promoted from associate to full Professor. He was also elected Department Chairman and will serve a three year term in the rotating chairmanship program. Dr. Robert MacGregor III, promoted to Assistant Professor of Biology after receiving his Ph. D. in physiology from Louisiana State University. Dr. Jens Steensgaard has been named as Visiting Professor. He is Vice Chairman of the Institute for Medical Biochemistry at the University of Aarhus, Denmark. He is working with Dr. George Cline on computer models of antigen antibody interactions. Dr. James T. Tidwell joined the faculty as an Assistant Professor. Dr. Tidwell, a geneticist, comes to the University of Alabama in Birmingham from Roswell Park Memorial Cancer Center in Buffalo, N.Y. Dr. Wendell Wall has been appointed Assistant Professor of Biology and Coordinator of Freshman Studies. Dr. Wall was previously located at Birmingham Southern College. The following individuals have received grants to the Department of Biology, University of Alabama, Birmingham:

Dr. David T. Jenkins, "Taxonomic, Cultural and Biochemical Investigation of the Genus *Amanita* (Fungi: Basidiomycetes) for North America"; Dr. Robert MacGregor III, "Development of Radioimmunoassays for Avian Prolactin and Luteinizing Hormone using the Coturnix Quail"; Dr. Joseph J. Gauthier, "Phenol Degradation in an Industrial Waste Treatment Plant"; Dr. Daniel D. Jones, "Macromolecular Composition and the Cell Cycle of the Blue-Green Alga *Microcystis aeruginosa*"; Dr. Ken R. Marion, "Characterization of the Intestinal Microbial Flora of the Reptile, *Sceloporus undulatus*"; Dr. James T. Tidwell, "Synthesis and Modification of tRNA in the Cell Cycle"; Dr. George B. Cline, "Molecular and immunologic characteristics of bovine fetal plasma membrane glycoproteins".

Ornithologist Dr. Henry Stevenson, Professor of Biology at Florida State University, has retired. Dr. Kurt Hofer, Florida State University, has received notice of support from the Public Health Service for his project entitled "Cell Population Kinetics as a Factor in the Olfactory System".

Thomas C. Emmel has been appointed the new Chairman of the Department of Zoology at the University of Florida. Robert M. DeWitt is Associate Chairman and Graduate Coordinator. Donna J. Howell has joined the staff as Assistant Professor of Zoology, following three-post-doctoral years at Princeton.

Gerald J. Miller was awarded the Ph.D. degree in Botany by the University of Georgia and is currently an Instructor in the Department of Biology at Agnes Scott College.

Dr. Lafayette Frederick, Professor and Chairman of the Department of Biology, Atlanta University, has been appointed chairman of the General Research Support Program Advisory Committee of the Division of Research Resources of the National Institutes of Health. Dr. Frederick was also elected President-elect of the Georgia Academy of Sciences. The following faculty have received grants in the Department of Biology, Atlanta University: Dr. Judith R. Lumb, recipient of Career Development Award from the National Institutes of Health; Dr. Enola L. Stevenson, recipient of Post-doctorate fellowship from Minority Access to Research

Careers Program of the National Institutes of Health. Dr. Stevenson is spending 12 months in the laboratories of Dr. Theodore Diener, Bureau of Plant Industry, United States Department of Agriculture, working on protoplast culture and viroids. Dr. Gustav Ofofu is engaged in post-doctoral research as a member of a research group at the Albert Einstein Medical College.

Appointments to the Department of Biological Sciences of Murray State University are: Dr. Robert Goetz (Ph.D. Iowa State University), physiology; Mr. James Sickle (Ph.D. Candidate, Emory University), invertebrate zoology, limnology and ecology. Dr. Evelyn Cole, who had taught at Murray State for 15 years, has retired. Dr. Cole taught general biology, invertebrate zoology and human anatomy and physiology, and received her Ph.D. from Vanderbilt University in Zoology. Mr. C. Wesley Kemper, Assistant Professor of Biology has also retired after 35 years at Murray State where he taught field biology and ornithology. Dr. Morgan Sisk of Murray State University has received the following grants: "Kentucky-Barkley Lakes Catfish Study", funded by the U.S. Fish and Wildlife Service and Ky. Fish and Wildlife Resources; "Ky. Embayment Study", funded by the Ky. Water Resources Research Institution; "Parasites of Ky. and Barkley Lake Fishes" and "Fishes of the Mayfield Creek Drainage System". Dr. Robert G. Johnson, Murray State, has received a grant to study the "Comparative Protein Population Investigations of the Cornus Complex." Dr. C. D. Wilder and Dr. Robert G. Johnson have also received a grant to make "A Preliminary Ecological Study of Stream Drainage Systems of the Jackson Purchase".

Professor Frank Afeman retired in May 1974 from the Department of Zoology, Louisiana Tech University. Dr. Larry Sellers from Iowa State University was hired to replace Professor Afeman.

Dr. Paul Ramsey joined the Zoology faculty at Louisiana Tech from the Department of Biology, Presbyterian College, South Carolina. He replaces Dr. James Bogart who went to the University of Guelph in Canada. Dr. Ramsey will be teaching advanced genetics, histology and evolution.

Dr. William W. Miller III has been promoted to the rank of Professor in the Department of Biology, Northeast Louisiana State University. Dr. David Kee, Northeastern Louisiana State University, has received a grant for parabolic microphone and recording equipment for ornithological research.

A five year research grant has been awarded to Drs. Syed M. Z. Naqvi, Nusrat Z. Naqvi and Abdul Latif, of the Department of Biology, Alcorn State University, Lorman, Mississippi by the United States Department of Agriculture, effective 1976-1981. The grant is entitled, "Toxicity and Ecological Effects of Selected Insecticides and Herbicides". A research laboratory will be built at Alcorn State with funds available through this grant.

The following individuals have joined the botany faculty at the University of North Carolina, Chapel Hill: Dr. Patricia G. Gensel (Ph.D. University of Connecticut), Assistant Professor of Botany; Dr. Ann G. Matthyse (Ph.D. Harvard), Assistant Professor of Botany; Dr. Robert K. Peet (Ph.D. Cornell), Assistant Professor of Botany. Dr. Albert Radford, University of North Carolina at Chapel Hill, has been on leave during the fall semester working on the Southeastern Flora, Volume 1 (of 4 volumes). Dr. H. Eugene Lehman will be teaching embryology to graduate students at the University of Vienna, Austria and at Ischia, Italy this coming summer.

Dr. Janice Coffey, Queens College at Charlotte, N.C., has returned from a second period of work in herbaria of the USSR. She welcomes correspondence from anyone interested in information about botanical work going on in the USSR.

Dr. Joab L. Thomas has been appointed Professor of Botany and Chancellor of North Carolina State University effective January 1, 1976. Dr. Thomas is now Vice-President for Student Affairs and Professor of Biology at the University of Alabama in Tuscaloosa. Dr. Tom R. Wentworth (Ph.D. Cornell University) has been appointed Assistant Professor of Botany. Dr. R. W. Seibert is Visiting Associate Professor of Botany during 1975-76 filling the position of Dr. C. E. Anderson who is on leave to the Environmental Protection Agency in the Research Triangle Park. Dr. Hugo Rogers (Ph.D. University of North Carolina, Chapel Hill) has joined the faculty as a Research Associate to work on a USDA cooperative air pollution program. Mrs. Francis Moorman has also joined the faculty at NCSU as a Visiting Instructor in Botany to teach in the general biology program. Her M.S. degree is from the University of Vermont. Dr. A. W. Cooper resigned as Professor of Botany at NCSU to join the faculty of the School of Forest Resources.

Grants have been awarded to the following NCSU Botany faculty: L. M. Stroud and Dr. E. D. Seneca for an "Analysis of the Effects of the Brunswick Nuclear Power Plant on the Productivity of *Spartina alterniflora* in the Oak Island Saltmarsh"; Dr. A. W. Witherspoon "Phytoplankton Response to Water Quality in the Chowan River Estuary" from the Water Resources Research Institute; Dr. R. C. Fites "Changes in Free and Phosphorylated Thiamine Levels during Germination Initiation in Soybeans" from the North Carolina Soybean Producers Association.

Dr. Carl W. Helms, formerly Associate Professor of Zoology and Coordinator of Graduate Studies, University of Georgia has joined the faculty of Clemson University as Professor and Head of the Department of Zoology. Michael W. Monahan, from Indiana University and Catherine F. Sigmon, Darrell C. Yardley and Mary Ann Allan, all from the University of Georgia, have also joined the faculty ranks of Clemson's Department of Zoology.

Dr. Robert Morgan has joined the Biology staff at Union University. He will be teaching biochemistry and physiology.

Professor Dean P. Whittier has been appointed Chairman of the Department of General Biology at Vanderbilt University. **Professor Whittier** replaces **Burton J. Bogitsh** as chairman. Three grants have been awarded to two faculty members of the Department of General Biology: **Dr. Robert Kral** received a grant from the U.S. Forest Service, U.S.D.A. and **Dr. Burton J. Bogitsh** received two grants from the Edna McConnell Clark Foundation and the U.S. Army.

Dr. Sandy Echternacht has joined the faculties of the Graduate Program in Ecology and Department of Zoology at The University of Tennessee. **Dr. Echternacht** will offer courses and direct graduate research in ecology and herpetology. **Dr. Gary Saylor** has joined the faculties of the Graduate Program in Ecology and Department of Microbiology. **Dr. Saylor** will offer courses and direct graduate studies in microbial ecology. **Dr. Echternacht** and **Dr. Saylor** will occupy two of eight new ecological research laboratories obtained from the National Institutes of Health. Other ecology laboratories will be devoted to research in marine ecology, limnology, radiation ecology, animal behavior and physiological ecology.

Royal F. Ruth, recently of the University of Alberta, Edmonton, Alberta, Canada has been appointed Head of the Biology Department, Washington and Lee University. **Gary Hobson Dobbs III** (Ph.D. University of California) has been appointed Assistant Professor at Washington and Lee.

New faculty in the Biology Department at Virginia Commonwealth University include: **Fred Landa** (Ph.D. Kansas State) coming from the University of Missouri; **James Gates** (Ph.D. Missouri) from Randolph-Macon College; **Sara McCowen** (Ph.D. Virginia Commonwealth Univ.); **Robert Maher** (Ph.D. Southern Illinois) from Southern Illinois and **Robert Fisher** (Ph.D. Syracuse) coming from Michigan State University.

Dr. Vivian T. Mah (Ph.D. in Microbiology) has joined the faculty in the Biology Department, Radford College as Associate Professor of Biology. **Mrs. Virginia Tipton** has also been appointed to the faculty as Instructor of Biology.

The Department of Biology at Virginia Polytechnic Institute announces the following additions to their faculty: **Dr. Judith G. Croxdale**, Assistant Professor of Botany; **Dr. Asim Esen**, Assistant Professor of Botany; **Dr. Duncan M. Porter**, Associate Professor of Botany, coming from The National Science Foundation where he was Associate Program Director for Systematics; **Dr. Carl E. Schwaab**, Assistant Professor of Zoology and **Dr. Jackson R. Webster**, Assistant Professor of Zoology.

Jane C. Belcher has retired from the Department of Biology, Sweet Briar College. She has been replaced by **Thomas Long**, a molecular biologist, interested in the evolution of genetic systems. **Margaret Simpson** has

replaced **Miriam Bennett** in invertebrate zoology. A grant from the U.S. Department of Health, Education and Welfare for Studies in International Environment has been received at Sweet Briar College with **Milan Hapoke** director. A symposium on a No-Growth Society will be held in the spring of '76 at Sweet Briar College.

About Institutions

The Department of Zoology, along with other departments in the Division of Biological Sciences at the University of Florida, is in the process of developing a Core Curriculum for all majors in biological disciplines. Also the University of Florida Department of Zoology is now completely moved into a seven-floor, two-building Bartram Hall complex of new offices, research laboratories, and teaching laboratories.

The University of Alabama at Huntsville is offering a new M.S. degree in biology as a cooperative program between the University of Alabama in Huntsville and Alabama A&M University. Major areas are microbiology, physiology, entomology, molecular biology and ecology/systematics.

The Biology Department of Wesleyan College is conducting a January Study-Tour in the Amazon headwaters of Ecuador. Students will study the rich flora and fauna of the tropical area of eastern Ecuador. The Study-Tour is under the direction of **Patricia H. Lewis**.

The Murray State University Biological Station was completed in the fall of 1972. The one-half million dollar station is located in southwestern Kentucky. It has seven laboratories, numerous classrooms, a library, darkroom and living quarters for visiting scientists. The M.S. or M.A.T. in biology may be completed at the station during summer sessions.

New physiograph equipment was recently purchased with funds from a NSF Undergraduate Scientific Equipment Grant by the Department of Zoology at Louisiana Technological University. The grant was awarded to **Dr. Robert W. Flournoy** for \$9,800.

The National Science Foundation has awarded funds for establishment of a scanning electron microscope facility to the University of Southern Mississippi. Total funds amount to more than \$103,000. The facility will be utilized in research projects being conducted by the biology, chemistry, geology and polymer science departments. New equipment recently acquired by the Department of Biology at the University of Southern Mississippi includes: an advanced metals research 1000 A scanning electron microscope; a Kevex energy dispersive X-ray spectrometer; a Denton critical point dryer and darkroom facilities for the scanning electron microscope.

The Master of Science in Ecology degree will be given at North Carolina State University and will be administered by the Ecology faculty in the departments of zoology, botany, forestry, soil science, entomology, plant pathology and biomathematics.

(Continued on page 14)

Books and Periodicals

THE REPTILES AND AMPHIBIANS OF ALABAMA. Robert H. Mount. viii + 347 pp. Auburn Univ. Agr. Expt. Sta. 1975. \$4.20. (Softbound)

Culminating 13 years of combined research by the author, his students, and colleagues, this book is an important advancement in the knowledge of the herpetofauna of the southeastern United States. Mount has produced both a superb state faunal survey replete with original data, and an in-depth scholarly treatment of many taxonomic problems. The bulk of this publication consists of 187 accounts of species and subspecies of salamanders, frogs, lizards, snakes, and turtles of Alabama. In addition, there is a checklist of species and subspecies, and taxonomic keys to all groups including tadpoles (but no key to salamander larvae). Other sections of the book concern Alabama herpetological history, subspecies philosophy, climate, herpetogeography, problematical forms, introduced species, collecting and preserving, care in captivity, and snakebite treatment. Rounding this off is a glossary of terms, an extensive literature section, and an appendix treating threatened and endangered forms in the state.

The text is profusely illustrated with 189 black and white photographs and 134 distribution maps (Alabama localities indicated specifically by dots; U.S. distribution indicated by insert map). Each species or subspecies account contains a description, Alabama distribution, and habits (new data presented on life history and ecology for many species) section. For 70 species and subspecies there is also a remarks section under which Mount discusses geographic variation in Alabama and its possible bearing on taxonomy. In addition, there are 9 tables presenting meristic data on geographic variation in 2 lizards, 6 snakes, and 1 turtle. And for 4 taxa (*Eurycea bislineata*, *Necturus*, *Lamphropeltis triangulum*, *Pseudemys concinna*) Mount presents data and penetrating taxonomic discussions which may bear heavily in future revisions.

I found this book to be well-organized and clearly written. The checklist, keys to identification, descriptions of species, glossary, instructions for collecting, preserving, and care in captivity, should be invaluable aids to the layman learning the fauna, while the distribution maps and the remarks and habits sections under each species account contain much that is new and useful to the professional biologist.

The most serious criticisms are that the photographs are too grainy and the crosshatching and stippling on distribution maps are often not bold enough to see clearly without close inspection. Overall, its value as a

state faunal synthesis and its empirical contributions make this book an outstanding bargain at \$4.20 in these days of high book prices. A copy should be in the possession of everyone interested in amphibians and reptiles. — *D. Bruce Means, Tall Timbers Research Station, Route 1, Box 160, Tallahassee, Florida, 32303.*

BIOLOGY OF LICHENS (2nd Edition). Mason E. Hale. 181 pp. American Elsevier Publishing Co., New York. 1975. \$17.50 cloth; \$8.50 paper.

This second edition is essentially a reprint of the first (1967), but with up-dating consistent with progress in the field. Fifty-two new references are cited, these being interspersed as "A," "B," etc., between the 289 bibliography numbers of the first edition. The two greatest changes found in the new edition are (1) the partial re-writing of Chapter 6 on "Ecology and Succession" better reflecting "some of the European methods of phytosociology;" and (2) the replacing of a number of illustrations, with a few of the new ones being scanning E.M. ones.

The additions and revisions add to the luster of this brief tome which summarizes — expertly, concisely and clearly — the considerable volume and span of the work now encompassed in the field of lichenology. — *Walter S. Flory, Wake Forest University*

PRINCIPLES OF ANIMAL PHYSIOLOGY (2nd Edition). Dennis W. Wood. 342 pp. illust. American Elsevier Publishing Co., New York. 1974. \$19.50 cloth; \$11.75 paper.

Quite deliberately, as he writes in his introduction, Dennis Wood declines to distinguish between "general" and "comparative" physiology since "the distinction . . . is artificial. . . ." This is a risky approach since it can result in an incomplete coverage of the most simple principles underlying physiology. The author has taken the risk but has by and large avoided its inherent dangers. The result is a text which, better than most, provides a bridge between high-school level biology and that of the first college years. It is well written. Such books are usually dull. In this one Dennis Wood talks to, and not at, his reader, and his own enthusiasm for his subject is occasionally infectious.

In comparing the first edition with this latest it becomes apparent that, with the exception of dropping several illustrations and adding few new ones, little has

changed. Several chapters have had their texts broadened, bringing about an overall improvement.

Basically, the fourteen chapters of this book can be broken down into three sections representing three different approaches. Apart from an introductory chapter the first seven chapters deal with the cell and its physiology and are written with a biochemical slant. To give depth the author then explores his topic from a phylogenetic viewpoint. These seven chapters concern energetics, cell organization and function as well as respiration, metabolism, excretion, osmotic and ionic regulation, hydrogen balance and temperature relations. In stressing phylogenetic information the author has sacrificed a mechanistic approach. Structure-function relations are only partially exploited.

The next four chapters have been greatly improved. They concern nervous and muscular physiology with a very well written section on bioelectricity. The approach here is typically mechanistic and classical. Little phylogeny is necessary since the author restricts himself to the fundamentals of excitable tissue. The author has taken time to explain phenomena that are normally difficult to comprehend. This middle section is undoubtedly the best.

The final two chapters in the book deal with the hormones and an introduction to a systems approach to homeostasis. In the chapter on hormones the phylogenetic angle again is used. However, little is said about why the hormones work the way they do. Invertebrate endocrinology is introduced and is a welcome addition to endocrine physiology. With the exception of a study on regulatory activity of the adrenals this chapter is relatively weak. The last chapter is an introduction to systems physiology and gives the book an added, and necessary, dimension.

On the back of the cover of the book we are reminded that the book is aimed "not only for university students but also for students in colleges of education and sixth-form." It will not satisfy the depth or scope of a course designed for college juniors or seniors. More likely, the freshman or new biology major will find this book well within his or her capabilities.

This book certainly does "fill the gap" between high school biology and advanced biology majors and, because of its readability, could be used as a platform from which to begin the study of physiology. — *Hugo C. Lane, D.Sc. Wake Forest University*

(Continued from page 12)

The Eighteenth Southeastern Developmental Biology Conference will meet at Clemson University on 19-21 March 1976. The theme of the conference will be Regulation of Gene Expression. Anyone interested in further information is invited to write to the conference director, **Dr. Doris R. Helms**, Department of Biochemistry, Clemson University, Clemson, S.C. 29631.

Union University has moved into new academic facilities in the northwest part of Jackson, Tennessee.

The Biology Department at Virginia Commonwealth University has expanded into the facilities formerly used by the Chemistry and Physics departments. The net gain is six teaching labs, eight research labs, and twelve offices.

Radford College opened a new degree program this year for majors in Medical Technology. Students will spend three years on campus and will go to the University of Virginia Hospital, Roanoke Community Hospital or Roanoke Memorial Hospital for study during the fourth year. **Dr. Steve D. Chalgren** is the Director of the Medical Technology Program.

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

Emeritus Membership

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg*, Carolina Biological Supply Company, Burlington, N.C. 27215.

(Continued from page 4)

Tour 3 Streetcar Party and City Tour

Brief tour of French Quarter, bayou plantation homes, New Orleans Museum of Art, Cemeteries, and Garden District. Streetcar party riding along St. Charles Avenue with refreshments. 2:00 p.m.-5:00 p.m. \$8/person

Tour 4 Garden District Walking Tour

Visit private home and old cemetery. Complete party luncheon at Commander's Palace Restaurant. 9:30 a.m.-1:30 p.m. \$15.50/person

Tour 5 Mississippi River Road Plantation Tour

Three plantation homes — Home cooked creole or Southern style luncheon. 9:00 a.m.-4:45 p.m. \$22/person

Tour 6 Bayou Cruise

on the sternwheeler Cotton Blossom Down the Mississippi, through the Algiers Lock, along Bayou Barataria in Jean Lafitte Country return via the Harvey Canal and Harvey Lock. 11:00 a.m.-4:15 p.m. \$6/adult, \$3/child 6-12

Please reserve space for:

..... persons for Tour #..... for Thursday, April 22, 1975

..... persons for Tour #..... for Friday, April 23, 1975

Please send your reservation list designating the number of persons, tour number and date to *Rev. John H. Mullahy, S.J., Department of Biological Sciences, Loyola University, New Orleans, Louisiana 70118* by April 1, 1976.



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The ASB

BULLETIN

Volume 23, Number 2

April 1976



Wintertime in the Red River Gorge

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

ASB BULLETIN

Volume 23, Number 2 - April 1976

The ASB BULLETIN is the official quarterly publication of the Association of Southeastern Biologists, Inc., and is published at Philadelphia, Pennsylvania in January, April, July and October. Letters and other contributions, as well as all communications about editorial matters should be addressed to Dr. Margaret Y. Menzel, Editor, Department of Biological Sciences, Florida State University, Tallahassee, Florida 32306. News items should be sent to the News Editor, Dr. Jon Fortman, Department of Biological Sciences, Mississippi University for Women, Columbus, Miss. 39701. Inquiries about missing numbers and other circulation matters should be addressed to Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pa. 19103. Subscription orders from institutions should be sent to the Business Manager, Dr. R. O. Flagg, Carolina Biological Supply Co., Burlington, North Carolina 27215. Subscription rate for non-members of the ASB: \$10.00 per year. Printing and typography by the Fulton Press, Inc., Lancaster, Pa. Second-class postage paid at Philadelphia, Pennsylvania.

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COVER

This picture of the Wild River Section of the Red River Gorge in Kentucky was taken January 10, 1976 by William H. Martin, Department of Biological Science, Eastern Kentucky University. Cliff Rock is Pennsylvanian sandstone. Beech and hemlock forests are found in the Gorge. Pine communities are located on top of the cliffs, on the surface for the Cumberland Plateau. One such community is visible atop the cliff in the center of the picture. The Gorge ecosystem is one of the topics to be discussed at the Symposium on Rare, Endangered and Threatened Biota of the Southeast at the Annual Meeting (see page 29).



Program of the 37th Annual Meeting of the Association of Southeastern Biologists

Braniff Place
New Orleans, Louisiana
(University of New Orleans, Host)

A joint meeting with the Southeastern Section of the Botanical Society of America, the Southern Appalachian Botanical Club, the Southeastern Region of Beta Beta Beta National Honorary Biological Society, and the Southeastern Society of Parasitologists.

Wednesday, April 21, 1976

4:00-10:00 P.M. REGISTRATION

Lobby near Hall of Americas

Fees: \$4.00 Registration

8.15 Banquet. Deadline:

Noon Thursday, April 22

Field Trip Registration: Deadline:
Noon Thursday, April 22

Thursday, April 22, 1976

8:00- 5:00	REGISTRATION Lobby near Hall of Americas	12:30- 2:30	LUNCHEON, Southeastern Society of Parasitologists at Delmonico's Restaurant . Speaker: <i>Dr. Paul Beaver</i> of Tulane University, School of Tropical Medicine
8:00- 5:00	PLACEMENT SERVICE Room 6		
8:00-12:00	PAPER SESSIONS AND PRE- SIDERS Animal Ecology in Room 2 : <i>Dr. William D. Burbank</i> Aquatic Ecology in Room TS 3, 4, 5 : <i>Dr. Arthur L. Buikema</i> Ichthyology and Herpetology in Room 4-5 : <i>Dr. Robert Shipp</i> Plant Ecology in Room 1 : <i>Dr. Meredith Lieux</i> Animal Physiology in Room 9 : <i>Dr. T. L. Lawrence</i> Plant Systematics in Room 7 : <i>Dr. Mary G. Curry</i>	8:00- 5:00 1:00- 5:00	EXHIBITS in Hall of the Americas PAPER SESSIONS AND PRE- SIDERS Aquatic Ecology in Room TS 3, 4, 5 : <i>Dr. Michael Poirrier</i> Ichthyology and Herpetology in Room 4-5 : <i>Dr. Sam Rogers</i> Plant Ecology in Room 1 : <i>Dr. Steven Whiple</i> Animal Physiology in Room 9 : <i>Dr. Marilyn Coleman</i> Plant Systematics in Room 7 : <i>Dr. Loran C. Anderson</i> Rare & Endangered Species in Room 2 : (Invited Papers. Followed by Contributed Papers) <i>Dr. Clarence Styron</i>
11:00	BUSINESS MEETING, Southeastern Society of Parasitologists in Room 3.		

- 3:00- 5:00 Parasitology in **Room 3**: *Dr. Sharon Patton*
- 3:00 EXECUTIVE COMMITTEE MEETING, Association of Southeastern Biologists in **Room 10**
- 7:00 P.M. GENERAL SESSION in **Tulane Room**
Address of Welcome: *Chancellor Homer Hitt*, University of New Orleans
- 9:00-11:00 P.M. SMOKER in **Lobby** near **Exhibits and Registration**
- 9:00-11:00 P.M. EXHIBITS in **Hall of Americas**
- Response: *Dr. Perry Holt*, President, Association of Southeastern Biologists
Guest Lecturer: *Dr. Wes Jackson*, Professor Environmental Studies, California State University, Sacramento

Friday, April 23, 1976

- 7:30 BUSINESS MEETING, Southeastern Section of Botanical Society of America and the Southern Appalachian Botanical Club in **Room 10**. Dutch Treat Breakfast
- 8:00 PAST PRESIDENT'S BREAKFAST, Association of Southeastern Biologists in **Room TS 1, 2** (6th floor)
- 8:00-12:00 REGISTRATION in **Lobby** near **Hall of the Americas**
- 8:00- 5:00 EXHIBITS in **Hall of the Americas**
- 8:00- 5:00 PLACEMENT SERVICE in **Room 6**
- 8:00-11:00 PAPER SESSIONS AND PRE-SIDERS
Aquatic Ecology in **Room TS 3, 4, 5**: *Dr. George Vaught*
Ichthyology and Herpetology in **Room 4-5**: *Dr. Carter Gilbert*
Plant Ecology in **Room 1**: *Dr. Dempsey Thomas*
Parasitology in **Room 3**: *Dr. Ardis L. Cramer*
- 9:30 *Bicentennial Symposium*, Southeastern Society of Parasitologists
Cryptogamic Botany in **Room 2**: *Dr. William J. Koch*
Invertebrate Zoology in **Room 9**: *Dr. Rudolph Prins*
- 11:00 BUSINESS MEETING, Association of Southeastern Biologists in **Room TS 1, 2**.
- After Business Meeting ORGANIZATIONAL MEETING, Southeastern Chapter of Ecological Society of America in **Room 10**: *Dr. Frank McCormick*
- 1:00- 5:00 PAPER SESSIONS AND PRE-SIDERS
Aquatic Ecology in **Room TS 3, 4, 5**: *Dr. James R. Reed*
Cryptogamic Zoology in **Room 2**: *Dr. Shirley C. Tucker*
Invertebrate Zoology in **Room 9**: *Dr. Stuart Bamforth*
Animal Ecology in **Room 3**: *Dr. Marvin L. Wass*
Cytology and Genetics in **Room 4-5**: *Dr. Margaret Y. Menzel*
Plant Physiology and Morphology in **Room 7**: *Dr. J. K. Shull*
Beta Beta Beta in **Rooms TS 1 and 2**: *Dr. John Mullahy*
- 4:00 BUSINESS MEETING, Southeastern Section of American Society of Ichthyology and Herpetology in **Room 1**
- 7:00 P.M. BANQUET AND PRESENTATION OF AWARDS in **Tulane Room**
Cocktails available at 6:30 at cash bar in **Tulane Room**
Association Research Prize: Sponsored by Carolina Biological
Meritorious Teaching Award: Sponsored by Scientific Products
- 8:30 P.M. RETIRING PRESIDENT'S ADDRESS: *Dr. James Dent*
- 9:00 P.M. END OF MEETING PARTY in **Room 1**
Dutch Bar

8:00-12:00 FIELD TRIP to observe fauna and flora of a south Louisiana swamp (Sign up must be made during registration). *Dr. Stuart Bamforth* in charge.

8:30 A.M.

EXECUTIVE COMMITTEE BREAK-FAST, Association of Southeastern Biologists in **Room 10**.

SCHEDULE OF PAPER SESSIONS

THURSDAY MORNING — APRIL 22

ANIMAL ECOLOGY, SESSION I

ROOM 2

Presiding: *William Burbanck*

- | | | | |
|------|---|-------|--|
| 8:00 | 1. WARNER, RICHARD E., CHRISTOPHER L. COMBS AND DOUGLAS R. GREGORY, JR. (University of Florida). Biological Studies of the Spiny Lobster (<i>Panulirus argus</i> : family Palinuridae) in South Florida. | 9:44 | 9. BAKER, THOMAS R., JAMES F. PAYNE AND PAUL F. HENDRIX (Memphis State University). Quantitative Sampling of Chironomid Larvae in a Fourth Order Stream. |
| 8:13 | 2. TRUMPF, WILLIAM F., ERIC L. MORGAN AND PARLEY V. WINGER (Tennessee Technological University). Drift Activity of Macroinvertebrates in a Great Smoky Mountains National Park Stream for the Fall Season. | 9:57 | 10. DEMONT, DAVID J. (Louisiana State University). Some Aspects of the Ecology of the Benthic Invertebrates of the Lower Mississippi River. |
| 8:26 | 3. BUIKEMA, A. L. JR., J. D. MILLER AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University). Usefulness of the Grasshrimp, <i>Palaemonetes</i> (Decapoda) to Screen Refinery Effluents. | 10:10 | 11. MACIOROWSKI, A. F., E. F. BENFIELD AND A. C. HENDRICKS (Virginia Polytechnic Institute and State University). Macroinvertebrates of the Kanawha River, West Virginia. |
| 8:39 | 4. SHERBERGER, SARA RICE AND ARTHUR L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). Effects of Light Intensities, Wave-lengths, and Photoperiods on the Toxicity of Chromium to <i>Daphnia pulex</i> (Cladocera). | 10:23 | 12. VOSHELL, J. REESE, JR., GEORGE M. SIMMONS, JR., AND W. FORD CALHOUN (Virginia Polytechnic Institute and State University). The Immature Dragonflies and Damselflies (Insecta; Odonata) of a New Reservoir, Lake Anna, Louisa County, Virginia. |
| 8:52 | 5. GUTHRIE, PHYLLIS ANN AND PARLEY V. WINGER (Tennessee Technological University). Seasonal Variations in Chironomidae Populations of the Cumberland River. | 10:36 | 13. BISHOP, CLARINDA M., AND P. V. WINGER (Tennessee Technological University). Comparison of Benthic Macroinvertebrate Communities in Structured and Non-Structured Areas of Crow Creek, Franklin County, Tennessee and Jackson County, Alabama. |
| 9:05 | 6. MACIOROWSKI, A. F., G. F. WESTLAKE, E. F. BENFIELD AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University). A Technique Utilizing Crayfish Locomotor Activity as a Sensor in an Automated Biological Monitoring System. | 10:49 | 14. JONES, R. CHRISTIAN, WILLIAM H. YONGUI, JR., AND JOHN CAIRNS, JR. (Vanderbilt University and Virginia Polytechnic Institute and State University). Vertical Gradients in Substrate-associated Protozoan Community Structure in a Stratified Freshwater Lake. |
| 9:18 | 7. PAUL, ROBERT W., JR., EDWIN M. EUDALY, DAVID L. KUHN, AND WILLIAM F. RUSKA, JR. (Virginia Polytechnic Institute and State University). The Structure of a Macroinvertebrate Community in a Virginia Bog. | 11:02 | 15. WILLIS, JOHN A. (Georgia Southern College). The Toxicity of Cadmium and Zinc to the Mysid Shrimp, <i>Neomysis americana</i> Smith (Crustacea; Mysidacea). |
| 9:31 | 8. FOSTER, JOHN W. S., III, L. H. LIDEN, R. L. MARTIN AND ERIC L. MORGAN (Tennessee Technological University). Benthic | | |

- 11:15 16. CLARK, JAMES R. AND JOHN H. RODGERS, JR. (Virginia Polytechnic Institute and State University). Laboratory Studies of *Peltoperla maria* Nymph Feeding Rates and Efficiency (Plecoptera: Peltoperlidae).
- 11:28 17. TARTER, D. C., M. L. LITTLE, W. D. WATKINS AND J. T. GOODWIN (Marshall University, Ashland Oil Corporation and USAF Environmental Health Laboratory). Emergence Patterns, Distribution and New State Records of Fishflies in the Eastern United States (Megaloptera: Corydalidae).
- 11:42 18. CROPPER, WENDELL P., JR., MARK A. HARWELL AND HARVEY L. RAGSDALE (Emory University). A Monte Carlo Simulation of a Leslie Matrix Model of Competition Between Two Populations.

AQUATIC ECOLOGY, SESSION I

ROOM TS 3, 4, 5

Presiding: *Arthur L. Buikema*

- 8:00 19. NEMETH, JOHN CHARLES (Law Engineering Testing Company). An Ecological Study of Three Seagrass Species in an Estuarine Area Affected by Thermal Effluents From a Fossil Fuel Electrical Generating Plant.
- 8:13 20. GARRETT, ROBERT A. (Law Engineering Testing Company). A Survey of Fishes Associated with an Estuarine Area Affected by Thermal Effluents from a Fossil Fuel Electrical Generating Plant.
- 8:26 21. VAUGHT, GEORGE L. (Law Engineering Testing Company). Relative Abundance, Biomass, and Diversity of Benthic Macroinvertebrates Encountered in an Estuarine Area Affected by Thermal Effluents from a Fossil Fuel Electrical Generating Plant.
- 8:39 22. HENDRICKS, ALBERT C. AND BURL E. McCOSH (Virginia Polytechnic Institute and State University). Production of Extracellular Products by Algae Below Industrial Outfalls.
- 8:52 23. MOCHALSKI, JEFFREY C. AND PARLEY V. WINGER (Tennessee Technological University). Phytoplankton and Periphyton Productivity of the Cumberland River and Dixon Creek in the Vicinity of the Proposed Hartsville Nuclear Power Plant.
- 9:05 24. O'BRIEN, TIMOTHY P. (Louisiana State University). Crawfishes of the Atchafalaya Basin, Louisiana, With Emphasis on Those Species of Commercial Importance.
- 9:18 25. COOPER, JOHN E. AND MARTHA R. COOPER (North Carolina State Museum of Natural History). Marking Crayfish for Long-Term Ecological Studies.
- 9:31 26. WOOD, DOUGLAS H. (Savannah River Ecology Laboratory). Reproduction and Growth of the Snail, *Helisoma trivolvis* (Gastropoda: Planorbidae) in a Reactor Cooling Reservoir.
- 9:44 27. HART, DABNEY G. AND GEORGE R. ABBE (The MITRE Corporation and Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). Growth and Associated Organisms of Oysters (*Crassostrea virginica*) on Planted Beds in the Vicinity of a Steam Electric Station.
- 9:57 28. ABBOTT, TOM M., JOHN CAIRNS, JR., KEN L. DICKSON AND ERIC L. MORGAN (Virginia Polytechnic Institute and State University and Tennessee Technological University). *Corbicula manilensis* (Asiatic Clam) Population Zonation within a Stratified Reservoir.
- 10:10 29. SICKEL, JAMES B. (Murray State University). Population Growth and Productivity of *Corbicula manilensis* (Philippi) in the Altamaha River, Georgia (Bivalvia: Corbiculidae).
- 10:23 30. FULLER, SAMUEL L. H., AND MARC J. IM-LAY (Academy of Natural Sciences of Philadelphia and United States Fish and Wildlife Service). Spatial Competition between *Corbicula manilensis* (Philippi), the Chinese Clam (Corbiculidae), and Fresh-Water Mussels (Unionidae) in the Waccamaw River Basin of the Carolinas (Mollusca: Bivalvia).
- 10:36 31. EAGLESON, KENNETH (Tennessee Technological University). A New Holding Chamber for In-Stream Growth Studies on the Asiatic Clam, *Corbicula manilensis*.
- 10:49 32. DAVIS, MARGARET W. AND ERIC L. MORGAN (Tennessee Technological University). Industrial Application of a Biomonitoring System.
- 11:02 33. RODGERS, JOHN H., JR., KENNETH L. DICKSON AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Laboratory and Field Studies of Sulfur-35 Sulfate Assimilation by Periphytic Organisms.
- 11:15 34. RITCHIE, JERRY C., J. ROGER MCHENRY AND FRANK R. SCHIEBE (U.S. Sedimentation Laboratory). The Relationship Between Surface Suspended Sediment and the Total Suspended Sediment in a Reservoir Water Column.
- 11:28 35. KNIGHT, LUTHER A., JR., AND JACK HERRING (University of Mississippi and Mississippi Game and Fish Commission). Diurnal Changes in Water Quality in Ross Barnett Reservoir, Mississippi — 1973 and 1974.
- 11:42 36. BRIESE, LINDA A. AND JOHN P. GIESY (Savannah River Ecology Laboratory). Concentrations of Ten Heavy Metals Associated with Particulate and Dissolved Organic Fractions from the Okefenokee Swamp, Georgia.

ICHTHYOLOGY AND HERPETOLOGY, SESSION I

ROOM 4-5

Presiding: *Robert Shipp*

- 8:00 37. GILBERT, CARTER R. (University of Florida). The American Serranid Fish Genus *Hypoplectrus*: a Taxonomic Enigma.
- 8:13 38. BURGESS, GEORGE H. (University of Florida). Food Habits of Eleven Species of Fishes in a North Carolina Estuary.
- 8:26 39. TAPHORN, DONALD C. (University of Florida). South American Killifish Species, A Question of Time and Place (Cyprinodontidae).
- 8:39 40. GIBBONS, J. WHITFIELD (Savannah River Ecology Laboratory). Herpetofaunal Colonization Patterns of the Atlantic Coast Barrier Islands (Reptilia and Amphibia).
- 8:52 41. SCOTT, A. FLOYD AND JAMES L. DOBIE (Union College and Auburn University). Trailing Mud Turtles, *Kinosternon subrubrum* (Chelonia: Kinosternidae), Around an East Alabama Farm Pond.
- 9:05 42. POWDERS, VERNON N. (Georgia Southwestern College). Observations on Oviposition and Incubation of the Alligator Snapping Turtle, *Macroclemys temminki* (Chelydridae), in Georgia.
- 9:18 43. LEE, DAVID S. (North Carolina State Museum of Natural History). Vocal Strategies of Hylid Frogs.
- 9:31 44. DOUGLAS, MICHAEL EDWARD (Savannah River Ecology Laboratory). Male Reproductive Tactics in *Ambystoma jeffersonianum* ((Green), Ambystomatidae): Adaptive Response to a Competitive Breeding Environment.
- 9:44 45. HENDERSON, SUSAN E., DENISE I. PAV AND JERRY W. NAGEL (East Tennessee State University). Histological Examination of Integument in Sixteen Species of Salamanders (Plethodontidae).
- 9:57 46. THOMPSON, ANNE A., DENISE I. PAV AND JERRY W. NAGEL (East Tennessee State University). A Comparison of Hindlimb Musculature in Two Salamander Families, the Plethodontidae and the Ambystomidae.
- 10:10 47. BELL, S. L., J. B. GLADDEN AND D. J. SHURE (Emory University). The Uptake and Elimination of ¹³⁴Cs in Green Frogs (*Rana clamitans*: Amphibia).
- 10:23 48. CONNER, JOHN V. (Louisiana State University). Observations on the Ichthyoplankton of the Lower Mississippi River.
- 10:36 49. PERSCHBACHER, PETER WESLEY (University of North Carolina). Stimulatory Effects of an Herbivorous Fish, *Tilapia aurea* (Steindachner) on the Productivity of the Phytoplankton Community in Fertilized Microcosms.
- 10:49 50. FAST, DAVID E. AND FRANCISCO A. PAGAN (University of North Carolina and University of Puerto Rico). Comparison of Fishes and Biomass by Trophic Levels on Artificial and Natural Reefs Off Southwestern Puerto Rico.
- 11:02 51. SCHWARTZ, FRANK J. AND G. W. LINK, JR. (University of North Carolina). Status of Atlantic, *A. oxyrhynchus*, and Shortnose, *A. brevirostrum*, Sturgeons in North Carolina, (Pisces, Acipenseridae).
- 11:15 52. KILCH, BARRY L. AND C. PHILLIP GOODYEAR (Tennessee Technological University). The Horizontal and Seasonal Distribution and Relative Abundance of Larval Fishes in Center Hill Reservoir, Tennessee.
- 11:28 53. WILSON, JAMES H. AND KENNETH L. DICKSON (Virginia Polytechnic Institute and State University). The Effects of a Heated Power Plant Discharge on the Stomach Contents of Two Species of Catfish.

PLANT ECOLOGY, SESSION I

ROOM 1

Presiding: *Meredith Lieux*

- 8:26 54. CLARK, JAMES R., JOHN H. RODGERS, JR. AND KENNETH L. DICKSON (Virginia Polytechnic Institute and State University). Relative Sensitivities of Methods Used to Evaluate the Effects of Perturbation on Periphyton Communities.
- 8:39 55. WEAVER, GEORGE T. (Southern Illinois University-Carbondale). Models for Estimating Tree Branch Parameters of Upland Oaks and Hickories.
- 8:52 56. GARTEN, CHARLES T., JR. (Savannah River Ecology Laboratory). Multivariate Analyses of Elemental Concentrations in Plants.
- 9:05 57. HARWELL, MARK A. AND HARVEY L. RAGSDALE (Emory University). An Exploratory Discrete-Event Ecosystem Model.
- 9:18 58. PINDER, JOHN E., III (Savannah River Ecology Laboratory). Nitrogen and Phosphorus as Potential Limiting Factors of Net-Productivity in an Old-Field Plant Community.
- 9:31 59. HAY, J. DU'VALL AND H. L. RAGSDALE (Emory University). Fungi and ¹³⁷Cs Cycling in Two Forested Floodplains.

- 9:44 60. KESSELL, STEPHEN R. AND MONA M. MYATT (Gradient Modeling, Inc.). Gradient Analysis of the Vegetation of Glacier National Park, Montana.
- 9:57 61. KESSELL, STEPHEN R. AND MONA M. MYATT (Gradient Modeling, Inc.). Gradient Modeling: A New Approach to Vegetation Management.
- 10:10 62. FAIL, JOSEPH AND ZACKARY S. WOCHOK (University of Alabama). A Field Study of the Reclamation of Strip-mine Spoils with Fly Ash.
- 10:23 63. BIGGERS, J. PAUL (Southern Illinois University). A Method of Vegetation Analysis and Description for Highway Planning Purposes.
- 10:36 64. UMBER, ROGER L. AND JOHN E. PINDER, III (Southwestern Oklahoma State University and Savannah River Ecology Laboratory). Comparisons of Radiocesium Uptake Among Herbaceous Species Inhabiting a Contaminated Floodplain.
- 10:49 65. MILLER, GERALD J. AND DAVID STONEBURNER (Agnes Scott College and National Park Service). Effects of Hurricane Processes on Insular Tree Species.
- 11:02 66. IRWIN, JULIE E. AND REBECCA R. SHARITZ (University of North Carolina and Savannah River Ecology Laboratory). Structure of Stump Communities in a Stream Affected by Thermal Effluent.
- 11:15 67. MARTIN, CRAIG E. AND E. JENNIFER CHRISTY (Savannah River Ecology Laboratory). Vegetational Changes Following Thermal Alteration of a South Carolina Swamp.
- 11:28 68. WICKLAND, DIANE E. (University of North Carolina, Chapel Hill). The Occurrence of *Lygodium palmatum* (Bernh.) Swartz. (Schizaceae) on Heavy Metal Mines in the Piedmont of North Carolina.
- 11:42 69. WYATT, J. T. (U.S. Army Environmental Hygiene Agency). Archaic and Recent Vegetative Changes on McGregor Range, New Mexico.

ANIMAL PHYSIOLOGY, SESSION I

ROOM 9

Presiding: *T. L. Lawrence*

- 9:05 70. PATTERSON, E. CHARLENE AND D. J. STASZAK (Georgia College). The Effects of Clay Ingestion (Geophagia) on Pregnant Rats.
- 9:18 71. STRATTON, L. P., L. K. DUFFY AND A. S. PORCHET (Furman University and University of Alaska). Comparative Solubilities and Electrophoresis of Arctic Microtine Hemoglobins.
- 9:31 72. KNIGHT, JIM C., JR. AND WILLIAM W. NORRIS, JR. (Northeast Louisiana University). Spectrophotofluorometric Determination of Pineal Serotonin Concentration in Estrus, Metestrus, Early Diestrus and Mid-diestrus Phases of the Two-, Four-, and Eight-month Old Female Golden Hamster (*Mesocricetus auratus* Waterhouse).
- 9:44 73. OLEWINE, DONALD A., JOHN A. RODRIQUEZ-FEO, PATRICK K. MCSHANE AND H. WAYNE SMITH (Georgia Southern College). Modified Ivy Bleeding Time in Male and Female College Students Before and After Submaximal Exercise.
- 9:57 74. HOFMAN, JOHN W. AND GERALD C. LLEWELLYN (Virginia Commonwealth University). The Effects of Subacute Levels of Aflatoxin B₁ and Zinc on Male Mongolian Gerbils, *Meriones unguiculatus*.
- 10:10 75. LALOR, JOHN H. AND GERALD C. LLEWELLYN (Virginia Commonwealth University). The Interaction of Sodium Selenite with Aflatoxin B₁ in the Mongolian Gerbil, *Meriones unguiculatus*.
- 10:23 76. DRAKE, WILLIAM L. AND GERALD C. LLEWELLYN (Virginia Commonwealth University). The Response of Mongolian Gerbils, *Meriones unguiculatus*, to a Zinc Deficient Diet.
- 10:36 77. KIMBROUGH, T. DANIEL AND D. D. SHIL-LADY (Virginia Commonwealth University). A Comparison of MCD with Fluorometric Methods for Measuring Tissue Serotonin.
- 10:49 78. TAYLOR, NANCY, RICHARD R. MILLS AND GERALD C. LLEWELLYN (Virginia Commonwealth University). Haemolymph Proteins and Their Incorporation Into the Cuticle.
- 11:02 79. FLORENCE, JOSEPH A., G. C. LLEWELLYN AND R. R. MILLS (Virginia Commonwealth University). The Binding of Tyrosine Metabolites to Protein During Sclerotization (Insecta *Periplaneta americana*).
- 11:15 80. HERF, DAVID A., MARY L. PITTS AND LAURENCE G. TATE (University of South Alabama). The Distribution of NADPH Dependent Oxidases and Glutathione S-Transferases in Tissues of the Blue Crab, *Callinectes sapidus* (Crustacea: Decapoda).
- 11:28 81. SMILEY, JAMES W. AND ROY T. SAWYER (College of Charleston). Osmoregulation in the Leeches *Macrobdella ditetra* and *Haemopsis marmorata*.
- 11:42 82. WELLS, MARION R. AND CAROLINE MOHR O'HARA (Middle Tennessee State University). Carcinoembryonic Antigen in Human Sera and Effusions.

PLANT SYSTEMATICS, SESSION I

ROOM 7

Presiding: *Mary G. Curry*

- 8:26 83. MUSSELMAN, LYTTON J., WILLIAM F. MANN AND STEVEN D. RICH (Old Dominion University and Southern Forest Experiment Station). Host Range and Host Specificity of Parasitic Scrophulariaceae of the Southeastern United States.
- 8:39 84. MANN, WILLIAM F., JR. AND LYTTON J. MUSSELMAN (Southern Forest Experiment Station and Old Dominion University). Seed and Seedling Studies on Root Parasites of the Southeastern United States.
- 8:52 85. WILLINGHAM, FRANK F., JR. (Callaway Gardens). Pollen Viability in Southeastern Azalea Species and Their Hybrids.
- 9:05 86. WILLIAMS, R. D. AND M. M. SCHREIBER (Southern Weed Science Laboratory and Purdue University). Numerical Taxonomy of the *Setaria viridis* Complex.
- 9:18 87. TAYLOR, W. CARL, ROBERT H. MOHLENBROCK AND FREDDA J. BURTON (Southern Illinois University). Variation in North American *Asplenium platyneuron* (Aspleniaceae).
- 9:31 88. CARPENTER, I. W. AND MARIE L. HICKS (Appalachian State University). The Vascular Flora of Stone Mountain State Park in Wilkes and Alleghany Counties of North Carolina.
- 9:44 89. JOHNSON, MILES F. (Virginia Commonwealth University). Vernoniae (Asteraceae) in Virginia: *Vernonia* and *Elephantopus*.
- 9:57 90. STALTER, RICHARD (St. John's University). The Vascular Flora of Long Island.
- 10:10 91. JONES, SAMUEL B. (The University of Georgia). Ironing out the Problems in Ironweed (*Vernonia*; Compositae).
- 10:23 92. DENNIS, W. MICHAEL AND B. EUGENE WOFFORD (University of Tennessee). Evidence for the Hybrid Origin of *Proserpinaca intermedia* Mackenz. (Haloragaceae).
- 10:36 93. FLAGG, R. O. AND WALTER S. FLORY, JR. (Carolina Biological Supply Co. and Wake Forest University). A Putative *Zephyranthes* (Amaryllidaceae) Hybrid Recognized by Anthesis Timing.
- 10:49 94. FLORY, W. S. AND GERALD SMITH (Wake Forest University). *Zephyranthes bifolia* (Amaryllidaceae): Its Chromosomes and Taxonomic Position.
- 11:02 95. HARRIS, J. W., S. K. BALLAL AND F. P. SANDERS, JR. (Tennessee Technological University). Use of Electrophoretic Banding Patterns of Isozymes as Taxonomic Criteria for Certain Wood-Rotting Fungi (Basidiomycetes).

THURSDAY AFTERNOON — APRIL 22

AQUATIC ECOLOGY, SESSION II

ROOM TS 3, 4, 5

Presiding: *Michael Poirrier*

- 1:00 96. BARKO, JOHN W. (U.S. Army Engineer Waterways Experiment Station). Ecosystem Metabolism in a Lake Michigan Dune Pond.
- 1:13 97. HERRING, DANE C., GRAHAM J. DAVIS, DONALD B. JEFFREYS AND JAMES C. ANDERSON (East Carolina University). Groundwater Nutrient Gradients Between Septic Tank Absorption Fields and an Estuary.
- 1:26 98. MASNIK, MICHAEL T. (U.S. Nuclear Regulatory Commission). Data Base Structuring and Maintenance for Aquatic Biological and Physical Monitoring.
- 1:39 99. KERR, JOHN P. AND CHARLES A. GIFFORD (Baseline, Inc.). Distribution and Abundance of Aquatic Organisms Associated with the Modifications of the Withlacoochee River near Inglis, Florida: A Case History of a Public Works Project Providing a Largescale Ecological Experiment.
- 1:52 100. EDMISTEN, JOE A. AND JOHN P. KERR (Baseline, Inc.). Coastal Development in Florida: I. A Case History of Past Trends.
- 2:05 101. KERR, JOHN P. AND JOE A. EDMISTEN (Baseline, Inc.). Coastal Development in Florida: II. A Case History of Current Trends.
- 2:18 102. MCCOSH, BURL E. AND ALBERT C. HENDRICKS (Virginia Polytechnic Institute and State University). An Oxygen Study of the South River in Augusta County, Virginia.
- 2:31 103. PAUL, ROBERT W., JR. AND JAMES H. WILSON (Virginia Polytechnic Institute and State University). The Effects of a Heated Power Plant Discharge on a Macrobenthic Community.
- 2:44 104. RUTHIRFORD, CHARLES L., ARTHUR L. BUREMA, JR., D. RANDALL ARMANI AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). The Use-

- fulness of Enzyme Inhibition for Screening Petroleum Effluents.
- 2:57 105. KLARBERG, DAVID P. AND ERNEST F. BENFIELD (Virginia Polytechnic Institute and State University). Diversity and Cluster Analysis of New River Benthos.
- 3:10 106. COBURN, C. B., JR. AND A. A. FRIEDMAN (Tennessee Technological University). Development of a Tissue Bioassay Technique for Screening the Effects of Selected Pollutants on Fish.
- 3:23 107. BANDELEAN, JAMES W. AND JAMES R. REED, JR. (Virginia Commonwealth University). A Closed Recirculating System for High Density Culture of Marine Organisms.
- 3:36 108. WIELAND, WERNER AND JAMES R. REED, JR. (Virginia Commonwealth University). Effects of River Impoundment on the Recovery of Downstream Fish Populations from Acid Mine Drainage in a Piedmont-Coastal Plain Stream of Virginia.
- 3:49 109. BLOOD, ELIZABETH R. AND JAMES R. REED, JR. (Virginia Commonwealth University). Preliminary Studies on a Lake Affected by Acid Mine Drainage.
- 4:02 110. RADER, MARSIA ANN AND GEORGE M. SIMMONS, JR. (Virginia Polytechnic Institute and State University). The Effects of Acid Mine Drainage on Zooplankton Communities.
- 4:15 111. SINKS, JEFFREY D. AND ERIC L. MORGAN (Tennessee Technological University). Time Until Death Bioassay Assessment of Individual and Combined Effects of Low pH and Aluminum Concentrations on Three Stream Organisms.
- 4:28 112. RODGERS, JOHN H., JR., KENNETH L. DICKSON AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Primary Production and Degradation Rates of Submergent and Emergent Macrophytes of the New River, Glen Lyn, Virginia.
- 4:42 113. ZAMUDA, C. D., G. J. DAVIS, T. M. VICARS AND M. M. BRINSON (East Carolina University). Seasonal Decay Dynamics of *Vallisneria americana* Michx. in an Estuary.

ICHTHYOLOGY AND HERPETOLOGY, SESSION II

ROOM 4-5

Presiding: *Sam Rogers*

- 1:52 114. FEINSTEIN, ANDREW (University of South Florida). The Effect of Habitat on Diet of the Pinfish, *Lagodon Rhomboides* (Perciformes, Sparidae).
- 2:05 115. WILLIAMS, SHERRY E. AND ROBERT W. MCFARLANE (Savannah River Ecology Laboratory). Food Habits of the Mosquitofish, *Gambusia affinis* (Poeciliidae).
- 2:18 116. MOSER, GREGORY H. AND ALBERT C. HENDRICKS (Virginia Polytechnic Institute and State University). Effects of Size on Seasonal Changes in Food Selection and Condition Factor of Small Bluegill, *Lepomis macrochirus*, Rafinesque.
- 2:31 117. WELLS, STANFORD R., JR. AND JAMES R. REED, JR. (Virginia Commonwealth University). Fecundity, Seasonal Gonad Cycles, Egg Size and Condition of the Largemouth Bass *Micropterus salmoides* (Lacepede) in Lake Anna, Virginia.
- 2:44 118. WIELAND, WERNER AND JAMES R. REED, JR. (Virginia Commonwealth University). Age and Growth of Largemouth Bass, *Micropterus salmoides*, During the First Three Years of Impoundment of a Central Virginia Reservoir.
- 2:57 119. WIELAND, WERNER AND JAMES R. REED, JR. (Virginia Commonwealth University). Succession of Fish Populations in the First Three years of Impoundment of Lake Anna, A Newly-Constructed Reservoir in Virginia.
- 3:10 120. LIDEN, LAWRENCE H., JOHN W. S. FOSTER, III, ROBERT L. MARTIN AND ERIC L. MORGAN (Tennessee Technological University). Effects of Selected Combinations of Heavy Metals on Bluegill Sunfish, (*Lepomis macrochirus*).
- 3:23 121. LIDEN, LAWRENCE H., JOHN FOSTER, III, ROBERT L. MARTIN AND ERIC L. MORGAN (Tennessee Technological University). Heavy Metal Concentrations in Tissues of Fish from the Three-Reservoir, Toccoa-Ocoee River Drainage, Georgia-Tennessee.
- 3:36 122. HASTINGS, PHILIP A. (University of West Florida). Gonad Morphology of *Serranus subligarius* (Pisces: Serranidae).
- 3:49 123. WILLIAMS, JOHN S. (University of West Florida). Spawning Behavior of *Etheostoma edwini* (Pisces: Percidae).
- 4:02 124. SCOTT, EDWIN M., JR. AND R. DON ESTES (Tennessee Technological University).

- 115 116 BERBERER, HILDA A., V. LARRY HINDO
AND THOMAS S. HIGHT'S. Florida State
University, Indian River State College
and University of West Florida. Studies
in *Viola* and *Viola* in Florida. Paper
presented at the West Florida Forum.
- 116 117 THOMPSON, TIM T., JOHN S. RAGHED AND
BRUCE H. BAUER. Auburn University and

- 117 118 JACOB, DEBORAH J. and J. EDWARD HINDO.
The University of North Carolina at
Charlotte. Genetic Ecological Research
Program. *Viola blanda* in the Carolinas.
Paper presented at the West Florida
Forum.

PLANT ECOLOGY, SESSION II

ROOM 1

Presiding: *See on opposite*

- 118 119 BAINGER, PATRICIA G. Tennessee College
of Art, Jackson. A New Phytogeographi-
cal Key for Elm-Ashland Lakes.
- 119 120 JOHNSON, MICHAEL R. Middle Tennessee
State University. Adaptative Influence
of Seed Germination and Seedling Devel-
opment of *Thymus* and *Geranium* in
Successional Stages.
- 120 121 JANNER, WILLIAM H. AND JOHN W. DAY,
JR. Tennessee State University. Effect of
Flooding on Spring Germination.
- 121 122 KACHALEK, ELIZABETH L. W. F. JOHNSON, JR.
AND J. DONALD HAY. Tennessee
College of Art, Jackson. Spring
Water and Soil from Two Successional Flood-
plains.
- 122 123 LEVINS, KENNETH E. The University of
Alabama - Huntsville. The Effects of
Flood on Growth of Seedlings and Sap-
lings of the Angiosperm *Aster* and *Quercus*
in a Flood Plain.
- 123 124 McLEOD, KENNETH W., THOMAS E. FORBES
AND CASSEY SHERROD, JR. Southern
Mississippi University and Birmingham-
Southern College. Response of a
Tropical Pine to *Viola* and *Quercus*
in a Flood Plain.
- 124 125 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Seed Banks of
Woods of *Viola* and *Viola* in Florida.
- 125 126 RAMSEY, GEORGE S. The University of
the South. Spring Flooding of
Woods.
- 126 127 JACOB, DEBORAH J. AND GEORGE S.
RAMSEY. Southern Illinois University -
Carbondale. Impact of Spring Flooding
on Forest Floor Components of a
- 127 128 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Life
History and Ecology of the Bluebell Flower
(*Viola blanda*) in Tennessee. Inter-
mediate Communication
- 128 129 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Life
History and Ecology of the Bluebell Flower
(*Viola blanda*) in Tennessee. Inter-
mediate Communication
- 129 130 HITCHCOCK, ARLENE J. AND RICHARD R.
VAY. STOCKTON, CA. University of Califor-
nia. Genetic Ecological Research
Program. Southern Illinois. *Viola*
and *Quercus*.
- 130 131 VAY, STOCKTON, RICHARD R., R. AND ARLENE
J. HITCHCOCK. University of Califor-
nia. Genetic Ecological Research
Program. Southern Illinois. *Viola*
and *Quercus*.
- 131 132 WARDEN, JEROME L. Western Kentucky
University. Population Differences and
Seed Bank in *Viola* and *Quercus*. Re-
sponse to Spring Flooding in a Flood
Plain.
- 132 133 KINGLAND, MICHAEL E. Western Kentu-
cky University. Forest Composition of
a Flood Plain in *Viola* and *Quercus*
in a Flood Plain.
- 133 134 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Life
History and Ecology of the Bluebell Flower
(*Viola blanda*) in Tennessee. Inter-
mediate Communication
- 134 135 KINGLAND, MICHAEL E. Western Kentu-
cky University. Forest Composition of
a Flood Plain in *Viola* and *Quercus*
in a Flood Plain.
- 135 136 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Life
History and Ecology of the Bluebell Flower
(*Viola blanda*) in Tennessee. Inter-
mediate Communication
- 136 137 JACOB, DEBORAH J. AND J. EDWARD HINDO.
Florida State University. Life
History and Ecology of the Bluebell Flower
(*Viola blanda*) in Tennessee. Inter-
mediate Communication

ANIMAL PHYSIOLOGY, SESSION II

ROOM 9

Presiding: *Marilyn Coleman*

- 1:26 145. McCORKLE, FRED M. AND JAMES D. YARBROUGH (Mississippi State University). Formalin Toxicity to Insecticide-Resistant and Susceptible Mosquitofish (*Gambusia affinis*).
- 1:39 146. CHAMBERS, JANICE E. AND JAMES D. YARBROUGH (Mississippi State University). Induction of Mixed-Function Oxidases by Crude Oil in the Striped Mullet, *Mugil cephalus*.
- 1:52 147. FIVIZZANI, ALBERT J. AND ALBERT H. MEIER (Louisiana State University—Baton Rouge). Seasonal Changes in the Daily Rhythm of Plasma Prolactin Concentration in the White-throated Sparrow, *Zonotrichia albicollis* (Aves, Passeriformes, Emberizidae).
- 2:05 148. LEE, WARREN (Oklahoma Baptist University). Effects of Aspirin and Prostaglandin E(1) on the Release Reaction of Human Blood Platelets.
- 2:18 149. D'ADDAMIO, GEORGE H. AND E. E. STORRS (Gulf South Research Institute). Changes in Urogenital Cytology During the Estrous Cycle of the Armadillo (*Dasypus novemcinctus*, Linn.).
- 2:31 150. LARY, JOSEPH M., RONALD D. HOOD, AND BOB BLACKLOCK (University of Alabama). Prenatal Effects of Ethanol Exposure in Mice with Chronic Respiratory Disease.
- 2:44 151. MECHAM, JOHN A. AND KENNETH L. CURRIE (University of South Carolina — Sumter). Purring in *Felis domestica*: Respirometry, Cardiac Rates, and Breathing Rates.
- 2:57 152. HOGAN, G. R. (University of North Carolina — Charlotte). PHA and X-Ray Sensitivity of Rabbit Lymphocytes in Culture.
- 3:10 153. HUNER, JAY V., JOSEPH G. KOWALCZUK AND JAMES W. AVAULT, JR. (Southern University — Baton Rouge and Louisiana State University). Postmolt Calcification in Subadult, Red Swamp Crawfish, *Procambarus clarkii* (Girard) (Decapoda, Crustacea).
- 3:23 154. NORTON, VIRGINIA M. AND KENNETH B. DAVIS (Memphis State University). Ion Levels in Plasma and Urine, and Urine Volume in Channel Catfish, *Ictalurus punctatus*, Transferred from Freshwater to Various Environmental Salinities.
- 3:36 155. HOOD, RONALD D. (University of Alabama). Prenatal Effects of Penitrem A and Penicillic Acid in Mice.
- 3:49 156. WIMER, LARRY T., ROLF ZIEGLER AND GERALD R. WYATT (University of South Carolina, Freie Universität Berlin and Queen's University, Kingston, Ontario). A Comparison of Two Assay Methods for Glycogen Phosphorylase in the Silkmoth Fat Body.

PLANT SYSTEMATICS, SESSION II

ROOM 7

Presiding: *Loran C. Anderson*

- 1:26 157. URBATSCH, LOWELL E. (Louisiana State University). Affinities and Status of *Haplopappus linearifolius* DC (Asteraceae).
- 1:39 158. BECKMANN, ROBERT L., JR. (Vanderbilt University). Soluble Seed Proteins of *Hydrophyllum* (Hydrophyllaceae) with Reference to their Systematics.
- 1:52 159. FAIREY, JOHN E., III (Clemson University). The Section Schizolepis of the Genus *Scleria* (Cyperaceae) in Central America.
- 2:05 160. MELVIN, NORMAN C., III (Clemson University). Clinal Variation in *Leucothoe axillaris* (Lam.) D. Don (Ericaceae).
- 2:18 161. FANTZ, PAUL R. (University of Florida). A Comparative Diagnosis of *Clitoria* and *Centrosema* (Leguminosae).
- 2:31 162. DUBAY, ROBERT (University of Virginia). Experimental Pollination in Natural Populations of *Asclepias syriaca* L. (Asclepiadaceae).
- 2:44 163. COFFEY, JANICE C. (Queens College). The Genus *Luzula* in the Hawaiian Islands (Monocotyledonae, Juncaceae).
- 2:57 164. EVANS, DAN K., ROBERT H. MOHLENBROCK AND JUDITH MURPHY (Marshall University and Southern Illinois University). *Carex rosea* — *Carex retroflexa* (Sect. *Bracteosae*) Complex in Illinois.
- 3:10 165. STONE, HARRY J. (Vanderbilt University). A Taxonomic Review of *Anthraenantia* (Gramineae).
- 3:23 166. BALLARD, ROBERT E. (Clemson University). A Biosystematic and Chemosystematic Study of the *Bidens pilosa* L. (Com-

- positae) Complex in North and Central America.
- 3:36 167. BELL, C. RITCHIE (University of North Carolina). Inflorescence Shape and Pollinator Activity in *Daucus carota* L. (Apiaceae).
- 3:49 168. CHAPMAN, ROBERT H. (University of Georgia). Population Structure and Local Differentiation in *Diamorpha smallii* (Crasulaceae).
- 4:02 169. LINDSEY, ANNE H. (University of North Carolina). Characterization Versus Classification in *Thaspium* and *Zizia*. (Apiaceae).

RARE AND ENDANGERED SPECIES

ROOM 2

Presiding: *Clarence E. Styron*

Invited Papers: Rare, Endangered and Threatened Biota of the Southeast

- 1:00 170. WILLIAMS, JAMES D. (Office of Endangered Species, U.S. Fish and Wildlife Service). The Endangered Species Act of 1973: A Review and Explanation.
- 1:26 171. BAKER, GAIL S. AND BRUCE MACBRYDE (Office of Endangered Species, U.S. Fish and Wildlife Service). The Endangered and Threatened Plant Program of the U.S. Fish and Wildlife Service.
- 1:52 172. REKAS, ANTHONY (Corps of Engineers, Waterways Experiment Station). Rare, Threatened and Endangered Species Data and Computer Information Systems Developed by the Corps of Engineers.
- 2:18 173. KITCHINGS, T., S. ANDERSON AND R. J. OLSON (Environmental Sciences Division, Oak Ridge National Laboratory). Biogeographic Distribution of Endangered Animal Species in the Southeastern United States.
- 2:44 174. HALCOMB, C. MONTY, REX R. BONER AND JACK W. SITES, JR. (Tennessee Heritage Program, The Nature Conservancy). Tennessee Heritage Program: An Applied Data Management System for Endangered and Threatened Species Information.
- 3:10 175. LAYNE, JAMES N. (Archbold Biological Station of the American Museum of Natural History). Report on Work of the Florida Committee on Rare and Endangered Plants and Animals.
- 3:36 176. MARTIN, WILLIAM H. (Eastern Kentucky University). The Red River Gorge Controversy in Kentucky: A Case Study in Preserving a Natural Area.
- 4:02 *Break.*

Contributed Papers

- 4:15 177. CURRY, MARY G. (VTN Louisiana, Inc.). Rare Vascular Plants of Louisiana.
- 4:28 178. TUCKER, GARY E. (Arkansas Polytechnic College). Rare and Endangered Vascular Plant Species of Arkansas.
- 4:41 179. PITILLO, J. DAN (Western Carolina University). Yellowwood (*Cladrastis lutea*, Fabaceae): an Example of a Nationally Threatened Species.
- 4:54 180. HARVEY, MICHAEL J. (Memphis State University). Distribution and Status of Endangered Chiroptera in the Southeastern United States.
- 5:07 181. FULLER, SAMUEL L. H., MARC J. IMLAY AND JAMES D. WILLIAMS (Academy of Natural Sciences of Philadelphia and U.S. Fish and Wildlife Service). Endangered or Threatened Fresh-Water Mussels (Mollusca: Bivalvia: Unionidae) of the Waccamaw River Basin of the Carolinas.
- 5:20 182. LEE, DAVID S. AND JOHN E. COOPER (North Carolina State Museum of Natural History). Endangered Species: Problems Associated with Habitat Protection.
- 5:33 183. SAYLOR, CHARLES F. AND DAVID A. ETNIER (Tennessee Valley Authority and University of Tennessee). Rediscovery of the Sharphead Darter, *Etheostoma acuticeps* Bailey, in the Lower Nolichucky River, Tennessee.

PARASITOLOGY, SESSION I

ROOM 3

Presiding: *Sharon Patton*

- 2:57 184. RONEY, M. W. AND G. L. RONEY (College of Charleston and The Citadel). Preliminary Study of Gametogenesis and Fertilization in *Cosmocercoides dunikae* Holl, 1928 (Phasmodia: Cosmocercoidae). 4:02 189. CURRIE, KENNETH L. AND JOHN A. MECHAM (University of South Carolina—Sumter). "White Spot" on the Shells of *Biomphalaria glabrata* (Gastropoda, Pulmonata, Planorbidae), Reared in Captivity.
- 3:10 185. BUTTS, JEFFREY A. AND JAMES C. TRAVIS (University of North Carolina—Charlotte). Haptoglobin Levels During Prepatency and Early Patency of *Dipetalonema viteae* (Nematoda: Filarioidea) Infections in Jirds, *Meriones unguiculatus* (Rodentia: Gerbillidae). 4:15 190. BUTT, A. J., AND S. B. COLLARD (University of West Florida—Pensacola). Infestation of the Medusae of *Podocoryne minima* (Anthomedusae: Hydractiniidae) by Metacercaris of *Opechons* sp. (Digenea: Lepocreadiidae) from a Gulf of Guinea Neuston Collection.
- 3:23 186. BUCKNER, RICHARD L., S. C. BUCKNER AND D. F. OETINGER (The University of Nebraska). Population Dynamics of an Acanthocephalan Parasite of the Creek Chubb, *Semotilus atromaculatus* (Mitchill). 4:28 191. ALIFF, JOHN V. (Georgia College). A Survey of Adult Digenetic Trematodes from Kentucky Fishes.
- 3:36 187. OSBURN, RICHARD L. AND JAMES H. OLIVER, JR. (Georgia Southern College). Chemosterilization of *Dermacentor variabilis* (Acari: Parasitiformes: Ixodidae): Effects of Metepa on Selected Developmental Stages of Nymphs. 4:42 192. TURNER, HUGH M. AND KENNETH C. CORKUM (Louisiana State University). Observation on a Digenetic Trematode (Trematoda: Plagiorchiida) in the Red Swamp Crayfish *Procambarus clarkii* (Crustacea: Decapoda: Astacidae).
- 3:49 188. MAYER, R. P. AND J. K. SHULL (Loyola

FRIDAY MORNING — APRIL 23

AQUATIC ECOLOGY, SESSION III

ROOM TS 3, 4, 5

Presiding: *George Vaught*

- 8:00 193. WILLIAMS, LOUIS G. (University of Alabama). Causes of the 1975 Massive Duckweed Nuisance in the Black Warrior River, Alabama. Effect of Power Plant Discharge on Leaf Decomposition.
- 8:13 194. VICARS, THOMAS, GRAHAM J. DAVIS AND MARK M. BRINSON (East Carolina University). Variation of Submerged Plant Bed Patterns in an Estuary. 9:05 198. HART, C. W., JR. (Smithsonian Institution) AND DABNEY G. HART (The MITRE Corporation). Primary Productivity Associated with an Undisturbed Caribbean Coral Reef.
- 8:26 195. SKLAR, FRED, EUGENE TURNER AND JOHN DAY (Louisiana State University). Primary Production, Nutrient and Plant Pigment Distributions for an "Offshore Estuary" in Louisiana. 9:18 199. KENNEDY, JAMES H. AND ROBERT W. PAUL, JR. (Virginia Polytechnic Institute and State University). Leaching Rates of Sycamore (*Platanus occidentalis* Gymnospermae: Platanaceae) Leaves in Aquatic Environments.
- 8:39 196. BREWER, MICHAEL E. AND DANIEL D. JONES (University of Alabama—Birmingham). Effect of Growth Rate and Light Intensity on Relative Vacuolation of *Microcystis aeruginosa* (Cyanophycophyta) in Continuous Culture. 9:31 200. REED, S. E., G. J. DAVIS AND M. M. BRINSON (East Carolina University). The Ecology of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina.
- 8:52 197. PAUL, ROBERT W., JR. AND E. F. BENFIELD (Virginia Polytechnic Institute and State University). Leaf Degradation and the 9:44 201. HARWOOD, J. E., (Duke Power Company). A Study of the Submerged Aquatic Macrophytes of an Industrial Cooling Lake by Means of Remote Sensing.

- 9:57 202. WARK, KAREN E., G. B. HALL AND GEORGE M. SIMMONS, JR. (Virginia Polytechnic Institute and State University). Investigations of Phytoplankton Communities in the North Anna Reservoir.
- 10:10 203. PLAFKIN, JAMES L. (Virginia Polytechnic Institute and State University). Colonization of Artificial Substrates by Protozoa in a Small Cave Stream; Tawney's Cave, Giles County, Virginia.
- 10:23 204. KUHN, DAVID L. AND JAMES L. PLAFKIN (Virginia Polytechnic Institute and State University). The Effect of Freshwater Microbes on the Protozoan Colonization of Artificial Substrates.
- 10:36 205. YONGUE, WILLIAM H., JR., J. D. MILLER, AND A. L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). Persistent Soft Water Planktonic Protozoans.
- 10:49 206. POLLARD, GLORIA R., R. A. POLLARD AND H. L. STIREWALT (Augusta College). Planktonic Responses to an Industrial Effluent.

ICHTHYOLOGY AND HERPETOLOGY, SESSION III

ROOM 4-5

Presiding: *Carter Gilbert*

- 8:00 207. ROBISON, HENRY W. (Southern State College). A Preliminary Survey of the Fishes of the Petit Jean River System, Arkansas.
- 8:13 208. NESTER, R. DOUGLAS AND ROBERT L. SHIPP (University of South Alabama). The Fishes of the Northern Rim of the DeSoto Canyon.
- 8:26 209. BORTONE, STEPHEN A. (University of West Florida). The Florida Middle Grounds: A Tropical Ichthyofauna Assemblage?
- 8:39 210. KELLY, J. PADGETT AND GLENN H. CLEMMER (Mississippi State University). Stream Channelization and Fish Diversity in the Luxapalila River in Alabama and Mississippi.
- 8:52 211. CASHNER, ROBERT C., JAMES S. ROGERS AND MICHAEL T. SOB CZAK (University of New Orleans and Tulane University). The Fishes of Buffalo Bayou in Western Mississippi.
- 9:05 212. SABINS, DUGAN S. (Louisiana State University). Preliminary Observation on the Fishes of the Atchafalaya Basin, Louisiana.
- 9:18 213. CHAPMAN, ROBERT W. (University of West Florida). Biochemical and Morphological Variation in Northern Gulf of Mexico Populations of the Rock Seabass, *Centropristis philadelphica*.
- 9:31 214. MIDKIFF, W. M. AND JAMES R. REED, JR. (Virginia Commonwealth University). Genetic Analysis of Two Polymorphic Protein Systems in Natural Populations of Brook Trout, *Salvelinus fontinalis*.
- 9:44 215. DAWSON, RICHARD H. (College of Charleston). Systematics of the Genus *Stenotomus* (Pisces: Sparidae).
- 9:57 216. THOMPSON, BRUCE ALLEN (Tulane University). A Survey of the Vertebral Number of the Suborder Percoidei (Class: Osteichthyes, Order: Perciformes).
- 10:10 217. FELLE Y, JAMES (Savannah River Ecology Laboratory). The "Handpaint," a Form of the Bluegill (*Lepomis macrochirus*: Centrarchidae) from the Apalachicola Valley, Florida.
- 10:23 218. STARNES, WAYNE C. AND LYNN D. BETSON (University of Tennessee). A New Form of *Phoxinus* (Cyprinidae) from the Upper Tennessee System.
- 10:36 219. CHERR, GORDON DAVID (Florida State University). Reevaluation: *Fundulus notti* and *Fundulus notti lincolatus*.
- 10:49 220. ETNIER, DAVID A. AND ROBERT E. JENKINS (University of Tennessee and Roanoke College). A New Madtom of the Subgenus *Rabida* from the Clinch and Duck Rivers, Tennessee.

PLANT ECOLOGY, SESSION III

ROOM 1

Presiding: *Dempsey Thomas*

- 8:52 221. ROBERTSON, PHILIP A. (Southern Illinois University—Carbondale). Size-class Structure of a Bottomland Hardwood Forest in Southern Illinois.
- 9:05 222. DZIADYK, BOHDAN AND PHILIP A. ROBERTSON (Southern Illinois University—Carbondale). Above Ground Biomass on Three Grassland Sites in Southern Illinois.
- 9:18 223. PEARSON, JOHN AND GEORGE T. WEAVER (Southern Illinois University—Carbondale). Loss of Nutrients from Leaf Litter-fall as Affected by Exposure to Rainfall.
- 9:31 224. BOSTIC, STEPHEN R. (The University of Texas). Allelochemical Germination Interactions in *Typha latifolia* L. and *Typha domingensis* Pers. (Typhaceae).
- 9:44 225. BEAL, E. O. AND R. M. SOUTHALL (Western Kentucky University and North Carolina State University). Response of *Nuphar* Sm. (Nymphaeaceae) Populations in North Carolina to Vernalization Treatments.
- 9:57 226. PLUMMER, GAYTHER L. (University of Georgia). Geo-botanic Ecosystems: A New Map of Georgia.
- 10:10 227. SUDA, JANET R. (University of Georgia). A Comparative Study of Northeastern and Southeastern Ecotypes of *Typha latifolia* (Typhaceae).
- 10:23 228. MASHBURN, SUSAN J. AND REBECCA R. SHARITZ (Savannah River Ecology Laboratory). Studies of Genetic Variation in Southeastern *Typha* Populations.
- 10:49 229. BELLIS, VINCENT J. AND CYNTHIA E. BLANCK (East Carolina University). The Relationship of Vegetation to Shoreline Erosion in North Carolina Estuaries.

PARASITOLOGY, SESSION II

ROOM 3

Presiding: *Ardis L. Cramer*

- 8:00 230. GREER, GEORGE J. AND KENNETH C. CORKUM (Louisiana State University). The Life Cycle and Biology of a Parasite (Trematoda: Opisthorchida: Cryptogonimidae) in *Micropterus salmoides* (Osteichthyes: Perciformes: Centrarchidae).
- 8:13 231. BOGITSH, B. J. AND S. P. KATZ (Vanderbilt University). Localization of Soluble Antigens in *Schistosoma mansoni* Cercariae by Immunocytochemistry.
- 8:26 232. MCCALL, JOHN W. AND JUNG JUN (University of Georgia). Collection of Infective Larvae of *Litomosoides carinii* (Secernentasia: Spirurorida: Onchocercidae) by Soaking the Pelts of Infected Birds.
- 8:39 233. MCCALL, JOHN W. AND HANNAH CROUTHAMEL (University of Georgia). Combined Infections of *Litomosoides carinii* and *Brugia pahangi* (Secernentasia: Spirurorida: Onchocercidae) in Birds For Screening Potential Chemotherapeutic Agents.
- 8:52 234. ROBINSON, JOHN M. AND B. J. BOGITSH (Vanderbilt University). Biochemical Studies on a Mitochondrial Peroxidase from *Hymenolepis diminuta* (Cestoda).
- 9:05 235. PATTON, SHARON (University of Kentucky). Passive Transfer of Immunity to *Hymenolepis nana* (Cestoidea: Cyclophyllidea).
- 9:18
9:30
Break
- Bicentennial Symposium*
236. BOGITSH, BURTON J. (Vanderbilt University). Historical Perspectives on Histocemical Methods.
237. ERNST, JOHN V. (USDA Regional Parasitology Research Laboratory at Auburn). Role of United States Department of Agriculture in the Development of Parasitology.
238. WEATHERSBY, A. B. (University of Georgia). History of Medical Entomology.
239. HARKEMA, REINARD (North Carolina State University). The Early Helminthologists.

CRYPTOGAMIC BOTANY, SESSION I

ROOM 2

Presiding: *William Koch*

- 9:18 240. MAROOKHANIAN, V., M. R. HOUSTON AND L. B. LOCKWOOD (Western Kentucky University). Constitutive Nature of 5-ketogluconate reductase of *Gluconobacter suboxydans*.
- 9:31 241. DIANIS, S. L., M. R. HOUSTON AND L. B. LOCKWOOD (Western Kentucky University). Isoenzymes of NADP⁺-dependent 5-ketogluconate reductase of *Gluconobacter suboxydans*.
- 9:44 242. WARE, K. L., L. P. ELLIOTT, AND L. B. LOCKWOOD (Western Kentucky University). The Metabolism of Glucose by the Combined Use of *Gluconobacter suboxydans* and *Pseudomonas fluorescens*.
- 9:57 243. HITE, DOUGLAS AND B. P. STONE (Austin Peay State University). Sensitivity of *Scenedesmus* and *Microcystis* to Ethionine.
- 10:10 244. MARTIN, W. WALLACE, (Randolph-Macon College). Studies of a Unique New Aquatic Phycomycete Parasitic in Insect Eggs.
- 10:23 245. BLACK, H. DELANO, (Memphis State University). Fungi of the Meeman Biological Field Station.
- 10:36 246. BARRASS, ANDREW N. AND DAVIS L. FINDLEY (Austin Peay State University). The Effects of LAS and LAE Surfactants on *Gloeocapsa* sp. (Cyanophyta).

INVERTEBRATE ZOOLOGY, SESSION I

ROOM 9

Presiding: *Rudolph Prins*

- 8:00 247. MORTON, RANDALL AND ERIC L. MORGAN (Tennessee Technological University). A Comparison: Ponar Grab Versus Hester Dendy Sampler in a Riverine System.
- 8:13 248. CHANDLER, CLAY M. AND JULIAN T. DARLINGTON (Middle Tennessee State University and Southwestern at Memphis). A Preliminary Survey of Arkansas Freshwater Planarians (Turbellaria, Tricladida).
- 8:26 249. BUIKEMA, A. L., JR., J. D. MILLER AND W. H. YONGUE, JR. (Virginia Polytechnic Institute and State University). Studies on the Relationship Between Protozoan Populations and *Polyarthra vulgaris* (Rotifera).
- 8:39 250. NELSON, DIANE R. (East Tennessee State University). Use of the Scanning Electron Microscope in the Identification of Tardigrades (Phylum: Tardigrada).
- 8:52 251. SHELLEY, ROWLAND M. (North Carolina State Museum). The Deep-Cape Fear Rivers of North Carolina as a Distributional Boundary for Millipeds.
- 9:05 252. MCCRONE, JOHN D. AND H. K. WALLACE (Western Carolina University and University of Florida). Geographic Variation and Zoogeography of *Lycosa ceratiola* (Araneae: Lycosidae).
- 9:18 253. VIDRINE, MALCOLM F., BLAKE J. VIDRINE, AND BLAINE J. VIDRINE (Gulf South Research Institute and Louisiana State University). New Locality and Host Records for *Najadicola ingens* (Koenike) (Acarina: Unionicolidae).
- 9:31 254. SHERBERGER, SARA R., ARTHUR L. BUIKEMA, JR. AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Effects of Short Term Temperature Shock on Growth, Molting, Reproduction and Survival of *Daphnia pulex* (Chadocera).
- 9:44 255. TOMBES, AVERETT S. AND MARIE W. FOSTER (Clemson University). Morphology of the Second Pleopod of *Macrobrachium rosenbergii* (Crustacea: Decapoda).
- 9:57 256. VAN HOFF, ROBERT J. AND RUDOLPH PRINS (Western Kentucky University). Effects of Photoperiod, Temperature and Preconditioning on the Molt Cycle of Samples from a Michigan Population of the Crayfish *Orconectes immunis* (Hagen).
- 10:10 257. CHAMBERS, CARLENE L., JAMES F. PAYNE AND MICHAEL L. KENNEDY (Memphis State University). Geographic Variation in the Dwarf Crayfish, *Cambarellus puer* (Crustacea: Decapoda).
- 10:23 258. RHOADS, PETER B. (University of Florida). Aspects of the Life History and Ecology of *Procambarus allenii* in the Everglades (Crustacea: Decapoda: Astacidea).
- 10:36 259. HUNER, JAY V. AND JOE B. BLACK (Southern University and McNeese State University). Aberrant Secondary Sex Characters in the Crawfish *Procambarus clarkii* (Girard) (Decapoda: Cambaridae).

FRIDAY AFTERNOON — APRIL 23

AQUATIC ECOLOGY, SESSION IV

ROOM TS 3, 4, 5

Presiding: *James R. Reed*

- 1:00 260. COBB, CHARLES S. AND FRANK J. BULOW (Tennessee Technological University). Application of the RNA-DNA Ratio Technique of Measuring Growth Rates of Fish to a Natural Population of Bluegills, *Lepomis macrochirus* (Centrarchidae).
- 1:13 261. BULOW, FRANK J. AND C. B. COBURN (Tennessee Technological University). Liver-Body Weight Ratios as Indicators of Seasonal Growth Variations in Two *Lepomis macrochirus* (Centrarchidae) Populations.
- 1:26 262. RICHARDSON, LEONARD B., STUART L. MARGREY AND DENNIS T. BURTON (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). Mortality of Atlantic Menhaden (*Brevoortia tyrannus*) Exposed to Chronic Hypoxia.
- 1:39 263. MARGREY, STUART L., DENNIS T. BURTON AND LEONARD B. RICHARDSON (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). A Preliminary Study of Chlorine Toxicity to Atlantic Menhaden (*Brevoortia tyrannus*) and Hogchoker (*Trinectes maculatus*).
- 1:52 264. CHERRY, DONALD S., KENNETH L. DICKSON, ROBERT C. HOEHN AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Site-Specific Field Laboratory Avoidances of Fish to Chlorinated Discharges.
- 2:05 265. JACOBS, KENNETH E. (Tennessee Technological University). A Model of the Young-of-the-Year Walleye *Stizostedion vitreum* (Mitchill) and White Bass *Morone chrysops* (Rafinesque) in the Headwaters of Center Hill Reservoir, Tennessee.
- 2:18 266. STIREWALT, H. L., AND R. S. HARVEY (Augusta College and E. I. duPont deNemours and Company and Savannah River Laboratory). Some Effects of Elevated Temperatures on the Golden Shiner, *Notemigonus crysoleucas* (Pisces: Cyprinidae).
- 2:31 267. HEATH, ALAN G. (Virginia Polytechnic Institute and State University). Toxicity of Intermittent Chlorination to Rainbow Trout, Coho Salmon, and Carp.
- 2:44 268. LUBINSKI, KENNETH S. (Virginia Polytechnic Institute and State University). Observations on the Preference-Avoidance Behavior of Bluegills to a Sublethal Concentration of Ammonia.
- 2:57 269. MATHEWS, RAYMOND C., JR. (Tennessee Wildlife Resources Agency and Tennessee Cooperative Fishery Research Unit). Crappie Utilization of Stake Beds.
- 3:10 270. COOMER, CHARLES, JR. AND C. PHILLIP GOODYEAR (Tennessee Technological University). An Initial Evaluation of a Tag-recapture Study of the Exploitation Rate of Black Bass in Center Hill Reservoir, Tennessee.
- 3:23 271. TODD, ROBERT M. AND P. V. WINGER (Tennessee Technological University). Comparison of Fish Populations in Structured and Non-structured Areas of Crow Creek, Franklin County, Tennessee and Jackson County, Alabama.
- 3:36 272. GLESNE, REED AND PARLEY V. WINGER (Tennessee Technological University). Comparison Between Habitat Types and Abundance of Centrarchid Fishes in Altered and Unaltered Sections of a Channelized Stream.
- 3:49 273. HOFF, MICHAEL H., ERIC L. MORGAN AND RAY HERRMANN (Tennessee Technological University and the National Park Service). Native Brook Trout (*Salvelinus fontinalis*) Displacement by Introduced Rainbow Trout (*Salmo gairdneri*) in Cosby Creek, Tennessee, Great Smoky Mountains National Park.
- 4:02 274. ESTES, R. D., STANLEY STOOKSBURY AND JOHN RUMANCIK (Tennessee Cooperative Fishery Research Unit). The Application of Biotelemetry Techniques to Inland Fishery Studies.
- 4:15 275. TRUESDALE, FRANK M. (Louisiana State University). Some Observations on Feeding and Shallow-Water Behavior of the Bottlenose Dolphin *Tursiops truncatus* in Louisiana Waters (Mammalia: Cetacea).
- 4:28 276. VICARS, THOMAS, GRAHAM J. DAVIS AND MARK M. BRINSON (East Carolina University). Organic Carbon in the Pamlico River Estuary.
- 4:42 277. HACKNEY, C. T. AND A. A. DE LA CRUZ (Mississippi State University). Temporary Range Extension of the Largemouth Bass, *Micropterus salmoides*, and its Effect on a Tidal Marsh System in St. Louis Bay, Mississippi.

CRYPTOGAMIC BOTANY, SESSION II

ROOM 2

Presiding: *Shirley C. Tucker*

- 1:13 278. SAMPSON, DAVID W. (Old Dominion University). Artificial Creation of a Fern Taxon, *Dryopteris atropalustris*.
- 1:26 279. FOX, NORMAN (Vanderbilt University). Enzymes of *Dictyuchus monosporus* (Phycomycetes, Saprolegniaceae).
- 1:39 280. JENKINS, DAVID T. AND DANIEL D. JONES (University of Alabama—Birmingham). Comparison of Proteins by Disc Gel Electrophoresis Within Varieties of *Amanita muscaria* (Fungi: Basidiomycetes).
- 1:52 281. CLAUSZ, JOHN, ROBERT GILLENWATER, KATHY RHODERICK, RICHARD RHODERICK AND SALLY SWEELEY (St. Andrews Presbyterian College). Effects of Nutrients and Temperature on Mycelial Lipids of *Achlya* sp.
- 2:05 282. DEASON, T. R. AND E. SCHNEFF (University of Alabama and Heidelberg University). A New Coccoid, Zoospore-producing alga (Chlorococcaceae) with Hirsute Cell Walls.
- 2:18 283. BULL, ANNIE M., ENOLA L. STEVENSON AND LAFAYETTE FREDERICK (Atlanta University). Polyacrylamide Gel Electrophoretic Studies of Homothallic Species of *Neurospora*.
- 2:31 284. PENDERGRASS, LEVESTER, LAFAYETTE FREDERICK AND IVAN L. ROTH (Atlanta University and University of Georgia). Observations on the Genus *Macbrideola* in Georgia (Myxomycetes).
- 2:44 285. GRIFFIN, DANA, III (University of Florida). Bryophytes of the Sierra de Perija, Venezuela.
- 2:57 286. ROGERS, D. W. AND L. P. ELLIOTT (Western Kentucky University). Evaluation of the Germ Tube Test for the Separation of *Candida albicans* from *Candida stellatoidea*.
- 3:10 287. CONNELL, MARY U. AND RUSSELL G. RHODES (Appalachian State University). A Photoperiodic Response in the Crust Forming Alga *Scytosiphon lomentaris* (Phaeophyceae).
- 3:23 288. HICKS, MARIE L. AND I. W. CARPENTER (Appalachian State University). Some Interesting Bryophytes from Stone Mountain State Park, North Carolina.
- 3:36 289. KELLER, HAROLD W. AND JAMES A. HUTCHISON (Wright State University and Arkansas State University). Myxomycetes of Arkansas: A Progress Report.
- 3:49 290. DYKSTRA, MICHAEL J. (University of Florida). Nuclear and Cell Division in *Sorodiplophrys stercorea*, an Unusual Labyrinthulid-like Organism.
- 4:02 291. GWYNN, THOMAS M. III (Old Dominion University). Studies of the Gametophytes of *Lycopodium obscurum*.
- 4:15 292. ELLIOTT, L. P. (Western Kentucky University). The Microbial Flora Obtained from Vaginal Swabs of White-tailed Deer.

INVERTEBRATE ZOOLOGY, SESSION II

ROOM 9

Presiding: *Stuart Bamforth*

- 1:52 293. BLACK, JOE B. AND JAY V. HUNER (McNeese State University and Southern University). A Silver Eye Mutant in the Crawfish *Procambarus clarkii* (Girard) (Decapoda: Cambaridae).
- 2:05 294. COOPER, MARTHA R. AND JOHN E. COOPER (North Carolina State Museum of Natural History). Growth and Longevity in Cave Crayfishes.
- 2:18 295. ADKISON, DANIEL L. (University of West Florida). Description of a Larval *Eretmocaris* Species (Decapoda: Caridea) from the Western North Atlantic Ocean.
- 2:31 296. LIPSCOMB, DIANA AND THOMAS E. SIMPSON (Agnes Scott College). Distribution of Symbiotes in the Eastern Wood Roach, *Cryptocercus punctulatus* (Orthoptera, Blattidae).
- 2:44 297. NELSON, CHARLES H. (University of Tennessee—Chattanooga). Numerical Cladistics of the Plecoptera (Insecta).
- 2:57 298. DUNDEE, DEE S., ANNA PAINE AND BILL COPELAND (University of New Orleans). A Preliminary Study of *Melanoides tuberculata* (Müller), Intermediate Host of the Human Liver Fluke, (*Ophistorchis sinensis*) in New Orleans, Louisiana (USA).
- 3:10 299. MENZEL, WINSTON (Florida State University). Mariculture: Hybridization and Selection in Clams, *Mercenaria* spp.
- 3:23 300. VIDRINE, MALCOLM F. AND MARK S. DE-ROUEN (Gulf South Research Institute). Notes on the Vivalves (Sphaeriacea: Corbiculidae and Sphaeriidae and Unionacea: Margaritiferidae) of the Bayou Teche System in Louisiana.

- 3:36 301. VIDRINE, MALCOLM F. AND MARK S. DE-ROUEN (Gulf South Research Institute). A Preliminary List of the Bivalves (Unionacea: Unionidae) of the Bayou Teche System in Louisiana.
- 3:49 302. BEREZA, DANIEL J., MALCOLM F. VIDRINE AND SAMUEL L. H. FULLER (Academy of Natural Sciences of Philadelphia and Gulf South Research Institute). Anatomical Differences Between *Ligunia nasuta* (Say) and *L. subrostrata* (Say) (Mollusca: Bivalvia: Unionidae).
- 4:02 303. FULLER, SAMUEL L. H. (Academy of Natural Sciences of Philadelphia). Apparent Resurgence of *Hydroliximex grisea* (Halde-
- 4:15 304. FOX, THOMAS H. AND CHARLES E. JENNER (University of North Carolina—Chapel Hill). Reproductive Adaptations of Montacutid Bivalves for a Commensal Mode of Life (Bivalvia: Montacutidae).
- 4:28 305. JENNER, MARTHA G. AND CHARLES E. JENNER (University of North Carolina—Chapel Hill). Differences in Sexual Expression Among Populations of *Ilyanassa obsoleta* (Gastropoda: Prosobranchia).
- 4:42 306. JENNER, CHARLES E. (University of North Carolina—Chapel Hill). The Uniqueness of *Solemya* (Bivalvia).

ANIMAL ECOLOGY, SESSION II

ROOM 3

Presiding: *Marvin L. Wass*

- 1:00 307. VARGO, MICHAEL J., RICHARD A. GEIGER AND I. LEHR BRISBIN, JR. (Savannah River Ecology Laboratory). Temporal and Spatial Patterns in the Distribution of Radiocesium Contamination of American Coots (Rallidae) of the ERDA Savannah River Plant.
- 1:13 308. BROWNE, MICOU M. AND WILLIAM POST (North Carolina State Museum of Natural History and North Carolina Department of Mental Health Services). Factors Influencing Fall Concentrations of Inland Shorebirds.
- 1:26 309. NELSON, DAVID H. (Savannah River Ecology Laboratory). Responses of the Freshwater Shrimp, *Palaemonetes kadiakensis*, to Thermal Stress.
- 1:39 310. LUE, KUANG YANG AND ARMANDO A. DE LA CRUZ (Mississippi State University). The Effects of Weathered Mirex Fire Ant Baits to Two Species of Non-target Soil Macroarthropods.
- 1:52 311. HARRISON, JANET S. AND JOHN B. GENTRY (Savannah River Ecology Laboratory). Foraging Patterns and Spatial Distribution of *Pogonomyrmex badius* (Hymenoptera: Formicidae) Colonies.
- 2:05 312. CARTER, KENNETH W., JANET S. HARRISON AND JOHN B. GENTRY (Savannah River Ecology Laboratory). Intracolony Density and Activity Relationships of the Florida Harvester Ant, *Pogonomyrmex badius* (Hymenoptera: Formicidae).
- 2:18 313. WALDORF, ELIZABETH S. (Louisiana State University). Antennal Amputations in the Springtail, *Sinella curviseta*.
- 2:31 314. PAINE, ANNA (University of New Orleans). A Biological Study of *Littoridina sphinctostoma* (Gastropoda: Hydrobiidae) in Lake Pontchartrain, New Orleans, Louisiana.
- 2:44 315. GEIGER, RICHARD A. AND F. WARD WHICKER (Savannah River Ecology Laboratory and Colorado State University). Plutonium-239 Contamination of Snakes Inhabiting ERDA's Rocky Flats Plant Site.
- 2:57 316. ABELL, PHILIP R. AND DENNIS T. BURTON (Academy of Natural Sciences of Philadelphia). Cold Shock: The Effect of Rate of Thermal Decrease on the Survival of Juvenile Atlantic Menhaden (*Brevoortia tyrannus*).
- 3:10 317. WIELAND, WERNER AND JOHN F. PAGELS (Virginia Commonwealth University). Influence of Temperature of Food Gathering and Nesting Behavior of the Hispid Cotton Rat, *Sigmodon hispidus*, (Rodentia: Cricetidae) in the Laboratory.
- 3:23 318. WILLARD, WILLIAM K. (Clemson University). Ecological Strategies of Small Mammal Populations.
- 3:36 319. LANGLEY, ALBERT K., JR., AND D. J. SHURE (Emory University). The Influence of a Loblolly Pine Plantation on a Cotton Rat Population.
- 3:49 320. MANLOVE, MICHAEL N. (Savannah River Ecology Laboratory). Spatial and Temporal Constructs of Genetic Heterogeneity in a Population of Whitetailed Deer (Cervidae).
- 4:02 321. JOHNS, PAUL E. (Savannah River Ecology Laboratory). Seasonal Changes in Body Condition of White-tailed Deer (Cervidae) on the Savannah River Plant in South Carolina.
- 4:15 322. SMITH, MICHAEL H. (Savannah River Ecology Laboratory). Kidney Fat as a Predictor of Body Condition in White-tailed Deer (Cervidae).
- 4:28 323. TESKA, WILLIAM R. (Savannah River Ecology Laboratory). The Effect of Food Availability on the Trap Response of the Cotton Rat, *Sigmodon hispidus*.
- 4:42 324. BRISBIN, I. LEHR, JR., RICHARD A. GEIGER, H. B. GRAVES, JOHN E. PINDER, III, JAMES M. SWEENEY AND JOHN R. SWEENEY (Savannah River Ecology Laboratory). Morphological Comparisons of Two Populations of Feral Swine (*Sus scrofa*).

CYTOLOGY AND GENETICS

ROOM 4-5

Presiding: *Margaret Y. Menzel*

- 1:00 325. RYAN, EDWARD L. AND THOMAS P. COOHILL (Western Kentucky University). The Effects of Monochromatic Ultraviolet Light on Mammalian Cell-Herpes Virus Capacity.
- 1:13 326. EICHENBRENNER, TIMOTHY J., THOMAS P. COOHILL AND STEPHANIE DRAKE (Western Kentucky University). Ultra-Violet Induction of SV 40 Coat Antigen in Transformed Baby Hamster Kidney Cells.
- 1:26 327. AMES, LEE J. AND M. H. SMITH (Savannah River Ecology Laboratory). Allozyme Variation in Mole Salamander (*Ambystoma talpoideum*) Populations: A Preliminary Assessment.
- 1:39 328. LARNER, E. H. AND CHARLES L. RUTHERFORD (Virginia Polytechnic Institute and State University). Biochemical Characterization of Human Mammary Tumors.
- 1:52 329. DIEBOLT, JOHN R. (Queens College). Cytogenetic Studies on *Luzula hawaiiensis* Buch.
- 2:05 330. LESLIE, LOUISE AND LARENCE A. DYCK (Clemson University). Subcellular Morphology of Internodal Cells from *Chara australis* (Charophyceae).
- 2:18 331. RUBIN, CAROL A., JAN DEBERRY, CHARLES BIGGERS, AND PAUL DENCARNACAO (Memphis State University). Effects of Amphetamine on *Drosophila melanogaster*.
- 2:31 332. SHULL, J. K. AND CLARE HASENKAMPF (Loyola University). The Meiotic Events of a Sterile *Lilium* Hybrid (*Lilium*, Angiospermae).
- 2:44 333. TOMAN, F. R., M. R. HOUSTON AND E. BENGALI (Western Kentucky University). Isolation of Microtubule-Like Structures from Selected Eucaryotic Plant Cells.
- 2:57 334. BENNER, D. B. (East Tennessee State University). Y-chromosome Hyperploidy and Fertility in Male *Drosophila*.
- 3:10 335. CARTER, CALEB AND ARTHUR L. WILLIAMS (Alabama State University). Characterization of Several Valine Resistant (Val^R) Mutants of *Escherichia coli* K-12.
- 3:23 336. WILLIAMS, ANN C. AND ARTHUR L. WILLIAMS (Alabama State University). Isolation of Specialized Transducing Phages Carrying Fragments of the Isoleucine-Valine (ILV) Operons of *Escherichia coli*.
- 3:36 337. LACY, H. M. AND P. S. RUSHTON (Memphis State University). The Dependence of Radiation-Induced Lymphopenia Upon Adrenocorticoids.
- 3:49 338. HOWE, H. BRANCH, JR., M. VISWANATH-REDDY, AND SARA N. BENNETT (University of Georgia). Polyol Non-utilizing Mutants of *Neurospora tetrasperma*.

PLANT PHYSIOLOGY AND MORPHOLOGY

ROOM 7

Presiding: *J. K. Skull*

- 1:00 339. SHEALY, HARRY E., JR. (University of South Carolina — Aiken). Comparison of Megasporogenesis in Species of *Oxalis*, *Ludwigia*, and *Cassia*. Class: Angiospermae.
- 1:13 340. RICH, STEVEN D. (Old Dominion University). Preliminary Comparative Studies on Haustorial Development and Seedling Morphology in Witchweed (*Striga asiatica*) and Hemp Broomrape (*Orobancha ramosa*) (Angiospermae; Scrophulariales).
- 1:26 341. MUSSELMAN, LYTTON J. (Old Dominion University). Germination and Cataphyll Movement in *Ximenia americana*.
- 1:39 342. FLAGG, R. O. (Carolina Biological Supply Co.). The Secret Life of Filter Paper.
- 1:52 343. FOX, L. RAYMOND, GWEN RONEY AND STEVE COGGIN (Florida State University). Physiological Aspects of *Hibiscus* Inter-group Hybrid Lethality (Malvaceae).
- 2:05 344. RONEY, GWEN, LORAN C. ANDERSON AND L. RAYMOND FOX (Florida State University). Development of Ruptured Petioles in Sublethal Hybrids of *Hibiscus* (Malvaceae).
- 2:18 345. REYNOLDS, JOHN D. AND WILLIAM V. DASHEK (Virginia Commonwealth University). Spectrophotofluorometric Analysis of Aniline Blue (w.s.) Specificity: Is Callose a Glycoprotein?
- 2:31 346. THOMPSON, MICHAEL R. AND ZACHARY S. WOCHOK (University of Alabama). Auxin Transport in *Pueraria lobata* (Kudzu).
- 2:44 347. CAPONETTI, JAMES D. AND KAREN W. HUGHES (University of Tennessee). The Response of Pine Callus to the Herbicide Paraquat in Sterile Culture (Gymnospermae, Coniferae, Pinaceae).
- 2:57 348. NANNEY, LILLIAN B. AND B. P. STONE (Austin Peay State University). Induc-

- tion of Photosensitivity in Dark-Germinating Lettuce Seeds.
- 3:10 349. YEALY, LYNN P. AND B. P. STONE (Austin Peay State University). Effects of Ionizing Radiation upon Growth and RNA Synthesis in Lettuce Seedlings.
- 3:23 350. WOLF, FREDERICK T., RONNIE H. TILFORD AND MITZI MARTINEZ (Vanderbilt University). Effects of Various Phenylpropanoid Compounds (Plant Phenolics) on Lettuce Seed Germination and Growth of *Avena* Coleoptiles.
- 3:36 351. ARMANT, D. RANDALL AND CHARLES L. RUTHERFORD (Virginia Polytechnic Institute and State University). Stage Specific Interactions Between Glycogen and its Synthetic and Degradative Enzymes During Differentiation of *Dictyostelium discoideum*.
- 3:49 352. DUKE, STEPHEN O. AND AUBREY W. NAYLOR (Southern Weed Science Laboratory and Duke University). Correlation of *In Vivo* Phytochrome States with Longitudinal Growth in Mesocotyls of *Zea mays* L.
- 4:02 353. O'KELLEY, JOSEPH C. AND JOHN K. HARDMAN (The University of Alabama). The Yellow Light-Absorbing Pigment, pY, of the Protosiphon Photoreversible Pigment System.

Abstracts of Papers Presented at the 37th Annual Meeting of the Association of Southeastern Biologists

The number in parenthesis at the top of each abstract refers to the number of that paper in the program.

(28)

Corbicula manilensis (Asiatic Clam) Population Zonation Within a Stratified Reservoir

TOM M. ABBOTT, JOHN CAIRNS, JR., KEN L. DICKSON
Virginia Polytechnic Institute and State University

ERIC L. MORGAN
Tennessee Technological University

Population zonation was shown for *Corbicula* clams collected at 8 meters depth (Zone I) and 14 meters depth (Zone II) using SCUBA gear and a Surber sampler by analysis of variance tests within and between Zones for shell length, height, width, and weight. Results confirmed the hypothesis that aggregations within these belts were characterized by uniform densities and similar age structure.

The upper zone (I) coincided with a belt-like area just above the thermocline of a blue-green alga, *Oscillatoria*, attached to a rocky substrate. Based on length frequency, 86% were of age group III and multiple samples showed a density of 379/m². There was no significant difference in any of the 10 paired t-tests ($p < .05$ for all pairs) for width and only one of the 10 paired tests was significant at $p = .05$ for length.

The lower zone (II) consisted of a mud substrate and showed a density of 1,295/m² with 61% of age group II, and the remaining 39% in age group III.

The F-ratios for mean differences between Zone I and Zone II showed highly significant differences at the .01 confidence level for length, height, width, and shell weight.

Corbicula occurrences showed low densities near the shorelines; gradually increasing offshore where a high density occurs at 7 to 9 meters depth (379/m²); and again being less dense until 13 to 15 meters depth where the second high concentration occurs (1,295/m²). Below 15 meters and the bottom of the reservoir (39 meters) densities dwindle to approaching zero.

(316)

Cold Shock: The Effect of Rate of Thermal Decrease on the Survival of Juvenile Atlantic Menhaden (*Brevoortia tyrannus*)

PHILIP R. ABELL AND DENNIS T. BURTON
Academy of Natural Sciences of Philadelphia

Rapid temperature decreases encountered by fish during the winter from shutdown of industries with heated

effluents have resulted in large kills. This study was initiated to assess the response of juvenile Atlantic menhaden (*Brevoortia tyrannus*) acclimated to 15°C and subjected to several rates of thermal decrease down to 5°C. The rates of decrease were 0.0, 1.5, 3.0 and 6.0 hours. In all cases disorientation occurred as the temperature approached 5°C. No significant difference in the median time to death (i.e., time at which 50% mortality occurred at 5°C) was found for fish exposed to the four rates. The average median time to death was 46 hours (range 43-48 hours). The results of this study show that temperature appears to be more important than the rate of decrease when cold shock occurs within 6 hours.

(295)

Description of a Larval *Eretmocarid* Species (Decapoda: Caridea) from the Western North Atlantic Ocean

DANIEL L. ADKISON
University of West Florida

Seven specimens of a species of the larval genus, *Eretmocarid* *bate*, were recovered from samples collected by an Isaacs-Kidd midwater trawl on a transect from the Gulf Stream into the western Sargasso Sea and back to the Gulf Stream. These seven larvae, closely allied to *Eretmocarid* *dolichops* Ortman and *Eretmocarid* *X* Lebur, have long, jointed eyestalks about 80% of body length. The rostrum is slender and unarmed. The lateral margin of the carapace has three or four small spines. Pleopods are present and biramous. The sixth abdominal segment is significantly longer than the other segments. These characteristics separate this group from other members of *Eretmocarid*.

(191)

A Survey of Adult Digenetic Trematodes from Kentucky Fishes

JOHN V. ALIFF
Georgia College

3,211 fishes representing 92 species were taken during 1971, 1972 and 1974 from the Kentucky River drainage (94 sites), the Big Sandy (8 sites), the Licking (5 sites), the Cumberland (5 sites), the Green (3 sites), the Salt (3 sites), and the Tennessee (2 sites). 22 species of adult Digena occurred in 16% or 517 host fishes as follows: Family Allocreadiidae: *Allocreadium lobatum*,

Allocreadium sp., *Crepidostomum cooperi*, *C. cornutum*, *C. isotomum*; Family Azygiidae: *Leuceruthrus microp-teri*, *Proterometra macrostoma* (cercariae), *Proterometra* sp.; Family Bucephalidae: *Paurorhynchus hiodontis*, *Rhipidocotyle septapillata*; Family Cryptogonimidae: *Acetodextra ameiri*; Family Gorgoderidae: *Phyllodistomum caudatum*, *P. ethiostomae*, *P. lacustri*, *P. lysteri*, *P. noconis*, *P. staffordi*; Family Lissorchiidae: *Lissorchis attenuatum*, *L. sineri*, *Lissorchis* sp.; Family Opcoelidae: *Plagioporus cooperi*, *P. serotinus*, *P. sinitsini*, *Plagioporus* sp., *Podocotyle* (*Allopodocotyle*) sp.; Family Paramphistomatidae: *Pisciamphistoma stunkardi*; and Family Plagiorchiidae: *Alloglossidium corti*.

(327)

Allozyme Variation in Mole Salamander (*Ambystoma talpoideum*) Populations: A Preliminary Assessment

LEE J. AMES AND M. H. SMITH
Savannah River Ecology Laboratory

Individuals from three South Carolina populations of the mole salamander (*Ambystoma talpoideum*) were subjected to starch gel electrophoresis to demonstrate protein variation corresponding to 25 genetic loci. Predicted and observed electromorph variation distributions were analyzed and levels of genetic population subdivision were compared to other vertebrate species. Possible relationships between patterns of allozyme variation and differential growth were investigated. Population specific developmental and reproductive strategies as related to electrophoretically detectable divisions of populations will be discussed.

(351)

Stage Specific Interactions Between Glycogen and Its Synthetic and Degradative Enzymes During Differentiation of *Dictyostelium discoideum*

D. RANDALL ARMANT AND CHARLES L. RUTHERFORD
Virginia Polytechnic Institute and State University

During cellular differentiation of *Dictyostelium discoideum* the storage of carbohydrate glycogen is used to provide precursors for synthesis of trehalose, cellulose, and mucopolysaccharide. Although the degradation of glycogen during the later stages of development has been demonstrated, the role of glycogen in the initial stages has not been studied.

Glycogen levels were enzymatically assayed during the differentiation cycle by utilizing glycogen phosphorylase and amyloglucosidase. Thus, both total glycogen as well as the extent of outer unbranched glucoside chains could be determined. The intercellular relationship between glycogen, its synthetic enzyme, glycogen synthetase (E.C.2.4.1.11), and its degradative enzyme, glycogen phosphorylase, (E.C.2.4.1.1), was studied by differential centrifugation.

Glycogen accumulated between the onset of aggregation (7 hrs.) and the beginning of culmination (20 hrs.). Paralleling this accumulation was an increase in the percentage of outer unbranched glucoside chains. Results of fractionation experiments suggested a stage specific interaction of the synthetic and the degradative enzymes with particulate glycogen.

(171)

The Endangered and Threatened Plant Program of the U.S. Fish and Wildlife Service

GAIL S. BAKER AND BRUCE MACBRYDE
U.S. Fish and Wildlife Service

The Endangered Species Act of 1973 differs from the 1966 and 1969 Acts by including plants. Individuals, scientists, institutions or other Federal agencies can nominate a plant for consideration by a substantive letter or petition to the Secretary of the Interior. The Smithsonian Institution prepared a list of 3,187 candidate Endangered and Threatened taxa as required by the Act. The U.S. Fish and Wildlife Service accepted this list as a petition in the *Federal Register* on July 1, 1975. The 45 foreign plant taxa on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora were published in the *Federal Register* on September 26, 1975. A major difference between the treatment for plants and animals in the Act is that the "taking" of plants is not regulated, although interstate and international commerce are. Section 6, dealing with state cooperative agreements, and Section 7, dealing with Federal cooperation, are some major strengths of the Act with respect to plants.

(9)

Quantitative Sampling of Chironomid Larvae in a Fourth Order Stream

THOMAS R. BAKER, JAMES F. PAYNE
AND PAUL F. HENDRIX
Memphis State University

Basket-type artificial substrate samplers were employed to determine the feasibility of this technique for studies of low order streams. All sampling was conducted in the Loosahatchie River, a fourth order stream in the Chickasaw River Basin of western Tennessee. Sampling was begun in October, 1974 and continued through September, 1975 to discern which time of year was most productive for benthic invertebrates. Chironomid larvae were the most abundant benthic fauna in all samples and often were the only taxa collected. Seventeen genera of chironomids were found. Three stations on the river were compared with respect to pollution-associated midges, and to their community indices (d). Selected physical and chemical data were related to chironomid abundance to determine which of these factors influenced numbers of chironomids. A seasonal succession pattern was observed in four genera of midge larvae.

(166)

A Biosystematic and Chemosystematic Study of the *Bidens pilosa* L. (Compositae) Complex in North and Central America

ROBERT E. BALLARD
Clemson University

Chromosome counts, flavonoid chemistry, breeding system data, hybridization experiments, and a quantitative analysis of twelve morphological features combine to show that the North and Central American populations of *Bidens pilosa* L. sensu lato Sherff actually include three distinct species: *B. odorata* (n = 12), *B. alba* (n =

24), and *B. pilosa* ($n = 36$). All these species are square-stemmed, white-rayed or discoid annuals with linear, obcompressed-quadrangulate, alternate achenes, but each species can be distinguished morphologically by differences in ray length, width, and shape, and chemically by differences in the specific chalcones accumulated in their vegetative tissues.

(107)

A Closed Recirculating System for High Density Culture of Marine Organisms

JAMES W. BANDELEAN AND JAMES R. REED, JR.
Virginia Commonwealth University

The culturing system described is based upon the principle of the classic closed recirculating marine water system incorporating biological filtration. The primary module of the system consists of panels of polyurethane foam forming an alternating grid within two 75 gallon rectangular glass tanks which comprise the main biological filter. The culture tanks are six 50 gallon units with intratank biological filtration which enables each unit to function independently if necessary.

This type of filtration system has increased the usable surface area for bacterial attachment up to 200 per cent. Excess nutrients in the system are accumulated by unicellular green algae grown upon a glass spillway. The algae are harvested regularly and returned to the system as a food source.

The system proved to be excellent for the culture of white and pink shrimp. It fulfilled the elementary principle of cultivation: providing excellent water quality under condition of overcrowding and diminishing the problem of overfeeding, thus improving the potential for culture and production.

(96)

Ecosystem Metabolism in a Lake Michigan Dune Pond

JOHN W. BARKO
U.S. Army Engineer Waterways Experiment Station

Annual estimates of gross assimilation and ecosystem respiration, based on measurements of CO_2 exchange, were made in a small shallow pond located in the sand dunes of Lake Michigan. Annual mean daily gross productivity ($547 \text{ mg C m}^{-2} \text{ day}^{-1}$) exceeded the annual mean daily rate of ecosystem respiration ($377 \text{ mg C m}^{-2} \text{ day}^{-1}$). Gross photosynthesis was weakly correlated with day length, efficiency, and solar energy, each treated independently. Annually, both heterotrophic and autotrophic components of ecosystem respiration were comparable, each accounting for approximately one half of total respiratory activity. During the study, the pond underwent seasonal transformations between autotrophic and heterotrophic modes of metabolic dominance. The annual ratio of gross assimilation/ecosystem respiration was estimated at 1.45, indicative of a potential accrual of organic carbon at the rate of $169 \text{ mg C m}^{-2} \text{ day}^{-1}$, the annual mean daily rate of net ecosystem production.

(246)

The Effects of LAS and LAE Surfactants on *Gloeocapsa* sp. (Cyanophyta)

ANDREW N. BARRASS AND DAVIS L. FINDLEY
Austin Peay State University

The effects of linear alkyl sulphonates and linear alkyl ethoxylates surfactant on algal production were explored. The alga *Gloeocapsa* sp. IUCC #795 was used as the bioassay organism. *Gloeocapsa* was exposed to various concentrations of LAS and LAE surfactant under controlled laboratory conditions. The variations in cell counts, dry weight biomass and growth rate were evaluated at different time intervals during thirty day periods. Results indicate support of either carbon assimilation or carbon limitation effects on growth.

(225)

Response of *Nuphar* Sm. (Nymphaeaceae) Populations in North Carolina to Vernalization Treatments

E. O. BEAL AND R. M. SOUTHALL
Western Kentucky University and North Carolina State University

Seed samples from populations of *Nuphar luteum* subsp. *macrophyllum* (Small) E. O. Beal, *N. luteum* subsp. *sagittifolium* (Walt.) E. O. Beal plus a morphologically and geographically intermediate population, when subjected to experimentally controlled vernalization treatments, respond both quantitatively and qualitatively. Each of the three populations exhibits a characteristic germination response to duration of vernalization at 4°C . Seedlings from each of the three populations, produced as a result of selective vernalization treatments, show that the gene pool of each population is inclusive of the other populations. Selective vernalization under experimental conditions results in the selective production of seedlings morphologically characteristic of the natural populations existing under corresponding natural vernalization conditions.

(158)

Soluble Seed Proteins of *Hydrophyllum* (Hydrophyllaceae) With Reference to Their Systematics

ROBERT L. BECKMANN, JR.
Vanderbilt University

Soluble seed proteins of representatives of the eight species of *Hydrophyllum* (all $n = 9$) were extracted by homogenizing in tris/glycine buffer, separated by polyacrylamide disc electrophoresis, and identified by use of Coomassie blue. The periodic acid-Schiff reaction was employed to detect glycoproteins. Stained gels were analyzed using a Varian-Techtron Model 635 Gel Scanner. Resultant electrophoregrams were used in conjunction with specific flavonoid profiles and morphological comparisons in assessing the genetic affinities of the species. Comparative data reveal that *Hydrophyllum* comprises eight closely related species and support the reported existence of two pairs of vicariads.

(125)

Studies of *Moxostoma poecilurum* (Pisces:
Catostomidae) in Two West Florida Rivers

HAL A. BEECHER, W. CARROLL HIXSON,
AND THOMAS S. HOPKINS
Florida State University,
Bream Fishermen Association,
University of West Florida

In a tagging study using a boat-mounted shocker, 19 *M. poecilurum* were recovered out of 195 tagged during 12 months in a 1070 m × 75 m segment of the Escambia River. Monthly catch rates ranged from 0.6 fish/hr in March to 14.4/hr in November. Long-term residence is indicated by tag recoveries. The mean standard length of seine-collected young-of-the-year from the Choctawhatchee River increased from 1.7 cm on 15 May to about 6 cm in October. A length frequency distribution of 71 shocker-caught *M. poecilurum* from the Escambia River during July shows peaks at 4, 11, 17, and 22 cm. Most of the fish were 20 cm or larger. During the 12 month study on the Escambia River, *M. poecilurum* constituted 16.5% by weight and 14.6% by number of all fish collected.

(167)

Inflorescence Shape and Pollinator
Activity in *Daucus carota* L. (Apiaceae)

C. RITCHIE BELL
University of North Carolina

Although self-fertile, the small, rather unspecialized and "promiscuously" pollinated flowers of *Daucus carota* do not usually self-pollinate and the normally high fruit set (95-100%) is directly dependent on the activity of the many unspecialized insect visitors. Thus fruit set can be used as a reliable indicator of pollinator activity. Drastic alteration of the general appearance of over 400 of the large circular white inflorescences by the removal of approximately 50% of the individual umbellets to form squares, rings and mosaics had no biologically significant effect on fruit set. It is therefore concluded that umbel shape and compactness are not important factors in the attraction of pollinating agents in *Daucus carota*.

(47)

The Uptake and Elimination of 134-Cs in Green
Frogs (*Rana clamitans*: Amphibia)

S. L. BELL, J. B. GLADDEN AND D. J. SHURE
Emory University

A study was conducted to examine the uptake and elimination of 134-Cs in Green frogs (*Rana clamitans*). The 134-Cs was administered through a simulated food chain. Two groups of crickets were given food containing different concentrations of radiocesium (35 and 55

nCi/gm). Tagged crickets were then fed to the frogs until equilibrium concentrations of 134-Cs were attained in *R. clamitans*. The frogs were then given untagged crickets and radiocesium uptake coefficients and elimination rates were estimated for *R. clamitans*. Results to date suggest a biological half-life of approximately 20 days for radiocesium in *R. clamitans* and analysis of elimination curves indicate fast and slow components in 134-Cs excretion.

(229)

The Relationship of Vegetation to Shoreline
Erosion in North Carolina Estuaries

VINCENT J. BELLIS AND CYNTHIA E. BLANCK
East Carolina University

Comparison of recent and thirty-year old air photos of North Carolina estuarine shoreline indicate erosion rates up to twenty feet per year. Erosion is widespread in the Albemarle-Pamlico Region with typical shoreline losses of 2-3 feet per year. Brackish marshlands, low swamp forests, and a marginal fringe of bald cypress (*Taxodium distichum*) act as natural buffers which dissipate storm wave energy and thus retard shoreline erosion. Extensive logging of bald cypress between 1870 and 1914 may have destroyed much cypress fringe and exposed the estuary bank to greater erosion. The current practice of bulkheading exposed shoreline alters nearshore sediment flow patterns and prevents the accretion of sandy beaches required for bald cypress germination and re-establishment. Measurements of tree stand age and distance between the partially submerged cypress fringe and the present shoreline yield estimates of local erosion rate prior to the period when air photos first became available.

(334)

Y-chromosome Hyperploidy and Fertility in
Male *Drosophila*

D. B. BENNER
East Tennessee State University

Cooper, 1956 (Genetics 41:242-246), has shown that *Drosophila* males bearing three Y-chromosomes produce no progeny. Grell, 1969 (Genetics 61:s23), presents evidence that certain combinations of two Y-chromosomes reduce male fertility. Other authors suggest Y-chromosome hyperploidy as the cause of non-fertile males observed in studies where Y-chromosome fragments are present in combination with complete Y-chromosomes. The present study was initiated to determine the general effects of two Y chromosomes on: (1) the percentage of tested males which are fertile (the usual observation reported), and (2) the number of progeny produced by each fertile male. The preliminary evidence suggests there is no reduction in the ability to produce some offspring, but there is a reduction in the average number of offspring produced by each fertile male.—Supported in part by a grant from the ETSU Research Advisory Council.

(302)

Anatomical Differences Between *Ligumia nasuta*
(Say) and *L. subrostrata* (Say) (Mollusca:
Bivalvia: Unionidae)

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MALCOLM F. VIDRINE

Gulf South Research Institute

SAMUEL L. H. FULLER

Academy of Natural Sciences of Philadelphia

Ligumia nasuta (Say 1817) of the Lake Erie and Atlantic drainages and *L. subrostrata* (Say 1931) of the Mississippi basin and the western Gulf drainage are conchologically similar, but anatomically very different. The inner lobes of the ventral mantle margins of *nasuta* from the Delaware River above Philadelphia (acceptable topotypes) are weakly undulate (at least in life) with rough outer surfaces; lack eyespots; are uniformly pigmented for their entire lengths; and bear weak, subequal, and closely spaced papillae, which extend anteriorly from the incurved aperture for more than half of the margin. The lobes of East Baton Rouge Parish, Louisiana, pond specimens of nominal *subrostrata* (whose type locality is the Wabash River) are neither undulate nor uniformly pigmented; possess eyespots posteriorly; have stronger, less closely spaced papillae, which increase in size anteriorly, especially in females; and are papillose and strongly pigmented anteriorly for only about one third of the ventral margin.

(63)

A Method of Vegetation Analysis and Description
For Highway Planning Purposes

J. PAUL BIGGERS

*Southern Illinois University and
Illinois Department of Transportation*

Field sampling methods, data reduction procedures, and ordination and clustering techniques commonly used in ecological research were examined to identify a practical method of analyzing and describing natural vegetation for transportation agencies. The desired product is a lucid procedure, for use in environmental assessments associated with highway projects, which would provide meaningful information to scientists, professional engineers and laymen. Methods were tested using three plant community types in southern Illinois; a remnant prairie, an abandoned field, and a mature woodland. Statistical analyses were used to determine the most efficient sampling intensities and to test the effectiveness of sample grouping techniques. Results suggest that modifications of "standard" ecological methods are appropriate for environmental assessments by transportation agencies.

(13)

Comparison of Benthic Macroinvertebrate
Communities in Structured and Non-structured
Areas of Crow Creek, Franklin County,
Tennessee and Jackson County, Alabama

CLARINDA M. BISHOP AND P. V. WINGER

Tennessee Technological University

As part of an overall study of the effects of gradient stabilization structures in a channelized stream, the benthic macroinvertebrate communities were studied at eleven sites in Crow Creek, Franklin County, Tennessee and Jackson County, Alabama. At each site three Surber samples and four core samples were taken monthly except during periods of high flow. Preliminary data indicate that riffle areas had a more diverse community structure than pool areas at all sites, but no differences were found between riffles or between pools in structured and non-structured areas. However, the riffle-pool ratios at the structured sites were found to be lower than for the non-structured sites indicating less riffle habitat in the structured areas. Thus in terms of overall benthic diversity and availability of food organisms, the structured areas were less desirable habitats than the non-structured ones.

(245)

Fungi of the Meeman Biological Field Station

H. DELANO BLACK

Memphis State University

Located in the extreme southwestern corner of the State of Tennessee in Shelby County, Meeman Biological Field Station is an inland field station of 623 acres. It is adjacent to Meeman-Shelby Forest State Park (12,500 acres) on the third Chickasaw Bluff composed mainly of loess soil. The mixed deciduous forest of oak, hickory, beech and maple represents the western zone of the Eastern deciduous forest of the United States. The topography of the station varies from old fields to steep bluffs to cypress swamps and affords excellent conditions and areas for collecting fungi. Representatives of the basidiomycetes are generally abundant during the spring, summer and fall because of the mild temperatures and abundant rainfall.

(293)

A Silver Eye Mutant in the Crawfish *Procambarus clarkii* (Girard) (Decapoda: Cambaridae)

JOE B. BLACK AND JAY V. HUNER

McNeese State University and Southern University

Eight specimens of *Procambarus clarkii* from an experimental farm pond near the campus of Louisiana State University, Baton Rouge have been collected which show an apparent lack of melanin in the compound eye. The external one-half of the eye is transparent with an inner core of a metallic silver hue with light amber over-tone. These animals do not respond to normal light or movement stimuli. The eye and eyestalk are of normal size. Two of the male mutants have been outbred to females with normal eye pigmentation. The F₁ offspring all show normal eye color. It is anticipated that inbreeding of F₁ specimens, now in progress, will show the mutant gene to be recessive to its normal allele. This is the first known record of this particular mutant. The relatively high frequency of the mutant allele in this population is probably due to spontaneous mutation combined with inbreeding.

(109)

Preliminary Studies on a Lake Affected by Acid Mine Drainage

ELIZABETH R. BLOOD AND JAMES R. REED, JR.

Virginia Commonwealth University

Lake Anna is a 13,000 acre reservoir created as a cooling facility for a local power company. This lake is affected by acid mine drainage from abandoned mines located on Contrary Creek, a major tributary of the lake. High concentrations of heavy metals are usually associated with this type of drainage. Various aspects of the ecosystem were analyzed to determine if the acid mine drainage was having an impact on Lake Anna. From data on sediment water, fish, plankton and macrophytes there are indications that Contrary Creek is the major point source for the majority of the metals monitored. However, there appear to be other sources (both natural and man made) of heavy metals in the system. —Funded in part by Virginia Electric and Power Co., Richmond, Virginia.

(236)

Historical Perspectives on Histochemical Methods

BURTON J. BOGITSH
Vanderbilt University

(No abstract received)

(231)

Localization of Soluble Antigens in *Schistosoma mansoni* Cercariae by Immunocytochemistry

B. J. BOGITSH AND S. P. KATZ

Vanderbilt University

Soluble cercarial antigen (CAP) was localized in cercariae of *Schistosoma mansoni* in the digestive gland of infected *Biomphalaria glabrata* by the unlabeled antibody method. Reaction product was observed in the post-acetabular gland cell contents, to a lesser extent in the contents of the preacetabular gland cells, and associated with the tegument. Reaction product was also observed on the inner aspect of the sporocyst wall. Supported, in part, by contract DADA-17-73-C-3052 from the U.S. Army R & D Command.

(209)

The Florida Middle Grounds: A Tropical Ichthyofauna Assemblage?

STEPHEN A. BORTONE

University of West Florida

Reef fish faunas of the Bahamas and the Florida Middle Grounds were qualitatively and quantitatively compared. Data for the comparison were obtained from *in situ* observation, cinemagraphic analysis, and the literature. Both diurnal and nocturnal communities were examined from both areas.

Total numbers of species present are equitable between the two areas but species associations and diversity are not. Many species were common to both localities studied but distinct differences in relative abundance and size of individuals were noted. Habitat diversity, relative stability, and biogeographic factors all contribute to an explanation of the observed differences. The Florida Middle Ground ichthyofauna is considered a unique faunal assemblage which is unlikely to be found at other West Indian-Caribbean reef areas.

(224)

Allelochemical Germination Interactions in *Typha latifolia* (L.) and *Typha domingensis* Pers. (Typhaceae)

STEPHEN R. BOSTIC
Savannah River Ecology Laboratory
and The University of Texas

Aqueous leaf extracts from *Typha latifolia* and *Typha domingensis* were tested for their effectiveness in inhibiting the germination of *Typha* seeds. Intraspecific tests with *T. latifolia* conducted at 25°C showed interpopulational variation in response to extract from a single population. Greatest inhibition was observed when seeds and extract were taken from the same population and increasing concentrations of extract showed increasing time required for seed germination. At 35°C this inhibition was not observed. Observations of seed germination in the field, under both normal and elevated thermal conditions, were consistent with the observations from growth chamber experiments. Intraspecific tests with *T. domingensis* conducted at 25°C showed considerable germination inhibition when seed and extract were from the same population. Interspecific tests showed that at 25°C *T. latifolia* extract greatly inhibited *T. domingensis* seed germination and vice versa. *Typha* germination inhibition is therefore more complex than previously reported in the literature.

(36)

Concentrations of Ten Heavy Metals Associated with Particulate and Dissolved Organic Fractions from the Okefenokee Swamp, Georgia

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Savannah River Ecology Laboratory

Concentrations of ten heavy metals (Co, Cu, Cd, Cr, Fe, Mg, Mn, Ni, Pb and Zn) associated with the particulate fraction ($\geq 0.15 \mu\text{m}$) and five dissolved organic fractions were determined, using atomic absorption spectrometry. The particulate fractions were concentrated by continuous flow centrifugation, while the organics were fractionated into five fractions ($\geq 300,000$; 300,000-50,000; 50,000-10,000; 10,000-500 and ≤ 500) using ultrafiltration. More than 70% of the dissolved organic carbon is in the fraction less than 500 mw while approximately 25% is in the fraction between 10,000 and 500 mw. Less than 3% of the organic carbon is in with the other three fractions. Most of the heavy metals are associated with the lower molecular weight fractions, due to the much higher concentrations of organics, but the heavy metal/carbon ratio is greater in the higher molecular weight fractions. The ecological significance of heavy metal binding to organic fractions is discussed and related to cycling of natural and anthropogenic sources of heavy metals in aquatic systems.

(196)

Effect of Growth Rate and Light Intensity on Relative Vacuolation of *Microcystis aeruginosa* (Cyanophycophyta) in Continuous Culture

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University of Alabama in Birmingham

A blue-green alga, containing gas vacuoles and often predominant in dense fresh-water blooms, *Microcystis aeruginosa*, has been grown axenically in continuous culture. Phosphate concentration in a basal salts medium, ASM-1, was growth-limiting; all other nutrients were supplied in excess. The growth rate of the organisms was dependent on the rate at which the modified ASM-1 medium was added to the culture (dilution rate). The relative degree of vacuolation was determined for cells cultured at different growth rates under identical light conditions and at a constant growth rate under varying intensities of illumination. Effects of growth rate on cellular characteristics such as cell volume and macromolecular content were studied.

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Morphological Comparisons of Two Populations of Feral Swine (*Sus scrofa*)

I. LEHR BRISBIN, JR., RICHARD A. GEIGER, H. B. GRAVES,
JOHN E. PINDER III, JAMES M. SWEENEY
AND JOHN R. SWEENEY
Savannah River Ecology Laboratory

Morphological comparisons were made between feral swine from an island (OIP) and mainland (SRP) population in the southeastern United States. These two populations differed in the amount of time that they had existed in the feral state, being essentially free from the influences of domestication for periods of several hundreds of years (OIP) and 20 years (SRP), respectively. SRP pigs were significantly heavier and had greater total body lengths than OIP pigs, but there were no differences in total body lengths or weights between sexes within either population. Flank and spinal hair lengths were significantly greater in the OIP pigs, with no sexual dimorphism being shown. The frequency of distribution of various color phenotypes was significantly different between populations, with differences being mainly attributable to a marked reduction in the frequency of the rarer phenotypes, particularly white, in the OIP population.

(308)

Factors Influencing Fall Concentrations of Inland Shorebirds

MICOU M. BROWNE

North Carolina State Museum of Natural History

WILLIAM POST

North Carolina Department of Mental Health Services

Random observations and banding data from an inland study site (Raleigh, North Carolina) indicate prolonged periods of stopover (maximum 22 days) for transient fall populations of shorebirds. A receding water level provided continuous foraging habitat. During the period of study, recaptured birds showed a marked increase in weight and fat reserves. Factors governing length of stay, turnover rate, species composition, and biomass of 19 species of shorebirds at this inland site are discussed.

(3)

Usefulness of the Grasshrimp, *Palaemonetes* (Decapoda) to Screen Refinery Effluents

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Virginia Polytechnic Institute and State University

A simple bioassay procedure was developed for screening estuarine refinery effluents. Seven invertebrates and three fish were tested under static conditions, using an arbitrary refinery mixture (ARM) at 35, 17.5, 9, 3.5 and 2 ppt salinities. The ARM consisted of kaolinite (20 mg/l), ammonium chloride (10 mg/l), No. 2 fuel oil (10 mg/l), potassium chromate (0.25 mg Cr/l), sodium monosulfide (0.17 mg sulfide/l) and phenol (0.10 mg/l). The animals were exposed to multiples and fractions of the ARM to determine 24 hr LC₅₀ values. LC₅₀ values exceeding 1× the ARM were obtained for *Fundulus heteroclitus*, *Poecilia* sp., *Syngnathus* sp., *Nereis limbata*, *Artemia salina*, *Uca virens* and *Arbacia punctulata*. Animals that had a LC₅₀ value below 1× the ARM were *Lagodon rhomboides*, *Penaeus* sp. and *Palaemonetes*. Further tests were conducted on mixed populations of *Palaemonetes pugio*, *intermedius*, and *vulgaris* from the New England and mid-Atlantic regions, and a population of *P. pugio* from the Gulf Region. The range of 24 hour LC₅₀ values for *Palaemonetes* from the three geographic regions and the five salinities was 0.29-0.38× the ARM. This research was supported by a contract from the American Petroleum Institute.

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Population Dynamics of an Acanthocephalan Parasite of the Creek Chubb *Semotilus atromaculatus* (Mitchill)

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The University of Nebraska

An acanthocephalan population was monitored by examining creek chubbs, *Semotilus atromaculatus* collected in four southeastern Nebraska streams from August, 1974 to July, 1975. Of 534 fish examined 78% were infected. A relatively high infection was noted throughout the year, ranging from 73% to 82%. The density of infection (mean number of parasites per fish examined) ranged from 1.2 to 7.7 depending on the stream and date of collection. The number, size, sex and maturity of the acanthocephalans are analyzed with respect to the stream, collection date, other helminths, and host length-weight classes.

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Studies on the Relationship Between Protozoan Populations and *Polyarthra vulgaris* (Rotifera)

A. L. BUIKEMA, JR., J. D. MILLER,
AND W. H. YONGUE, JR.

Virginia Polytechnic Institute and State University

Rotifer and protozoan populations were sampled every seven to 14 days from April through July, 1975 from a small soft-water Appalachian impoundment. The dominant rotifers were *Polyarthra vulgaris* and *Keratella cochlearis*. Potential food organisms for *Polyarthra* were analyzed and the dominant protozoan during the entire study was *Dinobryon sertularia*. Once the ambient temperature exceeded 15°C there was a good correlation between *D. sertularia* and *Polyarthra* populations.

Cryptomonas ovata was present only three times during the study and never in sufficient quantity to be a significant food organism. An inverse relationship between *Polyarthra* and *Monas* sp. was observed. No relationship was observed between *Polyarthra* and *Dinobryon divergens*, *Synura uvella* or *Chilomonas paramecium*.

Laboratory observations on food selection by *Polyarthra* support the conclusion that *Dinobryon* is a major food source for *Polyarthra*.

(283)

Polyacrylamide Gel Electrophoretic Studies of Homothallic Species of *Neurospora*

ANNIE M. BULL, ENOLA L. STEVENSON,
AND LAFAYETTE FREDERICK
Atlantic University

Polyacrylamide gel electrophoretic studies were conducted with soluble protein extracts from the mycelia of the 5 homothallic species of *Neurospora*. The patterns obtained were compared and their taxonomic value was assessed. Twenty-one soluble protein bands were delineated in the 5 species. Eleven bands occurred in *N. dodgei* and *N. lineolata*, 13 in *N. africana* and *N. galapagosensis*, and 15 in *N. terricola*. Five soluble protein bands were common to all 5 species. *N. dodgei* had 2 exclusive soluble protein bands. *N. africana*, *N. galapagosensis*, and *N. terricola* each had a band that was not present in any other species. *N. lineolata* had no band that was unique to it. The differences noted remained constant under the cultural conditions used and provide additional evidence in support of the recognition of these fungi as distinctly different species. Also, the results add further support to the concept that the electrophoretic technique is of meaningful value as a tool in assessing degrees of taxonomic similarity between species of the same genus or of closely related genera.

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Liver-Body Weight Ratios as Indicators of Seasonal Growth Variations in Two *Leomis macrochirus* (Centrarchidae) Populations

FRANK J. BULOW AND C. B. COBURN
Tennessee Technological University

RNA-DNA ratios and liver-body weight ratios were shown to be positively correlated with growth rates of bluegills, *Lepomis macrochirus*, held for ten days at three feeding rates. Throughout the year, bluegills collected from a shallow, fertile lake (Cookeville City Lake) had significantly higher liver-body weight ratios than those collected from a deep, less fertile lake (Center Hill Reservoir). Liver-body weight ratios showed similar seasonal fluctuations in both lakes, but fluctuations were more pronounced in Cookeville City Lake. Back-calculated lengths using the scale method revealed an overall greater annual increment of growth in Center Hill bluegills. This appears to be related to the longer growing season in Center Hill.

(38)

Food Habits of Eleven Species in a North Carolina Estuary

GEORGE H. BURGESS
University of Florida

Analysis of stomach contents is a useful tool in determining niche relations within a community. Diets of eleven species of estuarine fishes collected near Beaufort,

N.C. were analyzed. Three major constituents (Polychaeta, Crustacea, Pisces) contributed more than 80% by volume in all but two species (*Leiostomus xanthurus*, *Lagodon rhomboides*) examined. Significant additional components in the latter species were pelecypod molluscs (in *Leiostomus*) and algae (in *Lagodon*). *Pomatomus saltatrix*, *Cynoscion nebulosus*, and *C. regalis* were primarily piscivorous. *Paralichthys dentatus* fed equally on fish and crustaceans. Crustaceans formed the bulk of the diets of *P. lethostigma*, *Bairdiella chrysura*, and *Urophycis regius*. *Orthopristis chrysoptera*, *Micropogon undulatus*, *Leiostomus*, and *Lagodon* chose polychaetes as their prime food component. Ecological significance of food resource division is discussed.

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Infestation of the Medusae of *Podocoryne minima* (Anthomedusae: Hydractiniidae) by Metacercaria of *Opechona* sp. (Digenea: Lepocreadiidae) from a Gulf of Guinea Neuston Collection

A. J. BUTT AND S. B. COLLARD
University of West Florida

Of the 20 anthomedusae, *Podocoryne minima*, 17 (85%) were infested with metacercarial larvae of *Opechona* sp. (*O. bacillaria* ?) as follows: mesoglea, 24; radial canals, 17; ring canal, 4; other locations, 2. Additional planktonic intermediate hosts of these worms are discussed in light of the forage preferences of their previously reported definitive hosts. It is suggested that larval digenetic trematodes are versatile in their "selection" of pelagic interim hosts.

(185)

Haptoglobin Levels During Prepatency and Early Patency of *Dipetalonema viteae* (Nematoda: Filarioidea) Infections in Jirds, *Meriones unguiculatus* (Rodentia: Gerbillidae)

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University of North Carolina at Charlotte

Haptoglobin, a normal serum protein, has been used as an indicator of tissue damage or stress. Haptoglobin levels were monitored during prepatency and early patency of *Dipetalonema viteae* infections in jirds, *Meriones unguiculatus*. Animals were infected subcutaneously with 50 *D. viteae* L₃ larvae followed by weekly bleedings of approximately 1 ml from the retro-orbital sinus for haptoglobin analysis. Free hemoglobin, which binds to haptoglobin, was added to the serum, and the resulting haptoglobin-hemoglobin complex was identified and quantitated by acrylimide gel electrophoresis. Some of the infected animals were bled daily from the retro-orbital sinus to check for patency starting at day 48. Although jirds show an expected rise in haptoglobin levels following subcutaneous injection of turpentine, there was no significant increase in haptoglobin levels during prepatency or early patency of *D. viteae* infections. Daily bleeding appeared to be a more potent haptoglobin inducer than the parasites.

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The Response of Pine Callus to the Herbicide
Paraquat in Sterile Culture (Gymnospermae,
Coniferae, Pinaceae)

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University of Tennessee

Pine callus tissues were obtained in sterile culture from hypocotyl, cotyledon, and root of several species of pine seedlings which were raised in sterile culture. Seedlings were obtained from embryos isolated from seeds of white, pitch, Virginia, loblolly, and short leaf pines under sterile conditions. In a series of experiments, callus tissues were placed on modified Skoog's agar-solidified media containing the herbicide Paraquat in concentrations ranging from 10^{-8} to 10^{-3} M along with untreated controls. Fresh and dry weight data of the calli showed that callus growth of all species except white and pitch pines was increased over controls at concentrations of 10^{-6} and/or 10^{-7} M. The concentration 10^{-5} M was markedly inhibitory to calli of all species, and calli of all species tested either died or failed to grow on media containing 10^{-5} , 10^{-4} , and 10^{-3} M Paraquat. There was no observable difference in growth of calli from different parts of the seedling.

(88)

The Vascular Flora of Stone Mountain State Park
in Wilkes and Alleghany Counties of
North Carolina

I. W. CARPENTER AND MARIE L. HICKS
Appalachian State University

Stone Mountain State Park is an undeveloped tract of land which is contiguous with the Blue Ridge Parkway on the north and the Thurmond Chatam Game Preserve on the east. The collection area covers some 20 square miles of mountainous forests. In order to establish a check list of plants and to determine the existence of rare or endangered species a floristic inventory was undertaken in the fall of 1974. Collections were made weekly during the growing season from October 1974 to November 1975. A total of 709 collections were made which represented over 600 species of vascular plants and over 200 county records. Many unique habitats and range extensions were found. One interesting ravine contained large colonies of *Cymophyllus fraseri* and *Boykinia aconitifolia*. Collections common on the granitic rock outcrops included *Arenaria groenlandica*, *Cheilanthes lanosa*, *Hypericum gentianoides*, *Juniperus virginiana*, *Pinus pungens*, *Pinus virginiana*, *Ptelea trifoliata*, *Selaginella rupestris* and *Talinum teretifolium*.

(335)

Characterization of Several Valine Resistant
(Val^R) Mutants of *Escherichia coli* K-12

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Alabama State University

In this study, several valine resistant mutants of *E. coli* K-12 were examined to determine the precise nature of

these mutations. It was found that these mutant strains were resistant to 1mM valine and glycylvaline (Val^R) and caused the biosynthetic enzyme, acetohydroxy acid synthase (AHAS) to be less sensitive to feedback inhibition by valine than the wild-type enzyme. Further, it was shown that the isoleucine-valine (ilv) biosynthetic enzymes of these mutants were depressed several fold as compared to the wild-type strain. Preliminary genetic data indicated that these Val^R markers (mutations) are linked to leucine. These Val^R mutants will be discussed in reference to the regulation of the isoleucine-valine (ilv) operons of *E. coli* K-12.

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Intracolony Density and Activity Relationships
of the Florida Harvester Ant, *Pogonomyrmex*
badius (Hymenoptera: Formicidae)

KENNETH W. CARTER, JANET S. HARRISON
AND JOHN B. GENTRY
Savannah River Ecology Laboratory

An attempt was made to estimate intracolony densities of a group (N = 11) of *P. badius* colonies by correlating above-ground activity patterns with the number of individual ants per colony. Above-ground activity was determined by counting the number of ants leaving the nest during a five-minute period. At the end of the activity observation phase of the study, all colonies were excavated to determine the absolute number of ants in each. A simple linear correlation revealed no significant relationship between activity and ant numbers. The lack of a significant correlation was due primarily to the narrow range in ant numbers of the 11 colonies excavated. For example, eight of the colonies contained between 5000-6000 adult ants. An equation to predict intracolony density from activity counts could be derived if colonies were chosen to represent a broader spectrum of ant numbers.

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The Fishes of Buffalo Bayou in
Western Mississippi

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Tulane University

A survey of the fishes of Buffalo Bayou in western Mississippi was conducted over a five year period. Over 71,000 specimens were collected from 17 stations located from the headwaters to the river's confluence with the Mississippi River. Seventy-one species representing 13 families were recorded from Buffalo Bayou, with three cyprinid species, *Notropis camurus*, *N. longirostris*, and *N. venustus*, accounting for nearly 73% of total specimens captured. A pattern of species addition and replacement was seen in the longitudinal distribution of the ichthyofauna.

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Geographic Variation in the Dwarf Crayfish,
Cambarellus puer (Crustacea: Decapoda)

CARLENE L. CHAMBERS, JAMES F. PAYNE,
AND MICHAEL L. KENNEDY
Memphis State University

Dwarf crayfishes, *Cambarellus puer*, were studied from 41 localities throughout the known range and measurements of selected external anatomical characters were taken from 652 adult specimens. Univariate and multivariate statistical analyses were applied to assess geographic variation in this species. Six of nine body size characters exhibited significant sexual dimorphism. All characters varied geographically except dactyl length. Three dimensional projections of localities onto principal components showed that in general, specimens from the northern populations were larger than those from southern populations.

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Induction of Mixed-Function Oxidases by Crude
Oil in the Striped Mullet, *Mugil cephalus*

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Mississippi State University

Microsomal mixed-function oxidases, important in the metabolism of many endogenous and exogenous compounds, are inducible by a variety of foreign materials, some of which are components of crude oil. Striped mullet, *Mugil cephalus*, were exposed to 75 ppm emulsified Empire Mix or Saudi Arabian crude oils for 4 days. The following microsomal electron transport components were measured in liver homogenates: cytochromes b_5 and P-450, NADH- and NADPH-cytochrome c reductases, NADPH-dichlorophenolindophenol reductase and NADH-cytochrome b_5 reductase. In addition, liver weight to body weight ratios and total and microsomal protein content of the liver were determined. Cytochromes b_5 and P-450 were induced, with the latter four fold higher in crude oil-treated fish than in control fish. The NADPH-dependent enzymes appeared to be induced whereas the NADH-dependent enzymes were not. Protein, both total and microsomal, was decreased. Liver weight to body weight ratios were increased 50% in treated fish.

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A Preliminary Survey of Arkansas Freshwater
Planarians (Turbellaria, Tricladida)

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*Middle Tennessee State University
and Southwestern at Memphis*

Seven species of planarians were collected from 48 sites in 27 counties of Arkansas from 4 June through 28 June 1974. *Dugesia dorotocephala* occurred at 20 sites that were mainly in northern Arkansas and was abundant at four sites. *Dugesia tigrina* was obtained from 17 sites that were not the same sites as those for *D. dorotocephala* and was abundant at only one site. *Cura foremanii* was collected from six sites and was associated with three other species at four of these sites. *Phagocata gracilis* occurred at five sites, all of which were spring-fed. A monopharyngeal species of *Phagocata* was

collected from three sites, but since all specimens were asexual, it could not be identified specifically. *Dendrocoelopsis americana*, an unpigmented form, was taken from two, small, mountain springs. *Procotyla fluviatilis* occurred at only one site. Data are also presented for water temperature, pH, calcium, and total dissolved solids.

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Population Structure and Local Differentiation
in *Diamorpha smallii* (Crassulaceae)

ROBERT H. CHAPMAN
University of Georgia

The technique of starch gel electrophoresis was used to examine the genotypic composition of a population of *Diamorpha smallii* on a Georgia granite outcrop. Heterogeneity within and between spatially separated sub-populations was correlated with pollinator behavior and patterns of seed dispersal. The evolutionary implications of this type of localized intraspecific differentiation will be discussed.

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Biochemical and Morphological Variation in
Northern Gulf of Mexico Populations of the Rock
Seabass, *Centropristis philadelphica*

ROBERT W. CHAPMAN
University of West Florida

Biochemical and morphological studies on the rock seabass, *Centropristis philadelphica*, from the northern Gulf of Mexico, suggest the presence of discrete populations. Electrophoresis of plasma esterases show polymorphisms at the Esterase-I and Esterase-II loci for all populations. The Est-II polymorphism apparently consists of alleles Est-II a, b, and null, while the genetic basis for the Est-I polymorphisms is not yet understood. Populations of *C. philadelphica* from Horn Island, Mississippi differ from Mobile Bay, Alabama conspecifics in the mobility of the Est-II b allele and the frequency of the Est-II null allele. Morphological variations in eye diameter, snout length and interorbital width suggest zoogeographical barriers at Mobile Bay and the Mississippi River.

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Reevaluation: *Fundulus nottii nottii*
and *Fundulus nottii lineolatus*

GORDON DAVID CHERR
Florida State University

Individuals intermediate between typical *Fundulus nottii* and *Fundulus lineolatus* have been identified from the Choctawhatchee, Apalachicola, New, Ochlockonee, and Suwannee River drainages in Florida and Georgia. These individuals indicate that the two nominal species are actually subspecies, as noted by Brown, 1958 Amer. Midl. Nat. 59(2): 477-488, and not full species as suggested by Rivas, 1966 Copeia 1966(2): 353-354, and Wiley and Hall (1975). Intermediacy was determined by the frequency distribution of caudal peduncle scale counts, the distribution of supra-occipital canal pores, and pigmentation patterns of mature males and females.

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Site-Specific Field Laboratory Avoidances of Fish to Chlorinated Discharges

DONALD S. CHERRY, KENNETH L. DICKSON,
ROBERT C. HOEHN, AND JOHN CAIRNS, JR.

Virginia Polytechnic Institute and State University

Chlorine avoidances of fish were studied at a site-specific field laboratory located along the New River at the Appalachian Power Company's fossil fuel plant, Glen Lyn, Virginia. Two avoidance approaches were used, one in which fish were exposed to increasingly higher chlorine concentrations from 0, 0.025, 0.05, 0.10, 0.20, 0.40 and 0.80 mg/l, and the other which consisted of one specific dose, 0.025, 0.05 or 0.10 mg/l. Fish were continuously monitored via closed-circuit television for 10-min periods at each dose in the first method, while a 30-min period (separated into three consecutive 10-min intervals) was utilized for the designated concentration in the second approach. Fish species, smallmouth and spotted bass (*Micropterus dolomieu* and *M. punctulatus*), were tested at five acclimation temperatures, 6, 12, 18, 24 and 30°C. Both species avoided lower chlorine concentrations at colder acclimation temperatures (0.05 mg/l at 12°C and 0.20 mg/l at 30°C), and when exposed to an immediate, single dose. At concentrations less than 0.05 mg/l, bass appeared to acclimate to or prefer chlorinated water prior to the avoidance response. — *This research was supported by the American Electric Power Service Corporation.*

(16)

Laboratory Studies of *Peltoperla maria* Nymph Feeding Rates and Efficiency (Plecoptera: Peltoperlidae)

JAMES R. CLARK AND JOHN H. RODGERS, JR.

Virginia Polytechnic Institute and State University

Autumn-shed leaves of maple (*Acer saccharum* Marshall), oak (*Quercus rubra* L.) and sycamore (*Platanus occidentalis* L.) were offered to nymphs of *Peltoperla maria* Needham and Smith under controlled laboratory conditions. The insects were acclimated at each incubation temperature, and after a sufficient period to clear their guts, they were offered leaves which had been previously conditioned, dried, weighed and reconditioned for 24 hours. A diurnal regime of 12 hours of light and 12 hours of darkness was imposed. Results confirm that *P. maria* has definite feeding preferences and additions to the POC and DOC in aquatic habitats from their fecal pellets may be significant. In this manner, *P. maria* can play an integral role in the energy flow and nutrient cycles in a small stream.

(54)

Relative Sensitivities of Methods Used to Evaluate the Effects of Perturbation on Periphyton Communities

JAMES R. CLARK, JOHN H. RODGERS, JR.

AND KENNETH L. DICKSON

Virginia Polytechnic Institute and State University

Structural and functional characteristics of perturbed periphyton communities on glass slides were studied using artificial streams which received water pumped directly from the New River, Glen Lyn, Virginia. Chlorine, phosphate, sucrose, and copper were each applied to one artificial stream of six parallel streams, leaving two untreated streams as controls. The periphytic growth in each stream was evaluated in terms of ash free dry weight, ATP, chlorophyll a content, and community structure. Inorganic carbon-14 and sulfate-35 assimilation were the functional parameters measured. The sensitivities of the methods in measuring changes in the periphyton communities under stress were compared. Alkalinity, pH, dissolved oxygen, temperature, sulfate, phosphate, nitrate, chlorine, and metals were monitored. Results indicate that no one technique was sufficient to explain all situations. Combinations of techniques led to better appraisals of the situations.

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Effects of Nutrients and Temperature on Mycelial Lipids of *Achlya* sp.

JOHN CLAUSZ, ROBERT GILLENWATER, KATHY RHODERICK,

RICHARD RHODERICK AND SALLY SWEELEY

St. Andrews Presbyterian College

Sterile broth cultures were inoculated with one ml. of hyphal fragments of *Achlya* sp. and were incubated at 25, 30 and 35°C in media which were one-half, full or twice the recommended recipe strength. Enriched and chemically defined media were used. Samples were collected at 24 hour intervals, washed to remove all excess broth and freeze-dried to remove all moisture. After weighing, the mycelia were subjected to a chloroform-methanol lipid extraction. The weight of the lipid in the chloroform layer was determined.

The dry weight curves of the fungus under all experimental conditions are typical S-shaped growth curves. In the peptone-yeast extract-glucose broth at all media concentrations, an accumulation of lipids up to the sixth day is observed followed by a decline and stabilization of lipid content. The lipid decline coincides with the point of the logarithmic phase where the curve is changing from accelerated growth to decelerated growth. The highest temperature is detrimental to fungal growth. Initial work with thin layer chromatography indicates the presence of polar and non polar lipids.

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Application of the RNA-DNA Ratio Technique of Measuring Growth Rates of Fish to a Natural Population of Bluegills, *Lepomis macrochirus* (Centrarchidae)

CHARLES S. COBB AND FRANK J. BULOW
Tennessee Technological University

Monthly samples of bluegills, *Lepomis macrochirus* (Centrarchidae), were taken from a middle Tennessee lake between October, 1974 and September, 1975 for the determination of RNA and DNA levels of liver tissue. Computer analysis was employed to examine variations in RNA-DNA ratios associated with season, size, sex, age and gonadal development. This baseline data will be a useful aid in the interpretation of subsequent growth rate assessments based on RNA-DNA ratios.

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Development of a Tissue Bioassay Technique for Screening the Effects of Selected Pollutants on Fish

C. B. COBURN, JR. AND A. A. FRIEDMAN
Tennessee Technological University

Extensive experiments with zinc compounds, arsenic compounds, alcohols, malathion, parathion, and phenols have been performed using conventional TL_m methods and a tissue respirometric method. The rate of metabolism of the fish tissues can be used as a predictor of TL_m for some pollutants.

The respirometric tissue bioassay technique of ascertaining the toxicity of pollutants: can be performed in about three hours, is readily adaptable to any effluent or water sample, gives good repeatability, can be standardized from lab to lab, and is not subject to as many variables as the classical TL_m methods.

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The Genus *Luzula* in the Hawaiian Islands (Monocotyledonae, Juncaceae)

JANICE C. COFFEY
Queens College

The family Juncaceae is represented in the endemic flora of the Hawaiian Islands only by the genus *Luzula*. Plants from all known populations on the islands of Oahu, Kauai, Maui, Molokai and Hawaii were studied in a re-evaluation of this genus, long neglected, as it occurs on these islands. Anatomical, morphological, cytological, ecological, and chemical data are used to demonstrate the variation which exists among these populations. The various taxonomic treatments are evaluated and a proposal for an acceptable treatment is offered.

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A Photoperiodic Response in the Crust Forming Alga *Scytosiphon lomentaria* (Phaeophyceae)

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An investigation was made of morphogenesis of the crust (microthallus) of the brown alga *Scytosiphon lomentaria* isolated from the Eastern Coast of Virginia. Morphogenesis of the crust resulting in the production of macrothalli was found to be induced by a short day photoperiod. This induction met the criteria for defining a true photoperiodic response. The plant could be induced to respond after a short exposure to the inducing daylength and the response was sensitive to a light break administered during the dark period. Cold temperatures, however, were required for growth of the macrothalli after induction by short day photoperiods. Field experiments substantiated laboratory findings. Basal systems of *S. lomentaria* outplanted to the field developed high frequencies of macrothalli only for those exposed to short day photoperiods prior to transplant.

(48)

Observations on the Ichthyoplankton of the Lower Mississippi River

JOHN V. CONNER
Louisiana State University

Planktonic early life-history stages of fishes were sampled along a 10-mile reach of the Mississippi River near St. Francisville, Louisiana, with a conical tow net (1-meter diameter, 0.505 mm mesh). Although eggs, larvae, and/or juveniles representing about 30 species were collected, only about 10 forms were common in the main river channel: *Dorosoma* spp.; *Cyprinus carpio*; *Hybopsis* spp.; *Carpoides carpio*; *Pomoxis* spp.; *Aplodinotus grunniens*. Of these, planktonic stages of only the chubs, carpsucker, and drum were virtually confined to main channel habitats, while young of the other species occurred also (sometimes more abundantly) in extrariverine areas such as the lower reaches of tributaries and inundated floodplains. Temporal patterns of occurrence of the principal fishes were: shad (March through July); carp (April through June); chubs (May through August); carpsucker (May through August); crappie (April through June); drum (May through September). Ichthyoplankton densities in the river were greatest from April through July.

(130)

Effect of Flooding on Swamp Productivity

WILLIAM H. CONNER AND JOHN W. DAY, JR.
Louisiana State University

Study in the Lac des Allemands swamp area yielded net primary productivities of 1140 and 1574 $g\ m^{-2}\ yr^{-1}$ for baldcypress-water tupelo and bottomland hardwood sites, respectively. These productivity values plus those from the Okefenokee Swamp, Georgia (707 $g\ m^{-2}\ yr^{-1}$) and the Big Cypress Swamp, Florida (1170 $g\ m^{-2}\ yr^{-1}$) indicate that seasonal flooding and flowing waters provide for optimum growth and survival of cypress trees. The lowest productivity levels were in Florida cypress

domes ($192\text{-}416\text{ g m}^{-2}\text{ yr}^{-1}$) where standing, stagnant water exists or where the water has been drained away. Research has shown that tree diameter increase for Louisiana swamps is three times greater than that of cypress domes.

(270)

An Initial Evaluation of a Tag-Recapture Study of the Exploitation Rate of Black Bass in Center Hill Reservoir, Tennessee

CHARLES COOMER, JR. AND C. PHILLIP GOODYEAR
Tennessee Technological University

A reward tag study on Center Hill Reservoir was initiated May 4, 1975. The purpose of this study is to determine the effects of fishing pressure on the black bass population (largemouth, spotted and smallmouth bass) in Center Hill. Nine hundred eighty-nine (989) bass were tagged with five different colored tags of progressively greater monetary value. Mathematical analysis of the rate of return on each value tag should provide an accurate appraisal of the total number of fish caught. Early returns have indicated a high percentage of the bass population is removed by angling during May and June. Tag returns decreased during the following months, but indications are that angling removes a large portion of the adult size population each year.

(25)

Marking Crayfish for Long-term Ecological Studies

JOHN E. COOPER AND MARTHA R. COOPER
North Carolina State Museum of Natural History

Numbering machine inks injected just beneath the sternites of crayfish provide marks which are not lost in molting. Laboratory tests for up to 16 months verified that red, black, and green inks were suitable. Discrete spots usually broke up into several movable particles which stabilized within two days. This technique has been used in the field since November 1968 in a continuing study of three species of troglobitic crayfishes in Shelta Cave, Alabama. About 1,500 individuals were marked, and about 1,250 recaptures were made, including multiples. After ten consecutive monthly markings, all samples of an abundant species taken through the following year contained an average 70% marked individuals. Lowered marking frequency in the ensuing five years resulted in a sharp drop in the percent of marked individuals in samples. This may reflect population changes or the loss of some marks. A number of marks were clearly visible more than six years after injection.

(294)

Growth and Longevity in Cave Crayfishes

MARTHA R. COOPER AND JOHN E. COOPER
North Carolina State Museum of Natural History

Studies of troglobitic crayfishes in Shelta Cave, Alabama, over seven years indicate slower growth and much greater longevity than is commonly assumed for invertebrates. Data were obtained from mark-recapture sampling, and from specimens confined in the cave. Published growth data for epigeal crayfishes, expressed as change per unit time, show rates ranging from 2.8 to 5.2 mm per month. By contrast maximum growth in any cave crayfish represented a rate of 0.38 mm/month.

Troglobites molted less frequently, and growth at any molt was less than half the maximum reported for epigeal species. A positive correlation was observed between failure to increase carapace length and energy demands for repair. Assuming maximum growth rates observed at various sizes, age of the largest individuals of *Orconectes a. australis* (47 mm CL) is estimated at over 37 years and 175 years assuming average rates. The two smaller species have lifespans conservatively estimated at ten and fifteen years.

(134)

Root Uptake of ^{134}Cs by Turkey Oaks (*Quercus laevis*)

J. M. CROOM AND HARVEY L. RAGSDALE
Emory University

Bioaccumulation of radio-caesium in southeastern U.S. ecosystems has recently received much attention. Both low clay content and cation exchange capacity of soil in the root zone results in greater availability of caesium for plant uptake. In an upland, sand-hills turkey oak community a 25m^2 area was labeled with $25\text{ nCi}^{134}\text{Cs}/\text{cm}^2$ in early April 1975. Stratified soil and vegetation samples (branch and leaf) were collected at intervals throughout the growing season. In September 1975, 92.5% of the radioactive label was in the 0-5 cm soil layer, 5% below 5 cm and 2.5% had been translocated to above ground plant tissues. Analysis of ^{134}Cs movement within the soil column will be presented along with a model of root uptake by turkey oaks.

(18)

A Monte Carlo Simulation of a Leslie Matrix Model of Competition Between Two Populations

WENDELL P. CROPPER, JR., MARK A. HARWELL,
AND HARVEY L. RAGSDALE
Emory University

A computer model of competition between two populations was developed based on a modification of the Leslie matrix model of population growth. Each population was assigned a constant matrix which described its dynamics in an unlimited environment. For each time interval, the growth of both populations was modified by density-dependent, time lag, and competition parameters. Model response was investigated by randomly selecting values for all of the parameters of each population and mapping coexistence/noncoexistence loci in projections of parameter hyperspace.

(189)

"White Spot" on the Shells of *Biomphalaria glabrata* (Gastropoda, Pulmonata, Planorbidae), Reared in Captivity

KENNETH L. CURRIE AND JOHN A. MECHAM
University of South Carolina at Sumter

It is not uncommon for a colony of *Biomphalaria glabrata*, reared in captivity, to develop whitish spots on their shells. Evidence was gathered to establish the fact that *Biomphalaria glabrata* feed on the shells of companion snails, creating cavities or spots on the shell. The average percentage area of shell spotting was determined

with snails reared in isolation (0.3%) versus snails reared in the presence of other snails (4.3%). Attachment or cannibalistic behavior was observed to be a frequent occurrence in a community of snails. Calcium deposition studies are currently being conducted to trace the cycling of calcium as a result of cannibalism among snails. — *This study was supported in part by a grant from the University of South Carolina Research and Productive Scholarship Fund.*

(177)

Rare Vascular Plants of Louisiana

MARY G. CURRY
VIN Louisiana, Inc.

In order to determine the number, status and distribution of rare vascular plants in Louisiana, six categories were created. Those plants fitting into one or more of the categories are considered to be rare in Louisiana. The categories include small overlooked species (which often only appear to be rare), recently introduced species (which also may have the potential to become noxious weeds), disjunct species, peripheral species, endemic species, and species of limited geographical distribution (which may also be locally abundant). Several species fit into more than one category and, in many cases, should also be considered threatened or endangered. Some of Louisiana's rare vascular plants include *Actaea alba* (L.) Mill., *Apteris aphylla* (Nutt.) Barah., *Kalmia latifolia* L., *Ottelia alismoides* (L.) Pers., *Pachysandra procumbens* Michx., *Panax quinquefolium* L., *Sagittaria guayanensis* H.B.K., *Sarracenia purpurea* L., *Serenoa repens* Bart. and *Tillandsia recurvata* L.

(149)

Changes in Urogenital Cytology During the Estrous Cycle of the Armadillo (*Dasypus novemcinctus*, Linn.)

GEORGE H. D'ADDAMIO AND E. E. STORRS
Gulf South Research Institute

Urogenital smears obtained from adult female armadillos during September and October revealed cyclic cytologic changes. Cornified squamous epithelial cells were present during estrus (1 to 2 days) and metestrus. Neutrophils appeared during metestrus (1 day) and became abundant during diestrus (1 to 3 days). Squamous epithelial cells were present during diestrus and proestrus (1 to 2 days) with the only differences between these stages being the absence of leucocytes during proestrus and the presence of a few cornified squamous epithelial cells in late proestrus. These cytologic changes are similar to those seen in cycling rats and differ only with respect to the presence of relatively fewer neutrophils during metestrus in the armadillo than in the rat. These data suggest that the armadillo is a short cycle, fall seasonal breeder in captivity. — *The authors thank J. W. Arnold for expert technical assistance.*

(32)

Industrial Application of a Biomonitoring System

MARGARET W. DAVIS AND ERIC L. MORGAN
Tennessee Technological University

The development of a continuous biomonitoring apparatus, used as a practical early warning system for the

detection of immediate acute changes in water quality at an industrial site, is discussed. The breathing rates of fish are monitored to detect these changes. Background data of fish breathing rates under normal unstressed conditions are taken continuously to determine any diurnal changes. These rates are then compared to breathing rates of the fish subjected to toxicants likely to be found in the plant effluent during a spill condition. The design of this system and interpretation of data will be summarized. Results of the use of this biomonitoring system at an industrial site will be given.

(215)

Systematics of the Genus *Stenotomus* (Pisces: Sparidae)

RICHARD H. DAWSON
*Grice Marine Biological Laboratory,
College of Charleston*

The sparid genus *Stenotomus* is reviewed. There are apparently three species of *Stenotomus*, all from the western North Atlantic. They are compared using both meristic and morphometric characters and electrophoretic patterns of liver and muscle proteins.

(282)

A New Coccoid, Zoospore-producing alga (Chlorococcaceae) With Hirsute Cell Walls

T. R. DEASON AND E. SCHNEPF
University of Alabama and Heidelberg University

A new coccoid alga was isolated from the Warrior River near Tuscaloosa, Alabama. Vegetative cells were embedded and sectioned, and wall fractions were shadowed and negatively stained for electron microscopic observations. The fibrous walls exhibit a periodicity of 33 nm, and are covered with hairs 30 nm in diameter. The use of wall structure and composition as taxonomic characteristics will be discussed.

(10)

Some Aspects of the Ecology of the Benthic Invertebrates of the Lower Mississippi River

DAVID J. DEMONT
Louisiana State University

Benthic invertebrates were collected monthly by Petersen dredge along a seven-mile section of the Mississippi River near St. Francisville, Louisiana from February, 1972 through December, 1973. *Limnodrilus hoffmeisteri*, *Tortopus primus*, *Pentagenia vittigera*, and *Corbicula manilensis* were numerically dominant among the 66 species collected. Invertebrate concentrations were highest along the river banks and were lowest in the sand substrate at midstream stations. *Limnodrilus hoffmeisteri* dominated mud substrates while *Tortopus primus* was the most numerous organism in the more solid substrates. Length-frequency distributions for *Pentagenia vittigera* and *Tortopus primus* indicated spring and fall emergence times, respectively. Fluctuations in the relative abundance of these two species showed habitat time-sharing. Benthic invertebrate concentrations declined during and after the 1973 flood. *Corbicula manilensis* data indicated a dramatic decline and slow recovery.

(92)

Evidence for the Hybrid Origin of *Proserpinaca intermedia* Mackenz. (Haloragaceae)

W. MICHAEL DENNIS AND B. EUGENE WOFFORD
University of Tennessee

On the basis of intermediacy of leaf shape, it has been suggested that *P. intermedia* is of hybrid origin from *P. palustris* L. and *P. pectinata* Lam. Additional evidence from field studies and flavonoid profiles support this hypothesis. In two populations where all three taxa were sympatric, *P. pectinata* had a constant flavonoid profile, *P. palustris* showed intervarietal differences, and *P. intermedia* had a flavonoid profile that was additive for *P. pectinata* and the variety of *P. palustris* with which it occurred.

(241)

Isoenzymes of NADP⁺-dependent
5-ketogluconate reductase of
Gluconobacter suboxydans

S. L. DIANIS, M. R. HOUSTON, L. B. LOCKWOOD
Western Kentucky University

Cell-free extracts of NADP⁺-dependent 5-ketogluconate reductase (EC 1.1.1.69) were prepared from cells of *Gluconobacter suboxydans* grown in media containing 10% concentrations of glucose, gluconate, glycerol, sorbitol, or mannitol. The extracts were fractionated by analytical polyacrylamide disc-gel electrophoresis. Gels were stained specifically for 5-ketogluconate reductase activity using a reaction mixture which contained gluconate, phosphate buffer, pH 8.5, NADP⁺, phenazine methosulfate, and nitroblue tetrazolium. The data obtained indicated that different isoenzymes of NADP⁺-dependent 5-ketogluconate reductase are produced by cells grown on different substrates.

(329)

Cytogenetic Studies on *Luzula hawaiiensis* Buch.

JOHN R. DIEBOLT
Queens College

Cytogenetic studies on the root tip chromosomes of plants belonging to the subgenus *Luzula* were conducted to determine the chromosome number of each and to develop a better staining procedure for root tip squashes. The plants were collected in the Hawaiian Islands and are classified as *Luzula hawaiiensis* Buch. Seeds were germinated in the light on filter paper in sterile petri plates. Germination time was between 5-6 weeks. Two staining procedures gave the best results: (1) root tips were pre-treated in an aqueous solution of p-dichlorobenzene at 5-10°C for 2½-3 hours, washed in water for 5-20 minutes, stained in warm 2% aceto-orcein for 4 seconds and squashed in 1% aceto-orcein; (2) root tips were pretreated and washed in water as in procedure (1), washed in 30% ETOH for 30-40 minutes, placed in Snow's stain for 24 hours at 60°C, washed in 70%

ETOH for 5-10 minutes, and prepared and squashed in 45% acetic acid. Procedure (2) gave the best results of the two methods. Of ten plants studied two individual plants yielded confirmed counts of $2n = 24$ and $2n = 42$ respectively. Two other individual plants have yielded probable counts of $2n = 14$ and $2n = 38$ respectively. Cytogenetic studies on the subgenus *Luzula* are being continued.

(44)

Male Reproductive Tactics in *Ambystoma jeffersonianum* (Green), (Ambystomatidae) :
Adaptive Response to a Competitive Breeding
Environment

MICHAEL EDWARD DOUGLAS
Savannah River Ecological Laboratory

A sylvan pond within Bernheim Forest, Bullitt and Nelson Counties, Kentucky, was isolated by drift-fence from January 1973 through June 1974. The winter-breeding *A. jeffersonianum* was the subject for ecological analyses involving: a) initiation of pre-reproductive migration, b) structure of the breeding population and c) length of the breeding season.

Results indicate that males, responding to cues earlier in the season, and moving in periods of deteriorating nocturnal temperatures, will usually arrive at the breeding pond much earlier than females. Duration of stay was significantly longer for males of the 1973 breeding season than for those of 1974, whereas duration of stay for females across both seasons remained unchanged. In conclusion, early arrival and prolonged stay at the breeding pond are interpreted as adaptive responses by males to a competitive breeding environment, and as such, are discussed in this report as male reproductive tactics.

(76)

The Response of Mongolian Gerbils, *Meriones unguiculatus*, to a Zinc Deficient Diet

WILLIAM L. DRAKE AND GERALD C. LLEWELLYN
Virginia Commonwealth University

Zinc is an essential element for all mammals and it is thought to be necessary for normal proliferative processes. Zinc has also been shown necessary for tumor growth. Zinc deficiency has been reported to be anti-neoplastic. In this experiment Mongolian gerbils were used to determine their response to the zinc deficient diet. The gerbils were maintained on a synthetic test diet with varying zinc concentrations. They were housed in plastic cages with non-metal lids. Food was provided *ad libitum* through glass feeders. All animals were also provided with distilled water in glass bottles. The following data were collected: mortality, change in body weight, food consumed, and water consumed. At sacrifice the general organ pathology was noted and the following organs were weighed and preserved for histopathology analysis: liver, kidney, adrenal glands, testes, heart and lung. From these data comparisons were made between the controls and test animals to determine the effect of a zinc deficiency.

(162)

Experimental Pollination in Natural Populations
of *Asclepias syriaca* L. (Asclepiadaceae)

ROBERT DUBAY
University of Virginia

The pollinia of the flowers of *Asclepias* must be inserted through a narrow interstaminal slit in the gynostegium and come in contact with the nectar before pollen tube growth will begin. This study, conducted on plants in populations near Mountain Lake, Virginia showed that, despite previous reports, pollinia orientation within the stigmatic chamber is unimportant so long as the pollinia is in contact with the nectar. Furthermore, self pollinations and both interpopulation and intrapopulation outcrosses showed approximately the same fruit set indicating self-compatibility in these herbaceous, clonal, perennials. These are the first successful experimental pollinations of *Asclepias syriaca* to be reported. After successful pollination, a marked decrease in fruit set in *Asclepias* populations in damp areas was noted and may be due to a fungal infection (by *Alternaria* sp., a known plant pathogen) that inhibits pod development.

(352)

Correlation of *In Vivo* Phytochrome States with
Longitudinal Growth in Mesocotyls of
Zea mays L.

STEPHEN O. DUKE¹
Southern Weed Science Laboratory

AUBREY W. NAYLOR
Duke University

A strong phytochrome control of longitudinal growth in maize mesocotyls was found by measurement of dark-growth subsequent to long (1-12 hr) white light exposures ended by brief red, far-red or red/far-red light treatments. Through dual wavelength *in vivo* spectrophotometry, a rapid decrease in total assayable phytochrome in the mesocotyl was shown to occur after exposure of intact maize seedlings to white light. Red and far-red light treatments converted 70% and 6% of the total phytochrome to P_{fr}, respectively. After 24 hr dark, resulting growth responses were of the same relative magnitude (ca. 5 mm with red and 15 mm with far-red light treatments), regardless of total assayable phytochrome. These results are consistent with the hypothesis that only a small fraction of the total phytochrome is physiologically active. —¹NRC-ARS Postdoctoral Associate.

(298)

A Preliminary Study of *Melanoides Tuberculata*
(Müller), Intermediate Host of the Human Liver
Fluke, (*Ophistorchis Sinensis*) in New Orleans,
Louisiana (USA)

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University of New Orleans

An exotic Thiarid snail, *Melanoides tuberculata*, has been found in the storm drainage canals of New Orleans,

La. In its native Oriental habitat it serves as an intermediate host for the Chinese liver fluke, *Ophistorchis sinensis*. A preliminary study of one locality has revealed a healthy population with high densities (2700 individuals/m²) in a weedy, sheltered microhabitat. The physical-chemical environment is similar to that reported in other U.S. localities with the exception of elevated salinity and alkalinity values. It is suggested that the spread of this snail and the possible establishment of the liver fluke life cycle be closely watched.

(290)

Nuclear and Cell Division in *Sorodiplophrys*
stercorea, an Unusual Labyrinthulid-like
Organism

MICHAEL J. DYKSTRA
University of Florida

In *Sorodiplophrys stercorea*, the first indication of nuclear division at the light microscope level is the elongation of the nucleus and nucleolus. Shortly after elongation, the nucleolus disperses at which time the nucleus begins a period of marked conformational changes. The nucleus eventually enters anaphase-telophase and assumes a dumbbell shape. After separation of the daughter nuclei, pronucleoli appear which fuse to form the single nucleolus characteristic of interphase nuclei. Following nuclear division, the cell divides by introgressive cleavage. Centrioles consist of nine singlet peripheral tubules with a 300 Å central tubular element. They are not observed in interphase cells. Microtubules are observed to pass from the cytoplasm into the nucleoplasm via nuclear pores. Nuclear division is strictly intranuclear. The whole process of nuclear and cell division typically takes 25-30 minutes.

(222)

Above Ground Biomass on Three Grassland Sites
in Southern Illinois

BOHDAN DZIADYK AND PHILIP A. ROBERTSON
Southern Illinois University at Carbondale

Above ground biomass was measured throughout one growing season on three grassland sites in southern Illinois; a hill prairie and a railroad right-of-way prairie both dominated by *Andropogon scoparius* and an old field dominated by *A. virginicus*. Total biomass (production + standing dead + litter) ranged from 493 g m⁻² on the hill prairie to 1268 g/m² on the railroad prairie. Similarly, minimum standing crop and litter occurred on the hill prairie while these two biomass components reached maximum amounts on the railroad prairie. Peak standing crop occurred during late summer on the hill prairie and old field community and during mid-summer on the railroad prairie. Differences in these community features are related to the effective moisture on the three sites.

(31)

A New Holding Chamber for In-Stream Growth Studies on the Asiatic Clam, *Corbicula manillensis*

KENNETH EAGLESON

Tennessee Technological University

Previous growth studies on bivalve molluscs have generally centered around estuarine and marine species. The introduction of the pest clam, *Corbicula*, has created a need for a suitable technique for *in situ* growth studies of fresh water species of molluscs. A study was initiated on the Clinch River, Tennessee to determine long-term growth rates of *Corbicula* in this riverine system. A description of the holding chamber design as related to site selection is discussed. The clam marking technique and methods used for field measurement of growth are also presented. — This study was supported by Exxon Nuclear Corporation.

(100)

Coastal Development in Florida:
I. A Case History of Past Trends

JOE A. EDMISTEN AND JOHN P. KERR

Baseline, Inc.

Prior to the current awareness of the ecological value of mangrove forests, coastal wetlands were sold by Florida to encourage development. This and the following paper will discuss the changes in attitudes, laws, and techniques pertaining to coastal developments in Florida. These changes can be exemplified in the histories of the development of two adjacent sites at Apollo Beach, which is about 15 miles south of Tampa. This first paper will describe the attitudes, laws, and techniques applicable to the first phase of development through 1971, when extensive dredge-and-fill operations were completed at Apollo Beach in the submerged nearshore beds of turtlegrass and other seagrasses and in the nearby-mangrove swamps. As recently as 1971, such mangrove areas have been cleared by bulldozer. Color slides will be presented of the current ecological status and recovery in these highly disturbed areas. Successional trends and rates of recovery along older canals and within the recently (1971) cleared mangrove areas will be stressed. The paper following this one will discuss some current plans for an adjacent site designated for possible development in the near future.

(326)

Ultra-Violet Induction of SV 40 Coat Antigen in Transformed Baby Hamster Kidney Cells

TIMOTHY J. EICHENBRENNER, THOMAS P. COOHILL
AND STEPHANIE DRAKE

Western Kentucky University

The induction of SV 40 virus in a transformed line of baby hamster kidney cells (E-line) was studied. Virus induction was activated by exposure of the cells to ultra-violet light. The production of SV 40 coat antigen was used as an indicator of induction, and its presence was detected by the indirect immuno-fluorescence technique.

(292)

The Microbial Flora Obtained from Vaginal Swabs of White-tailed Deer

L. P. ELLIOTT

Western Kentucky University

The purpose of this research was to determine the normal microbial flora of the vagina of the white tailed deer (*Odocoileus virginianus*) and to determine the effects of insertion of a mechanical contraceptive upon this flora. The deer used in this study were yearlings or older and were held at the Mammoth Cave research facilities.

The dominant bacteria found in the vaginal tract of the 45 deer sampled were *Escherichia coli* (53.3%), followed by *Staphylococcus epidermidis* (42%), and alpha Streptococci (25.9%). Other bacteria isolated were of sporadic occurrence (3 or less times). A scant amount of fungi was isolated with *Candida* sp. being most prevalent. All deer had at least one organism present in the vaginal tract during at least one sampling period. Due to death or expulsion of devices, it was not possible to determine if the microbial flora was dramatically altered by the devices.

(237)

Role of United States Department of Agriculture in the Development of Parasitology

JOHN V. ERNST

USDA Regional Parasitology Research Laboratory
at Auburn

(No abstract received)

(274)

The Application of Biotelemetry Techniques to Inland Fishery Studies

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Tennessee Cooperative Fishery Research Unit

The application of biotelemetry to inland fisheries studies is receiving greater emphasis with the development of miniaturized internal transmitters and the development of temperature sensing capabilities. Biotelemetry is useful for such studies as movement of fishes between thermal gradients, spawning activities, home range, forage behavior, reactions to environmental stresses, and internal body temperature. Some factors limiting the greater use of biotelemetry are the need for nearly constant surveillance, transmission under severe turbidity conditions, lack of depth sensing capabilities, and equipment costs and maintenance.

(220)

A New Madtom of the Subgenus *Rabida* from the Clinch and Duck Rivers, Tennessee

DAVID A. ETNIER AND ROBERT E. JENKINS

University of Tennessee and Roanoke College

An extremely rare madtom, most similar to *Noturus hildebrandi* (Bailey and Taylor), has been known from

the Clinch and Duck rivers since the early 1970's. It is presently known from fewer than 20 specimens, most of which are apparently juveniles. Meristics, morphometry, and what is known of the biology of the new species are compared with that of *N. hildebrandi*. The extreme rarity and limited distribution of this apparently relict species has led to its being submitted to the U.S. Department of Interior Endangered Species office as a "threatened" species. The possible effects of Columbia Dam (being constructed nearly 100 river miles above known localities on the Duck River) on the species are discussed.

(164)

Carex rosea-*Carex retroflexa* (Sect. *Bracteosae*)
Complex in Illinois

DAN K. EVANS
Marshall University

ROBERT H. MOHLENBROCK AND JUDITH MURPHY
Southern Illinois University

The *Carex rosea*-*C. retroflexa* complex is variously treated in the manuals. Polygraph analysis of 10 morphological characters separates the complex into two groups; one composed of *Carex retroflexa* Muhl. and *C. texensis* (Torr.) Bailey, the other of *C. rosea* Schkuhr, *C. convoluta* Mackenz. and *C. socialis* Mohlenbr. and Schweg. Characteristics separating *C. texensis* from *C. retroflexa* include culm width, spikelets per culm, perigynium width, beak length and angle of divergence, achene width, and habitat preference. *Carex convoluta* is distinguished from its closest allies in culm and leaf characteristics, perigynia per spikelet, perigynium width and stigma characteristics. *Carex rosea* is set apart from *C. socialis* by differences in root-stock, perigynium width and beak length, as well as achene length and width. Scanning electron microscopy of achene surfaces confirm a strong alliance within the complex. Differences in epidermal cell configuration as well as size and shape of conical bodies serve to distinguish the complex from other taxa within section *Bracteosae*.

(62)

A Field Study of the Reclamation of Strip-mine
Spoils with Fly Ash

JOSEPH FAIL AND ZACHARY S. WOCHOK
University of Alabama

Our laboratory has been investigating the feasibility of additions of various amendments to Alabama strip-mine spoils for the purpose of revegetation. Amendments include treated sewage and fly ash. For the past two years, our studies have centered on the use of fly ash as an amendment for strip-mine spoils of varying quality and age. Fly ash has been supplied by AMAX Corporation and our field studies have been conducted on land owned by Gulf States Paper Corporation.

Field studies were performed on 32 transects, each measuring 608 square feet of which half were treated with 31 tons per acre of fly ash and half retained as controls. The species so far tested at the mine site include: *Glycine max*, *Agrostis tenuis*, *Lespedeza cuneata*, and *Festuca arundinacea*. Preliminary data, principally from soybeans, indicate a significantly greater growth on fly ash treated soils as compared by total dry weight averages, and plant height.

(159)

The Section *Schizolepis* of the Genus *Scleria*
(Cyperaceae) in Central America

JOHN E. FAIREY, III
Clemson University

The section *Schizolepis* is distinguished by a fimbriate or serrate margin of the hypopygium. It is represented on the North American continent by a single polymorphic species composed of two varieties, *Scleria latifolia* Sw. var. *latifolia* and var. *arundinacea* (Kunth) Pfeiff. It ranges from southern Mexico southward to Argentina. These two varieties have usually been retained as separate species, but Core in 1965 (Wrightia, Vol. 7, No. 7: 152) and others have suggested that *S. arundinacea* Kunth may represent merely a color form of *S. latifolia* Sw. A review of the material from the major herbaria in North America clearly supports this idea. Evidently exposure to strong sunlight is a primary environmental factor in the formation of this variety. Var. *arundinacea* can be separated from the typical variety on the following basis: Plants generally more robust, taller (up to 3 m), leaves wider (averaging 4.2 cm wide), inflorescence and achenes purple or purplish-black.

(161)

A Comparative Diagnosis of *Clitoria* and
Centrosema (Leguminosae)

PAUL R. FANTZ
University of Florida

The genus *Clitoria* is frequently confused with the nomenclaturally and morphologically related genus *Centrosema*. A number of species of both genera are superficially similar in appearance. Misidentifications of these species, even to genus, are common. These genera are almost always separated in keys by the pubescence of the style, a character which apparently is often misinterpreted. To correctly distinguish the two genera, the following characteristics should be used: *Clitoria*: Calyx infundibular, lobes shorter to nearly equal tube length; vexillum spurless; alae longer carina; style elongated, geniculate near apex, bearded lengthwise adaxially; legume stipitate, usually thickened on upper or both surfaces, nerveless or with 1 prominent lateral nerve. *Centrosema*: Calyx short campanulate, lobes usually equal or longer than tube; vexillum spurred or gibbous; alae nearly equal carina length; style U-shaped, usually bearded near apex around stigma; legume subsessile, thickened on both sutures, 2 prominent lateral nerves with 1 near each margin.

(50)

Comparison of Fishes and Biomass by Trophic Levels On Artificial and Natural Reefs Off Southwestern Puerto Rico

DAVID E. FAST
University of North Carolina

FRANCISCO A. PAGAN
University of Puerto Rico

An artificial reef of used vehicle tires was constructed off the southwest coast of Puerto Rico in 1971. Visual observations using SCUBA were made on the artificial and nearby natural reefs for a period of 18 months, after which the reefs were poisoned. Fishes were collected, identified, counted and weighed. The number of species and the total number and weight of all fishes observed and collected was recorded for each trophic level, carnivore, omnivore, and herbivore. The percentage of the total number of species that were carnivores was the same, 72%, for both the artificial and the natural reefs. However, the percentage of the total number of fishes (92.5%-76.5%) and the percentage by weight (88.5%-51.3%) revealed that the artificial reef had a greater biomass of carnivorous fishes than did the natural reefs. The natural reef had over twelve times the biomass of herbivorous fish that was found on the artificial reef.

(114)

The Effect of Habitat on Diet of the Pinfish, *Lagodon Rhomboides* (Perciformes, Sparidae)

ANDREW FEINSTEIN
University of South Florida

Stomach contents of 698 pinfish, *Lagodon rhomboides* (L.) were analyzed from collections made over a 12 month period in Anclote Anchorage, a bay near Tarpon Springs, Florida, in which four bottom types were sampled. Of particular interest was the effect the different habitats had on the total diet. In percentage of dry weight, the major food item of pinfish from two manatee grass (*Syringodeum*) habitats of different depths was manatee grass itself. Other important items were organic and inorganic detritus, amphipods, and decapod shrimp. From a sandy bottom, seasonally abundant in turtle grass (*Thalassia*), detritus was the major item followed by benthic algae and polychaetes, but not significant amounts of turtle grass. From a sandy area devoid of seagrass, detritus was also the major item followed by porcellanid crab larvae and mysid shrimp, both highly abundant, one-time occurrences. This study describes ontogenetic changes in food habit for each habitat, changes that were more pronounced in the manatee grass habitats, probably because of greater variety of food available.

(217)

The "Handpaint", a Form of the Bluegill (*Lepomis macrochirus*: Centrarchidae) from the Apalachicola Valley, Florida.

JAMES FELLE
Savannah River Ecology Laboratory

The bluegill sunfish found in the region of the Apalachicola Valley, Florida (locally known as the "hand-

paint"), is strikingly different in coloration from other bluegill sunfish found in the Southeast. Adults of both sexes show black patches on the sides of the body. Breeding males are highly colored: below the lateral line, a broad black band extends from behind the opercle to the tail; the body above this is bright copper, and the breast is blood red. Morphology and genetic makeup of handpaints will be compared to these attributes in other populations of southeastern bluegills. Similarities and differences will be discussed.

(147)

Seasonal Changes in the Daily Rhythm of Plasma Prolactin Concentration in the White-throated Sparrow, *Zonotrichia albicollis* (Aves, Passeriformes, Emberizidae).

ALBERT J. FIVIZZANI AND ALBERT H. MEIER
Louisiana State University at Baton Rouge

Although daily rhythms of plasma prolactin concentration are well substantiated in vertebrates, few studies have investigated the possibility of seasonal changes in these rhythms. In the White-throated Sparrow, distinct daily rhythms of plasma prolactin levels, measured by radioimmunoassay, were observed at five times during the annual cycle. During the winter, peak levels of prolactin were observed late in the day. In the spring, when the reproductive system was developing, prolactin levels were highest during the night and early morning hours. In August, after the reproductive system had regressed, a bimodal pattern of plasma prolactin was observed with peak concentrations at dawn and early in the night. During the fall when the birds displayed migratory behavior, peak levels of prolactin occurred in the middle of the day. These results support the hypothesis that changes in the daily rhythm of circulating prolactin levels are involved in seasonal changes in the physiology and behavior of this animal.

(342)

The Secret Life of Filter Paper

R. O. FLAGG
Carolina Biological Supply Company

In recent years C. Backster (*Int. J. Parapsychol.* 10: 329-348, 1968), P. Tompkins and C. Bird (*The Secret Life of Plants*, Harper and Row, New York, 1973), and other neodruidic authors have inspired popular belief in capacities of plants to feel, to be purposeful, and to be telepathic. The presupposedly emotional responses of a plant are measured with a "lie detector," or galvanometer with electrodes attached to a leaf. A record is kept on polygraph paper or, at parties, one listens to the "responses" of the plant via an audio-amplifier. The latter is particularly dramatic as a plant "screams" when it is struck, threatened with fire or otherwise subjected to environmental modifications. That such remarkable responses can also be elicited from a piece of wet folded filter paper tends to put a damper on drawing ill-founded conclusions.

(93)

A Putative *Zephyranthes* (Amaryllidaceae)
Hybrid Recognized by Anthesis Timing

R. O. FLAGG AND WALTER S. FLORY, JR.
*Carolina Biological Supply Co.
and Wake Forest University*

The natural times of floral expansions of fall-blooming rain-lilies (*Zephyranthes pulchella*, *Z. smallii*, *Z. refugiensis*, *Z. jonesii*, *Z. herbertiana* and *Z. traubii*) agree with our postulation that a syngameon is developing on the Texas coastal plains. Anthesis in *Z. herbertiana* normally occurs after sunset at a time when it is little noticed. On the day of expected anthesis, *Z. herbertiana* plants were exposed to dark-light-dark regimes; the shorter the light exposure the later the buds began expansion. One clone represented by two plants started opening three hours earlier than would have been projected by the behavior of the others. As plotted on a graph (filament length vs. perianth-tube length) with glyphs, the early-opening clone was found to shift morphologically somewhat away from *Z. herbertiana* toward *Z. jonesii*, an afternoon-opening species. This suggests a backcross of *Z. jonesii* with *Z. herbertiana* as the origin of the early-opening clone.

(79)

The Binding of Tyrosine Metabolites to
Protein During Sclerotization
(Insecta: *Periplaneta americana*)

JOSEPH A. FLORENCE, G. C. LLEWELLYN,
AND R. R. MILLS
Virginia Commonwealth University

Tyrosine metabolites are known to cause hardening and darkening of the insect cuticle after ecdysis. Specifically, N-acetyldopamine has been identified as the sclerotization agent. N-acetyldopamine has been found to be incorporated into the cuticle by bonding to blood serum proteins which are then incorporated into the untanned cuticle after ecdysis. Once in the cuticle the protein bound N-acetyldopamine is crosslinked to cuticle proteins and chitin to form the insoluble, dark-colored matrix of the tanned cuticle.

(94)

Zephyranthes bifolia (Amaryllidaceae):
Its Chromosomes and Taxonomic Position

W. S. FLORY AND GERALD SMITH
Wake Forest University

This taxon was found on Santo Domingo by Plumier about 1690 and is not known from other areas. Plants with clear red flowers grow at higher altitudes; orange-flowered forms occur at lower elevations to the south. The two color forms will hybridize. All have $2n = 60$, a new chromosome number for *Zephyranthes*. The chromosomes of all are of three lengths: 8 are 11-14 microns; 26 average 7 microns; and 26 are only 3 or 4 microns long. The taxon has been placed, by different authors, in *Zephyranthes*, *Habranthus*, and *Amaryllis*. Sealy has suggested it is a hybrid. The species has re-

semblances with, and differences from, each of the three suggested genera. Here considered as a *Zephyranthes*, admittedly its taxonomic position is still puzzling and uncertain.

(8)

Benthic Macroinvertebrate Communities of the
Ocoee River, Copperbasin, Tennessee

JOHN W. S. FOSTER, III, L. H. LIDEN,
R. L. MARTIN, AND ERIC L. MORGAN
Tennessee Technological University

A twelve month study was conducted on the Ocoee River, Copperbasin area, Tennessee, to evaluate the condition of the benthic macroinvertebrate communities. The river has been stressed by industrial pollutants and severe surface erosion. Surber square foot and artificial substrate basket samples were collected monthly at nine river sites. Data from river collections were analyzed using several diversity and dominance indices and correlated with substrate type and several pollutants.

(343)

Physiological Aspects of *Hibiscus* Intergroup
Hybrid Lethality

L. RAYMOND FOX, GWEN RONEY, AND STEVE COGGIN
Florida State University

It has been reported that the endemic North American species of *Hibiscus* sect. *Trionum* fall into two breeding groups which are characterized by the production of viable interspecific hybrids from intragroup crosses and of conditionally lethal interspecific hybrids from intergroup crosses. Intergroup hybrid seedlings grown in the field develop a set of characteristic symptoms which are, for the most part, absent from plants grown in the greenhouse. These symptoms include a retardation or cessation of growth, the production of epinastic leaves with abnormal anthocyanin accumulation, and the development of petiole and midvein lesions during the final stages. Screening experiments suggest that the development of the lethal syndrome is more variable than previously reported and is probably modified by environmental factors. Starch distribution patterns and photosynthetic efficiency, translocation, and growth studies suggest that the development of lethal symptoms may be associated with an environmentally modifiable lesion in carbohydrate nutrition.

(279)

Enzymes of *Dictyuchus monosporus*
(Plycomycetes, Saprolegniaceae)

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Vanderbilt University

The aquatic phycomycete *Dictyuchus* is of interest by virtue of its heterothallism, the variations in sporangial discharge which occur in the genus, and the probability of the presence of sexual hormones as in the closely related genus *Achlya*. A strain of *Dictyuchus monosporus* collected from Radnor Lake, Nashville, Tennessee, was grown in axenic culture in liquid media, and a detailed

study of the activities of a number of its enzymes was made, using spectrophotometric methods. These include phosphofructokinase, aldolase, malate dehydrogenase, isocitrate dehydrogenase, cytochrome oxidase, glucose 6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase, lactate dehydrogenase, and catalase. Comparisons will be made with the findings of similar studies with *Achlya*.

(304)

Reproductive Adaptations of Montacutid Bivalves
for a Commensal Mode of Life
(Bivalvia: Montacutidae)

THOMAS H. FOX AND CHARLES E. JENNER
University of North Carolina at Chapel Hill

The bivalve family Montacutidae has been considered hermaphroditic by a number of authors. However, at least three species from the family show a marked sexual dimorphism (Jenner & McCrary, 1967, 1968), and the hermaphroditic condition of other species within the family is expressed in many ways, indicating that there is actually a great deal of variability overlying the essentially hermaphroditic reproductive condition. The most extreme dimorphic condition in the family is found in *Montacuta percompressa*, in which the male is reduced to nothing more than a testis embedded in the female tissue. The reproductive biology and the dwarf male of *M. percompressa* are described. Pertinent aspects of the reproductive biology of other members of the family are discussed to illustrate how similar selective pressures have lead to the evolution of both hermaphroditism and dwarf males within the family.

(303)

Apparent Resurgence of *Hydrolix grisea*
(Haldeman), the Grizzly Water-Slug
(Platyhelminthes: Turbellaria: Alloecocela)

SAMUEL L. H. FULLER
Academy of Natural Sciences of Philadelphia

After Haldeman's (1843, *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1: 166) original description, plus Leidy's (1852, *Ibid.*, 5: 290) record from the Delaware river basin (Pennsylvania, New Jersey), *Hydrolix grisea* was not reported again until Hyman (1938, *American Museum Novitates*, No. 1004: 1) noted its rediscovery in the Delaware basin. Further notice of this species rarely (or never) occurred until the past decade, when it was again encountered, with increasing frequency. R. Kenk and R. Diaz (personal communications) reported it from the Potomac (Virginia), James (Virginia), and Roanoke (North Carolina) basins. I have it from the Susquehanna (Pennsylvania) and Savannah (South Carolina, Georgia) basins. Morphologically unique, but minute, it has perhaps been overlooked. Alternatively, it may have become more plentiful and/or widespread during recent habitat degradation, for it is often abundant in severe sedimentation. Is *H. grisea* that rare creature, a genuine indicator species, the more remarkable for responding positively to environmental disturbance?

(30)

Spatial Competition between *Corbicula manilensis*
(Philippi), the Chinese Clam (Corbiculidae), and
Fresh-Water Mussels (Unionidae) in the
Waccamaw River Basin of the Carolinas
(Mollusca: Bivalvia)

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Academy of Natural Sciences of Philadelphia

MARC J. IMLAY
United States Fish and Wildlife Service

We found dead mussel shells and abundant living *Corbicula* below the confluence of the Waccamaw River with the Intracoastal Waterway (Horry County, northeastern South Carolina), where the River is profoundly altered by human activities. Above this confluence, where the River is, in general, little disturbed, we found mussels increasingly dominant over *Corbicula* as we sampled farther upstream, until the latter disappeared. *Corbicula* reappeared in Lake Waccamaw (Columbus County, southeastern North Carolina), but mussels persisted in apparently undiminished numbers. The Lake is almost encircled by extant and potential land development, but its floor remains negligibly damaged. It appears that *Corbicula* does not (and perhaps cannot) dominate indigenous bivalves in nearly or quite natural habitats, at least in slowly moving, soft-bottom Coastal Plain streams of the Atlantic drainage. Corollarily, not to disturb aquatic habitats may be man's best defense against domination of the benthos by *Corbicula*.

(181)

Endangered or Threatened Fresh-Water Mussels
(Mollusca: Bivalvia: Unionidae) of the
Waccamaw River Basin of the Carolinas

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Academy of Natural Sciences of Philadelphia

MARC J. IMLAY AND JAMES D. WILLIAMS
United States Fish and Wildlife Service

Elliptio waccamawensis (Lea) of Lake Waccamaw resembles specimens occasionally occurring in the Waccamaw River; unknown beyond the Waccamaw basin, this species is endangered by "development" girdling the lake. Typically exhibiting yellow periostracum with uniformly spaced growth rests, another *Elliptio* occurs in the Lake and upper River and possibly in Ortons Pond, Brunswick County, North Carolina. Probably a depauperate member of the *E. crassidens* (Lamarck) complex, a third *Elliptio* occurs in the middle River and perhaps in the Northeast Cape Fear River of North Carolina. The latter, undetermined species (or morphs) appear threatened. Remarkable because male shells so closely resemble those of *E. waccamawensis* of either sex, a conchologically unique, endangered population representing the "*Lampsilis*" *radiata* (Gmelin) complex dwells in the Lake.—This research was supported, in part by the Pew Foundation and by National Science Foundation grant GB-40064.

(142)

An Ecological Survey of Selected Heath
Communities Along the Blue Ridge
Parkway in North Carolina

LYNN GAINES AND JAMES H. HORTON
Western Carolina University

Along the Blue Ridge Parkway there are a number of plant communities in which the dominant plants are Ericaceous shrubs. In recent years the apparent encroachment of trees into these communities has been observed. This study was undertaken to determine the extent to which trees are currently present and/or are moving into three heath communities: Craggy Gardens (Buncombe County), Pisgah Campground (Haywood County) and Graveyard Fields (Haywood County). Sampling has been completed at two of the sites. The sampling methods used were the nested quadrat, releve, and transect. Soil samples were examined, and the approximate ages of the trees were determined through increment borings. The quadrat corners are being permanently marked so that this study can be repeated in order to gain additional insight into succession in these areas.

(20)

A Survey of Fishes Associated with an Estuarine
Area Affected by Thermal Effluents from a Fossil
Fuel Electrical Generating Plant

ROBERT A. GARRETT
Law Engineering Testing Company

Fishes were collected from West Bay near Panama City, Florida during September, 1975. The study was conducted to document the effects of a power plant's heated effluent on the fishes in the affected area. Thirty three species of fishes were collected from the study area. Certain species were found to be most abundant in the immediate area of the thermal discharge.

(56)

Multivariate Analyses of Elemental
Concentrations in Plants

CHARLES T. GARTEN, JR.
Savannah River Ecology Laboratory

Leaves from four species of plants were collected at eight locations along a creek on the southeastern coastal plain. Concentrations of K, N, Ca, P, Mg, Al, Na, B, Fe, Cu, Zn, Mo, Sr, Ba and radiocesium were measured. Elemental concentrations were positively skewed in each species although macroelements were generally less skewed than trace elements. Species differences accounted for more than 50% of the total variation in P, Mg, K, Ca, N, B, Na, Mo and Sr concentrations while locational differences were generally negligible. In a multivariate analysis of variance concentrations of both "structural" (Ca, Sr) and "metabolic" elements (K, P, Mg) contributed most to the differences among species in elemental composition. The degree of separation between species clusters in a two-dimensional discriminant space appears related to the physiological condition of

the leaves. Principal components analysis revealed "structural" and "cytoplasmic" components that were common to all four species.

(315)

Plutonium-239 Contamination of Snakes
Inhabiting ERDA's Rocky Flats Plant Site

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F. WARD WHICKER
Colorado State University

Three species of snakes (*Coluber constrictor flaviventris*, *Pituophis melanoleucus sayi*, and *Crotalus viridis viridis*) were collected in the vicinity of ERDA's Rocky Flats plant. Lung, liver, and bone tissues were analyzed for plutonium-239 activity. Interspecific comparisons were performed using nonparametric statistics. Concentration ratios (dpm/g snake to dpm/g soil) increased with distance from the presumed contamination site, suggesting that since there were only small variations in snake tissue activities, soil concentrations were the principal influencing components in the determination of concentration ratios.

(40)

Herpetofaunal Colonization Patterns of the
Atlantic Coast Barrier Islands
(Reptilia and Amphibia)

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Savannah River Ecology Laboratory

The Atlantic coast barrier islands present a unique biological situation in that proximity to the mainland should allow most animal species to reach adjacent islands. Nonetheless, herpetological studies have revealed the presence of a low proportion of the species occurring on the closest mainland. Distinct patterns of colonization by reptiles and amphibians on barrier islands have not been identified. The objective of this study was to obtain information on the population and general ecology of the herpetofauna on a particular island, Kaiwah Island, South Carolina, and to compare species diversity with that of other barrier islands. Lizards are found to be highly successful island colonizers whereas salamanders are extremely poor. Likewise, certain species are found on all barrier islands, whereas some common mainland forms are consistently absent. Explanations are given for the observed patterns. Species diversities are considered in the context of MacArthur-Wilson concepts for island biogeography.

(37)

The American Serranid Fish Genus
Hypoplectrus: A Taxonomic Enigma

CARTER R. GILBERT
Florida State Museum, University of Florida

The serranid fish genus *Hypoplectrus* (commonly known as hamlets) is confined to New World tropical waters, where it is one of the most characteristic and colorful components of the coral-reef community. At

least ten distinct color patterns exist. The fact that individuals possessing these patterns occur sympatrically, but may also exhibit characteristic geographic and bathymetric distributions, strongly suggests that a number of distinct species are represented. Further study and analysis of the problem suggests, however, that the Western Atlantic species at least should more properly be regarded as a single polychromatic species, which should be called by the highly inappropriate (in this case) scientific name of *Hypoplectrus unicolor*. This conclusion is based on the remarkable meristic and morphometric uniformity found in the genus, temporary changes in color pattern during times of stress, and the consistent variation in pigmentary details within the framework of a single color pattern. Possible reasons for this (based on the work of others) are mentioned.

(272)

Comparison Between Habitat Types and Abundance of Centrarchid Fishes in Altered and Unaltered Sections of a Channelized Stream

REED GLESNE AND PARLEY V. WINGER
Tennessee Technological University

A preliminary survey of centrarchid populations in altered and unaltered sections of Crow Creek, Franklin County, Tennessee and Jackson County, Alabama was completed during the summer of 1975.

The exact location at which the centrarchids were collected was recorded on a topographical map at each station, during electrofishing procedures. Greater numbers of centrarchids were found in areas associated with log and/or brush overhang. Riprap areas showed similar results, but to a lesser degree than that found in natural cover areas. Increases in the percentage of natural cover and riprap areas corresponds with increases in centrarchid numbers, while increases in the percentage of denuded bank areas shows an inverse relationship. However, the relationship between percent of denuded bank and centrarchid numbers depends largely on the quality of the other habitat areas present.

(230)

The Life Cycle and Biology of a Parasite (Trematoda: Opisthorchiida: Cryptogonimidae) in *Micropterus salmoides* (Osteichthyes: Perciformes: Centrarchidae)

GEORGE J. GREER AND KENNETH C. CORKUM
Louisiana State University

A cryptogonimid occurring in the intestine of the largemouth bass in south Louisiana has a life cycle that involves the hydrobiid snail *Cincinnatia peracuta*. A variety of centrarchid fishes serve as second intermediate hosts. Cercarial emergence is periodic.

(285)

Bryophytes of the Sierra de Perijá, Venezuela

DANA GRIFFIN, III
University of Florida

The Sierra de Perijá, the northernmost spur of the Andes in South America, remains very little known by

botanists. In July, 1975, a cooperative expedition mounted by the Universidad de Zulia, Maracaibo, and the University of Florida, Gainesville, collected some 400 bryophytes from the Sierra de Perijá, the first records from this region of Venezuela, and among which are 9 species heretofore unknown for the country. These species are: Hepaticae, *Bryopteris flaccida*, *Cephalozia subforticata* and *Ceratolejeunea maritima*; Musci, *Bryum apiculatum*, *B. limbatum*, *Cyclodictyon roridum*, *Lepidopilum stolonaceum*, *Leskeodon longipilus* & *Trichosteleum vencentinum*. All of these species, excepting *Bryum apiculatum*, have previously reported ranges limited to Northern Latin America. Their occurrence in Western Venezuela strengthens the floristic ties between the bryofloras of Mesoamerica and Northern South America.

(5)

Seasonal Variations In Chironomidae Populations of the Cumberland River

PHYLLIS ANN GUTHRIE AND PARLEY V. WINGER
Tennessee Technological University

Chironomidae populations were studied at four stations in the Cumberland River and one in Dixon Creek near the proposed Hartsville Nuclear Power Plant, Tennessee, over a two-year period. Samples were collected with a Ponar grab and analyzed using a standing crop and species diversity indices. Seasonal fluctuations in chironomid numbers were similar for each station, with the highest densities occurring in January and July and the lowest in April and September. Variation in diversity of Chironomidae was random with no apparent correlation to changes in density; however, redundancy values showed a direct relationship with numbers collected. Since the highest values for total numbers of chironomids collected were due to the increase of one genus, redundancy was larger during periods of greatest density.

(291)

Studies on the Gametophytes of *Lycopodium obscurum*

THOMAS M. GWYNN III
Old Dominion University

A population of 37 gametophytes and young sporophytes of *Lycopodium obscurum* L. were observed over a two year period in a young hardwood stand in the northeastern part of the Great Dismal Swamp. The plants were present only in the shallow furrows of an old field. After two years no gametophytes were found, although sporophytes were present. There is no vascular tissue present in the gametophyte. Various stages of gametangial development and early stages of sporophytic growth were observed. Particular attention was placed on the relationship between the sporophytic and gametophytic tissue.

(277)

Temporary Range Extension of the Largemouth Bass, *Micropterus salmoides*, and Its Effect on a Tidal Marsh System in St. Louis Bay, Mississippi

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Mississippi State University

Micropterus salmoides appeared in a tidal creek in St. Louis Bay, Mississippi in late May 1975 and were the dominant predator until November. During this period the salinity of the creek ranged from 0 to 6.3‰. Two distinct size groups were found. The most numerous were 4 to 9 cm standard length and the second 15 to 35 cm. The larger group fed on the marsh during high tide. Their diet consisted of fiddler crabs (*Uca pugnax*) and blue crabs (*Callinectes sapidus*). Smaller bass had a more varied diet consisting of those fish and invertebrates present in the creek and marsh. During fall the bass population left the creek presumably moving into a nearby fresh water river. This represents a significant movement of energy from the marsh to the river system.

(174)

The Tennessee Heritage Program: An Applied Data Management System for Endangered and Threatened Species Information

C. MONTY HALCOMB, REX R. BONER
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The Nature Conservancy

The Tennessee Heritage Program is a partnership between the Tennessee Department of Conservation and The Nature Conservancy. The Tennessee Program is a sophisticated data management system similar to The Nature Conservancy's South Carolina, West Virginia, New Mexico, and Oregon Heritage Programs.

The Heritage Program is designed to efficiently and effectively locate, collect, store, retrieve, and display information concerning existing and potential natural areas. Pertinent information is obtained from knowledgeable persons and processed into the manual, map, and computer files.

One of the most important classes of the Heritage Program's interest is special species. The class special species includes the subclasses endangered, threatened, special concern, rare, and peripheral plant and animal species. Each subclass is divided into species and sub-species of plants and animals which are called elements in the data management system.

Information concerning endangered and threatened species officially recognized by legislation is obtained from knowledgeable experts, publications, and unpublished sources. The information is incorporated into the data management system for dissemination to legitimate users.

Applications of the Tennessee Heritage Program's products include, but are not limited to, resource planning, land-use planning, residential and commercial development, scientific research, cultural development, environmental impact assessment, and resource management.

(239)

The Early Helminthologists

REINHARD HARKEMA
North Carolina State University

(No abstract received)

(95)

Use of Electrophoretic Banding Patterns of Isozymes as Taxonomic Criteria for Certain Wood-Rotting Fungi (Basidiomycetes)

J. W. HARRIS, S. K. BALLAL AND F. P. SANDERS, JR.
Tennessee Technological University

Electrophoretic separation, followed by histochemical staining of isozymes was investigated as a possible source of additional taxonomic criteria to aid in the classification of fungi. Mycelial extracts of two isolates of one species of *Fomitopsis* and four isolates of two species of *Fomes* were subjected to polyacrylamide slab gel electrophoresis. The gels were stained for esterase, lactate dehydrogenase, malate dehydrogenase and general protein. The resulting bands were subjected to analysis, with the aid of a computer, in an attempt to find correlations between the patterns observed for the isolates, species and genera studied. The mathematical model chosen to compare the banding patterns of the different isolates was a hypergeometric distribution equation. The preliminary results support the feasibility of such a model to clarify relationships between fungal taxa.

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Foraging Patterns and Spatial Distribution of *Pogonomyrmex badius* (Hymenoptera: Formicidae) Colonies

JANET S. HARRISON AND JOHN B. GENTRY
Savannah River Ecology Laboratory

Foraging patterns of Florida harvester ant (*Pogonomyrmex badius*) colonies were studied during two consecutive summers. Workers from each colony forage for seeds along 3-4 trails established in the spring. Foraging direction is determined by the position of nearest neighbor colonies, thus promoting efficient use of the available resources and reducing intercolony conflicts. Seasonal nest relocation of a colony always occurs along one of the established foraging trails. Movement can be predicted by noting direction of the main foraging trail. At the new nest site foraging trails are established in relation to the location and foraging pattern of the nearest neighbor nest. Seasonal nest relocations seem to be a mechanism by which a very uniform spatial distribution is maintained over long periods of time.

(198)

Primary Productivity Associated With An Undisturbed Caribbean Coral Reef

C. W. HART, JR.
Smithsonian Institution

DABNEY G. HART
The MITRE Corporation

Primary productivity adjacent to Carrie Bow Cay, Belize (C.A.), measured by the dark/light bottle method, is discussed and compared with productivity in other marine situations. A description will be presented of an ongoing comprehensive investigation of the shallow water ecosystems in the area.—*This work funded in part by a grant from the EXXON Corporation to the Smithsonian Institution.*

(27)

Growth and Associated Organisms of Oysters (*Crassostrea virginica*) on Planted Beds in the Vicinity of a Steam Electric Station

DABNEY G. HART
The MITRE Corporation

GEORGE R. ABBE
Academy of Natural Sciences of Philadelphia

Three planted oyster beds in the vicinity of the Chalk Point Steam Electric Station on the Patuxent River, Maryland, were studied between 1970 and 1975. Numbers and sizes of oysters, as well as incidence of associated organisms and internal characteristics, were tabulated. Most parameters, except size, were shown to be independent of the age of the oysters. Distinct trends over time, independent of age, were shown by many of the associated organisms and by the internal characteristics. The bed farthest downstream showed the most growth over the study period.—*This study was supported by the Potomac Electric Power Company.*

(180)

Distribution and Status of Endangered Chiroptera in the Southeastern United States

MICHAEL J. HARVEY
Memphis State University

Drastic reductions in populations of North American bats have occurred during the past several years. Information gathered from bat researchers throughout the United States indicated that 22 species or subspecies (out of 78 in the United States) were declining in number in part or all of their ranges. Biologists consider four southeastern United States bat taxa to be endangered (in danger of extinction throughout all or a significant portion of their range). They are *Myotis sodalis* (Indiana bat), *Myotis grisescens* (gray bat), *Plecotus townsendii virginianus* (Virginia big-eared bat), and *Plecotus townsendii ingens* (Ozark big-eared bat). Causes of population declines include loss of habitat, direct killing, and disturbance to hibernating and maternity colonies.

(57)

An Exploratory Discrete-Event Ecosystem Model

MARK A. HARWELL AND HARVEY L. RAGSDALE
Emory University

Mathematical ecosystem modeling has become an effective means of simulating steady-state levels of energetic compartments. Usual modeling techniques have often been shown to be predictive for steady-state values within the validated range of parameters; however, their serious limitations are the inability to describe temporal responses and to predict qualitatively the patterns reflective of real-world stability topology. As an initial effort to overcome some such limitations, a discrete-event model was developed and preliminary testing conducted. The model consists of the use of the Euler numerical technique for solving continuous compartmental functions onto which a stochastic, discrete feeding regime is superimposed. A total of 200 such compartments independently exchange discrete packets of energy each time-event, and total energetic values are summed into trophic levels. Subsequent sampling of the model at steady-state was conducted to estimate mean state and flux parameters. These estimations were incorporated into a five compartment model to test the effects on model temporal response of *a priori* vs. *a posteriori* summing over trophic levels.

(201)

A Study of the Submerged Aquatic Macrophytes of an Industrial Cooling Lake by Means of Remote Sensing

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Duke Power Company

Belews Lake is a 3800 acre reservoir built by the Duke Power Company to supply its Belews Creek Steam Station with once-through condenser cooling water. An extensive study program has been established on this lake to determine the effects of condenser cooling waters on the environment.

One aspect of this study deals with the remote sensing of aquatic vegetation of this cooling lake. Four flights were made along the shallow margins of Belews Lake, N.C. in the spring, summer, and fall of 1975. Three flights were made using a hand-held 35 mm SLR camera with color film. The fourth flight was made by a professional aerial photography concern which exposed color, color-IR and black and white panchromatic film simultaneously. In addition, an experimental water penetration film (Kodak SO-224) was employed in an effort to better distinguish underwater features such as these macrophyte beds. Plant beds were discernible with all combinations of films and cameras. Color enhancement techniques were used with the experimental film and results enabled the mapping of the submerged plant beds to a depth of 1.75-2.00 M. Plant coverage was determined to be 61% of the entire littoral zone existing in Belews Lake. There appeared to be an inverse relationship between macrophyte abundance and heated water discharged from the plant. However, all variables which can contribute to macrophyte abundance have not been fully examined to date. *Potamogeton diversifolius* and *Chara* sp., the two most abundant species, were present in Belews Lake prior to the commercial operation of Unit 1 in July, 1974. Those areas of the lake receiving nutrient inputs exhibited the greatest densities of plant growth. Consequently, the increased

growth in these areas may well be influenced to a greater degree by the availability of nutrients than by increased temperatures.

(122)

Gonad Morphology of *Serranus subligarius* (Pisces: Serranidae)

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The gonad of the synchronous hermaphrodite, *Serranus subligarius*, is composed of two lobes which are broadly united posteriorly. The anterior portion of the gonad is ovarian. Lamellae extend from the ovarian wall into a well defined lumen. The lumina from each lobe join and pass medial to the testicular tissue and ventrally into a small ovarian sinus which leads directly to the oviduct. The oviduct exits immediately posterior to the anus. The testicular tissue is restricted to a broad band which surrounds the posterior portion of the ovary. In this respect the gonad of *S. subligarius* more closely resembles the gonad of *Diplectrum* than the "Serranus type" gonad. Spermatozoa collect in crypts which drain dorsally into the sperm duct which passes dorsal to the oviduct and joins the urinary duct just prior to exiting from the tip of a heavily pigmented genital papilla.

(59)

Fungi and ^{137}Cs Cycling in Two Forested Floodplains

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Emory University

Previous studies have shown that fungi can act as differential accumulators of radionuclides in ecosystems. This hypothesis is tested through analysis of fungi from two radioactively contaminated floodplains along Lower Three Runs Creek, an Upper Coastal Plain stream near Aiken, South Carolina. Fungi were collected for over one year from a variety of habitats, including standing and prone dead trees, fallen branches, and the soil-litter substrate. ^{137}Cs activity in the fungi was determined with a NaI detector using single channel analysis. Selected fungi were analyzed with a Ge(Li) detector using multichannel analysis for determination of all gamma emitters present. The two floodplains were different with respect to the ^{137}Cs concentrations in fungi. Although not all fungi showed differential accumulation, some fungi at both sites concentrated ^{137}Cs by a factor of five or greater. There was also a difference between different families of basidiomycetes in the magnitude of concentration within a site, and fungi at both locations showed a seasonal pattern in the level of nuclide present. Although the results of this study generally support the hypothesis, not all fungi did concentrate ^{137}Cs above the levels found in their substrate.

(267)

Toxicity of Intermittent Chlorination To Rainbow Trout, Coho Salmon, and Carp

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Fingerling *Salmo gairdneri* (R.T.), *Onchorynchus kisutch* (C.S.), and *Cyprinus carpio* (C.P.) were exposed

to chlorine thrice daily in a flow-through bioassay system. During the chlorination pulse the concentration of chlorine reached a peak in 40 min. and then flushed out by 160 min. later. Concentrations are expressed in mg Cl/L at the peak of the pulse: The LC_{50} of free residual chlorine for R.T. are as follows: 24hr = 0.28, 48hr = 0.13, 96hr = 0.07, and 166hr = 0.06. Temperatures between 5 and 17°C had a negligible effect on the LC_{50} , however the LT_{50} were shorter at 12°C than at 5°C. The 96hr LC_{50} of chloramine was 0.5. Coho salmon and carp also showed a 7-fold difference in sensitivity to free chlorine and chloramine. The 96hr LC_{50} of free chlorine for C.S. was approximately 0.1 and of chloramine 0.68. No death occurred in chloramine as high as 0.4. Lethal concentrations for carp were 0.2 free and 1.72 chloramine. Tests with R.T. using combinations of free and combined chlorine (chloramine) show that lethality can be predicted from the concentration of free but not total chlorine as previously assumed. —Supported by American Electric Power Service Corporation.

(45)

Histological Examination of Integument in Sixteen Species of Salamanders (Plethodontidae)

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AND JERRY W. NAGEL
East Tennessee State University

To test the postulate that the integumental anatomy of salamanders corresponds to the moistness of their habitats, a histological investigation of the skin of 16 species of salamanders of the family Plethodontidae was undertaken. The skin was routinely prepared for observation under a light microscope. Measurements were made of the widths of skin strata and of numbers and types of glands and of numbers of capillaries. The skin of each species was found to have a characteristic morphology, and a larger number of capillaries was observed in the integument of the more aquatic species than in the more terrestrial ones. No other correlations were found between the histology of the skin and the wetness of habitat.

(22)

Production of Extracellular Products by Algae Below Industrial Outfalls

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Extensive algal beds of filamentous greens were found below industrial outfalls near Waynesboro, Virginia. The two primary outfalls from the industries had a $\text{NO}_3\text{-N}$ range of 28.4 to 2.5 ppm, and an $\text{NH}_3\text{-N}$ range of 3.9 to 0.4 ppm. $\text{NO}_3\text{-N}$ and $\text{NH}_3\text{-N}$ values at the site of the algal beds (Station 3) ranged from 3.19-1.54 and 0.15-0.04, respectively. Five day BOD values for Station 3 ranged from 7.4 to 6.3 ppm and these values were approximately 51% greater than the station with the next highest BOD values. Forty day BOD tests were run along with the five day BOD tests and by the end of five days approximately 60% of the biodegradable organic material had been utilized. The increase in BOD, the large diurnal fluctuation in dissolved oxygen and the rapid utilization of dissolved oxygen suggested the production of extracellular products by the algae.

(80)

The Distribution of NADPH Dependent Oxidases and Glutathione S-Transferases in Tissues of the Blue Crab, *Callinectes sapidus* (Crustacea: Decapoda)

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University of South Alabama

NADPH oxidases and glutathione transferases both play important roles in the detoxification of xenobiotics in a variety of organisms. This study concerns the distribution of these enzyme systems in tissues of the blue crab, *Callinectes sapidus*. Homogenates of several tissues were fractionated by differential centrifugation. Post-mitochondrial supernatants (microsomes and cytosol) were used for enzyme assays. Glutathione S-transferase activity was assayed using aryl, aralkyl and epoxide substrates. Several parameters reflecting NADPH dependent oxidase activity were examined. NADPH oxidase, O-demethylase and NADPH cytochrome C reductase activity were measured. Comparisons of specific activities for these enzymes revealed activity in gill, hepatopancreas and excretory gland. The results indicate detoxification enzyme activities are substantially lower in tissues of the crab than in mammalian tissues. —Supported in part by a grant from the University of South Alabama Research Committee.

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Some Interesting Bryophytes from Stone Mountain State Park, North Carolina

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Stone Mountain extends from the Blue Ridge escarpment to a short distance beyond the east prong of the Roaring River. The elevation varies from 3700 feet on the escarpment to 1400 feet along the Roaring River. The park contains a large granitic monolith, large areas of which are devoid of soil. The largest exposed outcrop is Stone Mountain which rises 700 feet above the surrounding area. Several creeks descend rapidly from the escarpment forming narrow ravines in the park. The variety in land form and elevation provide contrasting habitats for bryophytes. Mosses typical of rock outcrops, but not found elsewhere in the park were found on the exposed granite. The shady ravines with included waterfalls and cascades supported a bryophyte flora in sharp contrast to that of the rock outcrops. The liverwort genus *Calypogeia* was particularly well represented with *C. fissa*, *C. muelleriana*, *C. sullivantii*, *C. neesiana* and *C. peruviana*. The tropical species *Calypogeia peruviana* was collected from a shady ravine at an elevation of 1500 feet. This collection extends the range of this plant northward along the escarpment. To date, 90 mosses and 60 liverworts have been collected from the park.

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Sensitivity of *Scenedesmus* and *Microcystis* to Ethionine

DOUGLAS HITE AND B. P. STONE
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The effects of ethionine on the characteristics of algal growth in cultures of limited volume will be discussed. *Microcystis* was more sensitive to ethionine inhibition. The ethionine inhibition of growth could be partially reversed by the presence of methionine in the culture.

(97)

Groundwater Nutrient Gradients Between Septic Tank Absorption Fields and an Estuary

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DONALD B. JEFFREYS, AND JAMES C. ANDERSON
East Carolina University

Eight (8) shallow pipe wells were driven at each of two sites on the Pamlico River estuary in August, 1975, to monitor nutrient concentrations in the groundwater from septic tank absorption fields to the estuary. Wells were positioned along anticipated paths of groundwater flow. All test wells, as well as residential water wells and adjacent estuarine waters, are sampled periodically for dissolved organic carbon and inorganic ions. At site one definite gradients have been established while at site two groundwater flow seems to be complicated by a nearby canal and other factors. Groundwater nutrient levels from the absorption field to the estuary at site one, range as follows (ppm): dissolved organic carbon, 43.7-17.8; NH₄, 36.3-0.5; NO₃, 0.02-0.20; P, 15.5-0.5; Na, 98.0-15.0; K, 11.5-2.6; Ca, 25.5-8.0; and Mg, 5.1-3.0. Analysis for NO₃ is to be made. Differences in concentration gradients between ionic species, as well as between sites, will be discussed. —This research was funded in part by the Institute of Coastal and Marine Resources at East Carolina University.

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Native Brook Trout (*Salvelinus fontinalis*) Displacement by Introduced Rainbow Trout (*Salmo gairdneri*) in Cosby Creek, Tennessee, Great Smoky Mountains National Park

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and the National Park Service*

Cosby Creek, a trout stream in the Great Smoky Mountains National Park, was selected as a study site to evaluate possible causes for displacement of the native brook trout (*Salvelinus fontinalis*) by the introduced rainbow trout (*Salmo gairdneri*) in the Park. The U.S. Fish and Wildlife Service trout population survey of Cosby Creek indicated that only brook trout inhabited the highest elevations of the creek, while further downstream there was a mixed population of brook and rainbow trout and in the lowest reaches of the stream the

rainbow trout greatly outnumbered the brook trout. Two study sections were selected in each of the three trout habitats to assess physical, chemical and biological parameters which may play a role in brook trout displacement. Preliminary results of the first six months of the study are discussed. — *This research was supported with funds provided by the Southeast Regional Office of the National Park Service.*

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The Effects of Subacute Levels of Aflatoxin B₁ and Zinc on Male Mongolian Gerbils, *Meriones unguiculatus*

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Virginia Commonwealth University

The effects of the carcinogenic mycotoxin, aflatoxin B₁, have been well documented on various animals. To determine the possible antineoplastic effects of zinc against aflatoxin B₁, a study utilizing subacute levels of zinc was performed. Such interactions have not been studied previously. Subacute levels of zinc and pure aflatoxin B₁ were fed ad libitum to juvenile male Mongolian gerbils, *Meriones unguiculatus*, for 84 days. Experimental parameters measured include: mortality, gross pathological changes, body weight responses, water and feed consumptions and basal metabolic rates for each of three test diets and a control diet. Test diets consisted of zinc at 5,500 ppm, aflatoxin at 20 ppm and a combination of zinc (5,500 ppm) with aflatoxin B₁ (20 ppm). Animals receiving the test diets had a retarded growth rate. The most noticeable experimental changes occurred in the animals receiving the zinc supplemented diet. These changes included one lethality and erratically high consumption of water in relation to the controls. Gross pathological observations revealed that the highest deposition of adipose tissue was in aflatoxin treated animals; while those animals exposed to subacute levels of zinc demonstrated a lack of adipose tissue and a reduction in size of various organs relative to the controls.

(152)

PHA and X-Ray Sensitivity of Rabbit Lymphocytes in Culture

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Rabbit leukocyte cultures were irradiated (200 roentgens) immediately before the addition of the mitogen, phytohemagglutinin (PHA), or 6 hours after PHA. Similar cultures were exposed to X-rays at comparable times in the absence of PHA. After 72 hours of culture, cells were harvested and prepared for differential scoring. Counts were made of lymphocytes, neutrophils, and blast-like cells which appeared to be viable. Analyses of the ratios of lymphocytes/neutrophils and "blasts"/neutrophils suggest that the presence of PHA 6 hours before X-rays renders the cultured lymphocytes less sensitive to radiation. This increase in radioprotection is rather dramatic when comparisons are made to ratios calculated from irradiated cultures that did not receive PHA and from cultures in which the mitogen was added immediately after exposure to X-rays.

(155)

Prenatal Effects of Penitrem A and Penicillic Acid in Mice

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Two mycotoxins, penitrem A and penicillic acid, produced by *Penicillium crustosum* and by *P. puberulum*, *P. cyclopium*, etc., respectively, were administered ip to pregnant mice (Charles River CD-1 strain) on one of gestation days 7-10. Dose levels for penitrem A and for penicillic acid ranged from 1-3 and 30-50 mg/kg, respectively. Untreated and solvent-injected controls were employed. Pregnant females were killed on gestation day 18 and data obtained on prenatal growth and mortality and on developmental defects. Penitrem A did not affect prenatal survival, growth or incidence of gross external or visceral developmental abnormalities; however, the high dose groups treated on days 8, 9 or 10 exhibited an increased incidence of skeletal defects. Penicillic acid had no effect except for a reduction in fetal growth and survival in an additional group given a 90 mg/kg treatment on day 10. This treatment was also fatal to 8 of 10 dams.

(138)

Mixed Mesophytic Communities in Unglaciated Southern Indiana: *Magnolia tripetala*

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Deam (1950) records *Magnolia tripetala* in Southern Indiana as approximately 100 trees in a small valley in Crawford County. The authors have found this magnolia to extend into seven valleys along two drainages and have personally counted more than 1,600 individuals. The largest specimens are 9.5 inches DBH and show vigorous coppice growth at this size. Habitats, composed of moist sandstone, are similar in structure and flora to Hemlock-Mixed Mesophytic communities in Southern Indiana but contain no hemlock. The next nearest station of *Magnolia tripetala* lies fifty miles south at Rough River Reservoir, Kentucky and includes *Tsuga canadensis*.

(66)

Structure of Stump Communities in a Stream Affected by Thermal Effluent

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In a swamp stream receiving nuclear reactor effluents on the Energy Research and Development Administration's (formerly Atomic Energy Commission) Savannah River Plant, plant community structure in different temperature areas, three thermally affected sites (I, II and III with approximate water temperatures of 50°C, 45°C, and 40°C respectively) and one ambient site (IV approximately 20°C), was described and compared by sampling an equal number of randomly selected island communities within each site. Comparisons were made

of species composition and importance; species diversity (H) and evenness (J); species similarity; substrate temperature; and soil nutrients and pH. Species composition varies from site to site with no species dominant in more than one area. Diversity (H) is highest in the ambient area. Communities in the two highest temperature sites are most similar in species composition. Soil nutrients and pH differ little from site to site.

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Polyol Non-utilizing Mutants of *Neurospora tetrasperma*

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Mutants which were able to grow on sucrose but not on certain polyols as a carbon source were selected in GN4 by means of filtration-concentration experiments. A concomitant characteristic of these mutants, upon isolation, was their inability to form protoperithecia during growth on sucrose as a carbon source. The mutants were crossed to wild type strains GN4 and 85 and, to facilitate genetic analysis, were also introgressively hybridized with *N. crassa* wild-type strain 74. The inability to form protoperithecia was found to be an unstable trait which tended to segregate abnormally. Polyol auxotrophy, on the contrary, showed 1:1 segregation after several generations of introgression into an *N. crassa* genetic background. One such introgressed mutant, a glycerol non utilizer, had NAD-linked glycerol-3-phosphate dehydrogenase but lacked detectable glycerokinase. Both this mutant and wild type had NADP-linked glycerol dehydrogenase and glyceraldehyde kinase, as reported in mammalian systems. We have mapped this trait in linkage group VI, between *ad-1* and *rib-1*. Another glycerol non utilizing mutant lacked detectable glyceraldehyde kinase. This trait was mapped in linkage group I, between *nic-2* and *cr-1*.

(259)

Aberrant Secondary Sex Characters in the
Crawfish *Procambarus clarkii* (Girard)
(Decapoda: Cambaridae)

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Four *Procambarus clarkii* females with male secondary sex characters are reported; the first such report known for this species. Three are from a population near Baton Rouge. Two of these showed a unilateral, partially developed first gonopod, one possessing an annulus with a sperm plug, the other producing a normal brood in the laboratory. Both had normal second pleopods. The third was normal in all respects except for a prominent hook on the left fourth pereopod. A fourth, from Stuttgart, Arkansas showed normal, bilateral, Form I gonopods with stylets typical for the species, no annulus, both oviduct openings at bases of third pereopods and male genital papillae at bases of fifth pereopods. Dissection showed two anterior lobes of the gonad filled with well developed eggs. The posterior lobe was poorly developed, but testicular in nature. Both oviducts and sperm ducts were present, but poorly developed.

(153)

Postmolt Calcification in Subadult, Red Swamp
Crawfish, *Procambarus clarkii* (Girard)
(Decapoda, Crustacea)

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Premolt, subadult *Procambarus clarkii* (approximately 32 mm, cephalothorax length) were permitted to molt in hard ($\text{Ca}^{++} = 32$ ppm) and deionized water to evaluate the importance of body calcium reserves in capapace calcification. Observations were made at 0 hrs, 12 hrs, 24 hrs, 48 hrs, 72 hrs, 96 hrs, and 3 wks (deionized water treatment only) postmolt. In deionized water, body reserves of calcium were adequate for calcification to proceed to that level corresponding to molt stage C_1 ($\text{Ca}^{++} = 13\%$), approximately one-half the intermolt level (C_1) ($\text{Ca}^{++} = 24\%$). Calcification of the carapace ceased after 12 hours in the deionized water treatments; however, synthesis of matrix, as measured by dry weight per unit length, continued for 24 hours postmolt. Molt stages C_1 and C_2 ($\text{Ca}^{++} = 18\%$) were reached within 12 and 24 hours, respectively. *P. clarkii* survived 3 wks postmolt in deionized water without feeding. — ¹Present address: Southern University.

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A Model of the Young-of-the-Year Walleye
Stizostedion vitreum (Mitchill) and White Bass
Morone chrysops (Rafinesque) in the Headwaters
of Center Hill Reservoir, Tennessee

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A simulation model of the young-of-the-year Walleye and White Bass in Center Hill Reservoir has been constructed. One component of the model predicts the spawning dates from a functional relationship incorporating water temperature and water level. Another section checks for an adverse drop in water temperature that would halt spawning. Egg survival is a function of water level fluctuation and change in temperature. Growth and survival of the fry is a function of temperature, water level, and density, in the model. The model can forecast relative and absolute abundance of the two species. Age class strength can also be predicted. The model suggests a scheme to manage water levels for the maximization of fry production.

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Comparison of Proteins by Disc Gel Electro-
phoresis Within Varieties of *Amanita muscaria*
(Fungi: Basidiomycetes)

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When using morphological, microscopical, and toxicological characteristics, the subspecific taxa of *Amanita muscaria* (Linn. per Fr.) Hooker form a very homogeneous taxonomic group. To further analyze this ap-

parently natural relationship, protein patterns obtained by polyacrylamide disc gel electrophoresis were compared. Five varieties of this species were examined: *A. muscaria* var. *muscaria*, *A. muscaria* var. *formosa* (Pers. per Fr.) Bertillon, *A. muscaria* var. *alba* Peck, *A. muscaria* var. *regalis* (Fr.) Gilbert, and *A. muscaria* var. *persicina* Jenkins, *nom. prov.* The patterns of soluble protein proved useful in assessing the degree of taxonomic similarity within the subspecific taxa of *Amantina muscaria*.

(306)

The Uniqueness of *Solemya* (Bivalvia)

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The genus *Solemya* is represented by only a few, widely distributed species throughout the world. It is the only recent genus (some authorities recognize two) in the family Solemyidae, which is the only family in the order Solemyacea. Fossil *Solemya* date from the Devonian, and they are thought by some to represent the ancient subclass Cryptodonta, known from the Upper Cambrian.

The group is clearly evolutionarily isolated from all other bivalve mollusks and has evolved many unique features. Foremost among these are the pattern of development, the method of burrowing, and the nature of the shell, the palps, and the digestive system, which appears to be vestigial. Barnes (1974) and others have placed *Solemya* in the subclass Protobranchia with such forms as *Nucula*, *Nuculana*, *Yoldia*, and *Malletia*. Although *Solemya* is a protobranch, its uniqueness requires that it be placed in a separate subclass, the Cryptodonta.

(305)

Differences in Sexual Expression Among Populations of *Ilyanassa obsoleta* (Gastropoda: Prosobranchia)

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Throughout the range of the species, *Ilyanassa obsoleta* populations differ with regard to certain aspects of reproductive biology. In many populations, there are two kinds of immature snails. Some, which we presume become males, possess a small bump at the same location as the penis in the adult male. Others, which we presume become females, lack such a structure. In these populations, functional females show no male traits. In other populations, every immature possesses a bump. In such populations, many females display male attributes, including a penis-like structure in the identical position of the functional male penis.

Blakeman Smith (1971), who has also observed female *Ilyanassa* with male traits, refers to them as "imposex" snails and believes they result from the imposition of male traits onto females. We think the presence of male attributes in functional females is a manifestation of the basic instability of sex determination in the species.

(321)

Seasonal Changes in Body Condition of White-tailed Deer (Cervidae) on the Savannah River Plant in South Carolina

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Savannah River Ecology Laboratory

Kidney fat index was used as an indicator of body condition in white-tailed deer. Body condition varies as a function of season. Other important variables examined include sex, age and habitat differences. Deer were sampled throughout the year but mostly during the fall and early winter months. Data for over 900 deer taken from 1974 and 1975 hunt seasons are compared and discussed.

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Allelopathic Inhibition of Seed Germination and Seedling Development of Johnsongrass [*Sorghum halepense* (L.) Persoon.: Gramineae] by Selected Plant Species

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Johnsongrass [*Sorghum halepense* (L.) Persoon.] attains dominance in certain communities by means of allelopathy. However, the presence of certain other plant species in the community appears to inhibit, somewhat, the growth of Johnsongrass. Plants selected on the basis of field observations and/or known allelopathic potential were collected. Aqueous extracts were prepared from the plant-samples and were added, respectively, to different petri dishes, each containing Johnsongrass caryopses. Distilled water was used in the control group. After eleven days in a growth chamber, the number of seeds which had germinated was tabulated, and the shoot lengths of the seedlings were measured and tabulated for each group. Statistical analyses of the data indicated that the extract from *Brassica rapa* inhibited seed germination at the 0.01 level of significance, and the extracts from *Digitaria sanguinalis*, *Helianthus annuus*, *Cynodon dactylon*, *Solidago altissima*, *Chenopodium album* and *B. rapa* inhibited seedling development at the 0.01 level of significance.

(89)

Vernonieae (Asteraceae) in Virginia: *Vernonia* and *Elephantopus*

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Three species of *Vernonia* occur in Virginia. The distribution of *Vernonia noveboracensis* and *V. glauca* is general through the state; *V. gigantea* shows an apparent disjunct distribution. A putative hybrid between *V. noveboracensis* and *V. glauca* is reported from Virginia. *Elephantopus* consists of four species in Virginia. *Elephantopus nudatus* is a Coastal Plain species. *E. tomentosus* is present in the Coastal Plain and the Piedmont; *E. carolinianus* is general throughout the state. *Elephantopus elatus* is reported new to the Virginia flora.

(14)

Vertical Gradients in Substrate-associated Protozoan Community Structure in a Stratified Freshwater Lake

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Vertical gradients in substrate-associated protozoan community structure in a stratified freshwater lake were investigated using polyurethane foam sponges. Samples were collected at 0.2 m, 6 m, 10 m, 15 m, and 20 m after substrate exposure periods of 9 days, 16 days, 23 days, 30 days, and 37 days. Species lists were made for each sponge sampled. Physicochemical data were collected concurrently. On the basis of numbers of species and species composition, sampling depths formed two groups: hypolimnetic and epilimnetic. Differences in numbers of species between these groups were significant at the 0.001 level with more individuals found in the epilimnion. Percent overlap of "resident" species was high within each group and low between groups. The exact differences between epilimnion and hypolimnion which may have been responsible for these results are not clear, but clearcut differences in dissolved oxygen, pH, temperature, and light were noted between these two layers.

(91)

Ironing Out the Problems in Ironweed (*Vernonia*: Compositae)

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The tribe Vernonieae has ca. 1,450 species in 70 genera, 37 of which are monotypic. The largest genus in the tribe is *Vernonia* with ca. 1,000 species. The distribution of *Vernonia* includes parts of North, Central and South America, Africa and Southeast Asia. The massive size of the genus, combined with its largely tropical distribution and nomenclatural complexity is confounded by the lack of morphological features that can be used to establish subgenera, sections, and subsections or to delimit the genus. Since there is no modern treatment of *Vernonia* at the generic level, the need is stressed for studies on a world-wide basis rather than piecemeal treatments in limited geographic areas. These problems will be discussed along with recent evidence obtained from cytotaxonomy, comparative pollen morphology, phytochemistry, and SEM of morphological features.

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Myxomycetes of Arkansas: A Progress Report

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Collection of Myxomycetes in Arkansas began in 1965 centered in Craighead and surrounding counties. In the future, collecting will be extended to other areas of the state. Thus far approximately 60 species of Myxomy-

cetes have been collected and these species will represent the first published list of Myxomycetes from Arkansas. Included are some rarely collected species such as *Badhamia ainoae*, *Comatricha fimbriata*, *C. irregularis*, *Diderma chondrioderma*, *Didymium synsporos*, *Echinostelium minutum*, *Licea biforis*, *L. castanea*, *L. operculata*, *L. pedicellata*, *Macbrideola cornea*, *M. decapillata*, *Physarum crateriforme*, *Reticularia intermedia* as well as three undescribed species of *Licea*. *Echinostelium fragile* was harvested from moist chambers and this represents only the third known collection of this species. Because of the varied habitats, moderate temperatures, and poorly known distribution patterns of Myxomycetes in the southeastern United States, the states of Florida, Georgia, Alabama, and Arkansas are being explored intensively for Myxomycetes. — *Research supported by Grant BMS 75-19098 from the National Science Foundation.*

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Stream Channelization and Fish Diversity in the Luxapalila River in Alabama and Mississippi

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Three segments (recently channelized, unchannelized, and older channelized) of the Luxapalila River in north-eastern Mississippi and northwestern Alabama were studied from July 1973 to December 1974 to determine if differences existed in fish species diversity between the channelized and unchannelized segments. All fishes were collected by seining and categorized as resident or transient based on their frequency of occurrence ($> 10\% =$ resident). Eighty-two species of fishes were collected, with 62 in the recently channelized section, 67 in the unchannelized section and 45 in the older channelized section. Nearly half (46%) were transient species in the recently channelized section while 22.4% and 24% were transients in the unchannelized and older channelized segments respectively. Sixteen species were collected only in the unchannelized segment and nine species were taken only in the recently channelized segment. Total abundance was generally high for the recently channelized area, but 32 species were lower in frequency of occurrence in this segment.

(199)

Leaching Rates of Sycamore (*Platanus occidentalis* Gymnospermae: Platanaceae) Leaves in Aquatic Environments

JAMES H. KENNEDY AND ROBERT W. PAUL, JR.

Virginia Polytechnic Institute and State University

Investigations were conducted to characterize weight loss of water soluble constituents (leaching) from sycamore leaves. Leaves were exposed to artificial standing and flowing water systems for five days. Leachate loss, on the basis of percent original dry weight, was determined at six hour intervals during the first day, 12 hour intervals during the second day, and 24 hour intervals thereafter. Weight loss was greatest during the initial 6 hour interval. After four to five days no appreciable weight change was observed. Total weight loss was less than 10% in both systems. To permit comparisons with previous studies, leaching rates of whole leaves were compared with leaf disks taken from specific areas of the leaf.

(101)

Coastal Development In Florida:
II. A Case History of Current Trends

JOHN P. KERR AND JOE A. EDMISTEN
Baseline, Inc.

The preceding paper has described the type of development that was encouraged in Florida in the days before increased ecological awareness. This presentation will describe the proposed southward extension of development at Apollo Beach with consideration of the current laws, regulations, attitudes, and construction techniques that pertain to such coastal development in Florida. Now in Florida, several federal, state, regional, and county agencies as well as private conservation groups must be satisfied before development can be approved and various permits can be issued. Probably the most significant regulatory mechanism that must be dealt with is the state-required application for such Developments of Regional Impact (DRIs), in which detailed assessments of impacts must be made, including those for the environment and natural resources. The DRI system will be discussed, especially as related to wetlands and aquatic situations.

(99)

Distribution and Abundance of Aquatic Organisms
Associated with the Modifications of the
Withlacoochee River Near Inglis, Florida:
A Case History of a Public Works Project
Providing a Largescale Ecological Experiment

JOHN P. KERR AND CHARLES A. GIFFORD
Baseline, Inc.

Prior to construction of the reach of the Cross-Florida Barge Canal entering the Gulf, the Withlacoochee River flowed uninterrupted from the dam at Lake Rousseau, an impoundment of the river since early in the century. Construction of the CFBC now existing near Inglis, Florida was initiated in the mid-1960s. It has a lock below its entrance along the northern edge of Lake Rousseau and crosses the Withlacoochee River, truncating it into two segments, the upper one connected to the canal and leading to the dam, and the lower one disconnected from the canal but provided with bypass facilities for water supply assuring its continued flow toward the Gulf. Spoil islands were also created extending in a line from near the mouth. The modifications have led to changes in aquatic and wetland environments in the area, creating some new conditions and modifying some former ones, while leaving others about the same. These changes will be discussed along with associated patterns of distribution and abundance for selected macroinvertebrates, fishes, and aquatic plants. Recolonization of the spoil islands will be described. An assessment will be made of the overall ecological gains and losses resulting from the changes and suitable schemes will be suggested for desirable management of aquatic resources and spoil islands.

(61)

Gradient Modeling: A New Approach to
Vegetation Management

STEPHEN R. KESSELL AND MONA M. MYATT
Gradient Modeling, Inc.

Development of a resource and fire ecology model for Glacier National Park has demonstrated that the application of gradient analysis techniques offers greatly improved precision and refinement over traditional classification methods. The model links a terrestrial resource inventory, which is determined from aerial photos, quantifies each hectare's location on each of six environmental gradients, and offers 10 m resolution, with gradient models of the vegetation and fuel data by entering only a stand's geographical coordinates. These components are also linked to a fire behavior model which predicts spread rate and intensity for each individual fire under any weather conditions. The fire behavior results and gradient models are then used to predict successional development of the community after the fire. The system is now being considered for application to other National Park Service areas.

(60)

Gradient Analysis of the Vegetation of Glacier
National Park, Montana

STEPHEN R. KESSELL AND MONA M. MYATT
Gradient Modeling, Inc.

A gradient analysis of the west slope vegetation of Glacier National Park was conducted to provide both synecological insights into the distribution of plant species, diversity relationships, and successional patterns, and to serve as the basis for a vegetation management information system. The vegetation was modeled on six continuous temporal and spatial environmental gradients and within four additional categories of variation using the techniques of direct gradient analysis and indirect ordination (Bray-Curtis, Gaussian, and Principal Components Analysis). The resulting nomograms quantify the distribution of all tree species, many common herb and shrub species, flammable ground fuels, and diversity relationships; they allow the prediction of stand composition and successional development using a remote inventory system which does not require field sampling of each stand. The results suggest that the gradient analysis methods are vastly superior to the more traditional classification systems.

(52)

The Horizontal and Seasonal Distribution and
Relative Abundance of Larval Fishes
in Center Hill, Reservoir, Tennessee

BARRY L. KILCH AND C. PHILLIP GOODYEAR
Tennessee Technological University

As part of a study to generate a predictive model of fish populations in Center Hill Reservoir, larval fishes were collected weekly from mid-March to late September, 1975. Collections were made with 0.5 m larval fish nets, in mid-channel, at twelve sampling sites, along the 103 km length of the reservoir. Distribution and abundance of larval fishes were correlated, by species, to water temperature, turbidity and elevation of the reservoir.

(77)

A Comparison of MCD with Fluorometric Methods for Measuring Tissue Serotonin

T. DANIEL KIMBROUGH AND D. D. SHILLADY
Virginia Commonwealth University

A magnetic circular dichroism instrument and the spectrofluorometer were employed in a study designed to determine the relative merits of each instrument for the measurement of serotonin and other selected indoles. This work was done in conjunction with an investigation concerned with the measurement of serotonin hydroxylase levels in brain and gut as indicated by changes in tissue levels of serotonin. It was tentatively concluded that although fluorometry may provide the more sensitive technique for quantitating substances at the nanogram concentration range, the MCD spectra seemingly have more detail than fluorescence spectra when samples of equal concentration are assayed in both instruments.

(173)

Biogeographic Distribution of Endangered Animal Species in the Southeastern United States

T. KITCHINGS, S. ANDERSON¹ AND R. J. OLSON
Oak Ridge National Laboratory

The wildlife assessment effort within the Regional Analysis and Assessment project at Oak Ridge National Laboratory is directed toward delineating the geographical distribution of bird and mammal species within the 13-state southeastern region. The information being accumulated is designed to identify the distribution of species by state, county and by habitat, i.e., plant community associations. All mammal and avian species have been classified on a county basis using distribution maps from various animal guides and journal papers. The initial data compilation based on habitat factors has placed special emphasis on twenty-three bird and twenty mammal species deemed rare, endangered or threatened. Concomitant with the compiling of information to be stored within the data bank is the collection of macro-habitat values to be incorporated in models which quantify the changes in population structure resulting from habitat alteration.

The compilation of data has allowed us to examine the segregation of species within the principal plant communities of Florida and Louisiana to major physical and biological parameters by factor analysis and discriminant function analysis. The ultimate goal of this program is to provide decision-making groups with the capability to consider how their management or development decisions may ultimately affect the natural structure of local or regional mammal and bird populations.—*Research sponsored by the U.S. Energy Research and Development Administration under contract with the Union Carbide Corporation.*

¹Present address: *Oak Ridge Associated Universities.*

(105)

Diversity and Cluster Analysis of New River Benthos

DAVID P. KLARBERG¹ AND ERNEST F. BENFIELD
Virginia Polytechnic Institute and State University

Macroinvertebrate data generated from four yearly surveys of, primarily, the upper New River basin (North Carolina and Virginia) were subjected to analysis using the Baker clustering method and six diversity indices. The Baker analysis utilizes a generalized distance function which maximizes the distance between pairs of means for those linear combinations of characters that have maximized variance between pairs of groups relative to the pooled variance within groups. Heterogeneity indices calculated included DBAR of Wilhm and Dorris and Brillouin's; both derived from information theory. In addition, Simpson's Index and a modification thereof, McIntosh's, were also used. Evenness indices calculated included Redundancy (R), after Patton, and EVDEL, which measures the evenness of McIntosh's Index. DBAR is reported to be more sensitive to changes in rare species, whereas Simpson's and those similarly derived are more sensitive to changes in the most abundant species.—¹Present address: *Southern University.*

(72)

Spectrophotofluorometric Determination of Pineal Serotonin Concentration in Estrus, Metestrus, Early Diestrus and Mid-diestrus Phases of the Two-, Four-, and Eight-month Old Female Golden Hamster (*Mesocricetus auratus* Waterhouse)

JIM C. KNIGHT, JR. AND WILLIAM W. NORRIS, JR.
Northeast Louisiana University

One hundred twenty virgin female hamsters were divided into three age groups: 1) two-month, 2) four-month, 3) eight-month. Each age group was further divided into: 1) estrus phase, 2) metestrus phase, 3) early diestrus phase, 4) mid-diestrus phase. The lighting schedule was 12L:12D. Animals were sacrificed each day at 11:30 a.m. to 12:30 p.m. The mean pineal serotonin concentration of animals in estrus, metestrus, early diestrus, and mid-diestrus phases was respectively: 54.27 ± 9.80 $\mu\text{g/g}$ pineal, 52.77 ± 6.12 $\mu\text{g/g}$ pineal, 52.29 ± 9.82 $\mu\text{g/g}$ pineal, and 50.95 ± 4.80 $\mu\text{g/g}$ pineal. Mean pineal serotonin concentration of the two-, four-, and eight-month old hamsters was respectively: 52.34 ± 6.74 $\mu\text{g/g}$ pineal, 53.10 ± 7.93 $\mu\text{g/g}$ pineal, and 52.28 ± 5.33 $\mu\text{g/g}$ pineal.

Weight of the pineal, pituitary, and adrenals was not significant. The weight of the ovaries and uteri was significant in the phases and ages.

(35)

Diurnal Changes in Water Quality in Ross Barnett Reservoir, Mississippi — 1973 and 1974

LUTHER A. KNIGHT, JR.
University of Mississippi

JACK HERRING
Mississippi Game and Fish Commission

Ross Barnett Reservoir is a 30,000 acre impoundment of the Pearl River just northeast of Jackson, Mississippi. Water quality parameters were monitored at two hour intervals for 24 hour periods four times between September, 1973 and January, 1974. The physico-chemical conditions in littoral and pelagic zones were compared. The littoral zones were densely populated with both submergent vegetation (*Ceratophyllum*) and emergent macrophytes (*Brasenia*). Marked diurnal variations occurred in pH, D. O. and free CO₂ in the littoral zones during the summer and early fall. Stratification is usually weakly delineated in the main body of the reservoir, but in protected coves may be well established. Surface temperatures during the 24 hour periods varied as much as 5°C.

(204)

The Effect of Freshwater Microbes on the Protozoan Colonization of Artificial Substrates

DAVID L. KUHN AND JAMES L. PLAFKIN
Virginia Polytechnic Institute and State University

Water rich in protozoa and other microorganisms enclosed in dialysis tubing (12,000 MW) and placed in the center of otherwise sterile polyurethane artificial substrates was placed in three aquatic systems: Tawney's Cave, Giles County, Virginia, Hoop Lake, Cheboygan County, Michigan, and Long Lake, Cheboygan County, Michigan. The substrates were harvested on 1, 3, 6, 15, and 21 days after placement and the associated protozoa were recorded. In two of the locations (Tawney's Cave and Long Lake) the average numbers of species during the initial period of colonization were significantly lower ($\alpha = .10$) than in substrates lacking the dialysis tube. In addition these substrates were dissimilar in species composition and had different dominant protozoa. There was no sample evidence that the substrates placed in Hoop Lake were significantly different. It appears that depending upon local conditions colonizing protozoa are influenced by other organisms in the substrate.

(337)

The Dependence of Radiation-Induced Lymphopenia Upon Adrenocorticoids

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Memphis State University

The lymphopenic effect of radiation and adrenocorticoids in mammals is well recognized, as is the increased secretion of adrenocorticoids during radiation. There are conflicting reports as to whether the radiation-induced lymphopenia depends upon the presence of high levels of adrenocorticoids. The purpose of this study is to investigate further this dependency. Male *Mus musculus* were divided into four groups: (1) adrenalectom-

ized and sham-irradiated (2) adrenalectomized and irradiated with 400R x-rays (3) adrenalectomized, corticosterone replaced and irradiated with 400R x-rays (4) sham-adrenalectomized and irradiated with 400R x-rays. Adrenalectomy was accomplished chemically with intraperitoneal injections of Metopirone (SU-4885). Each group was sampled at 4, 8, 12, 24 and 36 hours post-irradiation for peripheral blood lymphocytes, spleen and thymus weights and degenerating cells in the spleen and thymus. Results indicate that the detrimental effect of radiation on the parameters measured does not depend upon the presence of adrenocorticoids.

(75)

The Interaction of Sodium Selenite with Aflatoxin B₁ in the Mongolian Gerbil, *Meriones unguiculatus*

JOHN H. LALOR AND GERALD C. LLEWELLYN
Virginia Commonwealth University

Juvenile, male Mongolian gerbils, *Meriones unguiculatus* were grouped by weight and fed one of four diets: 0.0 ppm Na₂SeO₃ + 0.0 ppm aflatoxin B₁ (control), 12.8 ppm aflatoxin B₁, 5.0 ppm Na₂SeO₃, or 5.0 ppm Na₂SeO₃ + 12.8 ppm aflatoxin B₁. Several morphological and behavioral parameters were followed. Growth data showed a retardation of growth rate by each of the test diets. Gross pathology proved normal in all animals within the control and Na₂SeO₃ groups. In the aflatoxin B₁ group, all animals had increased deposition of adipose tissue in the abdominal region and around the heart. In the Na₂SeO₃ + aflatoxin B₁ group, only one animal showed a deviation from the controls. This animal showed a slight increase in adipose tissue. Histopathology will be correlated with the above results.

(319)

The Influence of a Loblolly Pine Plantation on a Cotton Rat Population

ALBERT K. LANGLEY, JR. AND D. J. SHURE
Emory University

The population of Cotton rats (*Sigmodon hispidus*, Say and Ord) in two fields were censused monthly, from May '75-Oct. '75, using standard live-trapping techniques. An abandoned pasture, used as a control, was contrasted with an even-aged plantation of Loblolly pine (*Pinus taeda*). Significant differences in population size and composition were observed. Discriminant function analysis was used to determine significant variables accounting for the population differences. Among the significant variables were, foliage height diversity, plant biomass, litter biomass, and proportion of vegetation contained in the 0-12.5 cm. layer.

(328)

Biochemical Characterization of Human Mammary Tumors

E. H. LARNER AND CHARLES L. RUTHERFORD
Virginia Polytechnic Institute and State University

Alterations in tissue specific metabolism can be quantitatively evaluated for cell types within any given tissue

by means of an ultramicrochemical technique in association with routine histological examination. Frozen specimens are sectioned for staining or lyophilization in alternating sequence, then compared microscopically. By tandem observation the position of heavily invaded areas can be dissected from the experimental tissue sections in preparation for enzymatic analysis. It has thus been possible to compare the activities of lactic dehydrogenase, glycerol phosphate dehydrogenase, hexokinase, glucose-6-phosphate dehydrogenase, and phosphoglucose isomerase within malignant and benign human breast lesions as well as lactating bovine mammary gland. Tumor cell specific activities of lactic dehydrogenase and glycerol phosphate dehydrogenase merit attention. The ensuing high activity of the former reflects an anaerobic tendency in tumorigenesis while shunts to the normally operative mitochondrial respiratory apparatus are precluded by the conspicuous absence of the latter.

(150)

Prenatal Effects of Ethanol Exposure in Mice with Chronic Respiratory Disease

JOSEPH M. LARY, RONALD D. HOOD, AND BOB BLACKLOCK
University of Alabama

Groups of pregnant albino mice (Charles River CD-1 strain) infected with chronic respiratory disease (CRD) were given 20% ethanol solution in place of drinking water on gestation days 2-11, 6-11, or 7-11. Uninfected mice were given identical treatments, and both a healthy and a CRD control group received only water. An additional uninfected group was injected ip on day 11 with 20% ethanol at a dose level of 3g/kg and controls were injected with water. Chronic ethanol treatment was associated with increased fetal abnormalities and decreased fetal weights among all CRD groups and with increased prenatal mortality in the day 2-11 and 6-11 CRD groups. No significant changes associated with ethanol treatment occurred in any uninfected groups. An additional group given a sucrose solution on days 2-11 in amounts isocaloric to the alcohol consumed by the day 2-11 ethanol groups did not differ from the controls.

(175)

Report on Work of the Florida Committee on Rare and Endangered Plants and Animals

JAMES N. LAYNE
*Archbold Biological Station of
the American Museum of Natural History*

The Florida Committee on Rare and Endangered Plants and Animals (FCREPA) was organized in 1973 and is co-sponsored by Florida Audubon Society and Florida Defenders of the Environment. The objectives of the Committee include preparation of a comprehensive inventory of the rare and endangered biota of the state, developing guidelines and recommendations on matters relating to rare and endangered species on the state and national level, encouraging research that will aid in conserving and protecting rare and endangered species, and promoting greater public understanding of the role and importance of native wildlife. To date, the Committee has classified approximately 500 species of vascular plants, marine and freshwater invertebrates, in-

sects and other terrestrial invertebrates, fishes, amphibians, reptiles, birds, and mammals as endangered, threatened, rare, or species of special concern with regard to their status in Florida. About 20 percent of the species are considered as endangered and 28 percent as threatened. A comprehensive report including summaries of information on the status and relevant aspects of the ecology and life history of all listed species is in preparation. The lists and supporting data base assembled by the Committee are receiving increasing use by federal, state, regional, and local governmental agencies; environmental organizations; consulting firms; educational groups; and the news media.

(43)

Vocal Strategies of Hyliid Frogs

DAVID S. LEE
North Carolina State Museum of Natural History

Field studies of the preferred calling sites of male hyliid frogs in the southeastern coastal plain, and laboratory analysis of their vocalizations, suggest correlations that have previously been overlooked. Published reports indicate a wide range of frequencies in species-specific song. Audiospectrographic analysis (narrow band), however, shows that each species has a distinct dominant frequency. In general, songs with the lowest dominant frequencies are produced by species that call from the lower calling sites, while the reverse is true for those with songs composed of higher dominant frequencies. This pattern allows for the greatest carrying quality of species-specific songs and, at the same time, provides for minimal voice overlap in large, mixed choruses. Exceptions do occur. The patterns of selection of calling sites, and the spectrum of dominant frequency, probably allow species-specific identity to be maintained with minimal expenditure of energy.

(182)

Endangered Species: Problems Associated with Habitat Protection

DAVID S. LEE AND JOHN E. COOPER
North Carolina State Museum of Natural History

Protecting the habitat of endangered and threatened species has been recognized as the most viable strategy for maintaining their populations. Land acquisition and laissez-faire policies alone, however, may not be sufficient to perpetuate many species in jeopardy, especially at state levels where they may be peripheral. Some forms in this situation, notably terrestrial animals, display narrow ecological tolerance and often occur only in ecotonal habitats. Examples include the amphibian, *Gastrophryne carolinensis*, in Maryland, and breeding populations of the owl, *Aegolius acadicus*, in North Carolina. Some, like the turtle, *Chelmyss muhlenbergi*, are associated with isolated plant communities in relatively unstable seral stages. Competition from closely related species or ecological equivalents in adjacent areas represent added threats. These problems need to be considered and researched to provide guidance for instituting active management programs for endangered and threatened species.

(148)

Effects of Aspirin and Prostaglandin E(1) on the Release Reaction of Human Blood Platelets

WARREN LEE

Oklahoma Baptist University

Prostaglandin E(1) is a fatty acid-like substance with hormone-like action produced naturally which has several interesting physiological effects. It has been shown that aspirin is related to the effects of prostaglandin E(1). One related effect is found in the blood clotting process.

Incubation of calcium with citric platelet rich plasma in 0.85% saline shows a lag period and then rapid platelet aggregation. Aspirin and prostaglandin E(1) added 1 minute before and after calcium show longer lag period. This effect may be mediated by substances released from the platelet and the adenyl cyclase system.

(330)

Subcellular Morphology of Internodal Cells from *Chara australis* (Charophyceae)

LOUISE LESLIE AND LAWRENCE A. DYCK

Clemson University

Morphologic and topologic relationships of subcellular organelles have been observed within the giant internodal cells of *Chara australis* by modified scanning electronmicroscopic methods. Among the more significant observations revealed by the procedure were: (1) different axes of division and enlargement for chloroplasts oriented in easily recognized rows; (2) fascicles of microfilaments attached to chloroplasts at the boundary of ecto- and endoplasm; (3) presence of distinctive populations of mitochondria associated with plasma-lemma, chloroplasts and microfilaments. In addition, interpretation of interrelationships between the orientation of microfilaments and the dynamics of cytoplasmic streaming and chloroplast division will be presented.

(132)

The Effects of Flood on Growth of Seedlings and Saplings of the Angiosperm *Acer saccharinum* (Silver Maple)

KENNETH P. LEWIS

The University of Alabama in Huntsville

Quantitative surveys by this author of the alluvial flood plains of the Appalachian Plateau showed silver maple the dominant woody species. Alton Lindsey and Robert Gordon concluded from historical records that silver maple has been a part of the flood plain vegetation since before the arrival of European man. The continued presence of silver maple indicates that it is tolerant of flooding, but yields no information of such specific parameters as soil type, flood depth, associated vegetation or deposition. Experimental results indicate growth is significantly better in association with *Justicia americana* when flooded, the same as an unburied control when buried to 50% stem length by sand or silt-clay, less when buried to 70% stem length. Seedlings covered by flood suffered necrosis of the shoot, subsequent growth, after removal from the flood simulation chamber resulted in plants equivalent in biomass to those only partially flooded which retained their original shoot.

(120)

Effects of Selected Combinations of Heavy Metals on Bluegill Sunfish (*Lepomis macrochirus*)

LAWRENCE H. LIDEN, JOHN W. S. FOSTER III,

ROBERT L. MARTIN AND ERIC L. MORGAN

Tennessee Technological University

Bluegill sunfish were utilized in 96-hour acute bioassays to determine LC50 (concentrations of metals to kill 50% of the bluegill in the 96 hour test period). These data were then multiplied by their respective "application factor" (obtained from the literature), to obtain 'safe concentration' values. Additional, chronic bioassays were conducted using combinations of LC50 and 'safe concentration' values for selected metals, over short-term and long-term periods, to determine if any antagonistic or synergistic situations were occurring, and at what levels they were occurring. Bioassays were conducted using flow-through, Mount-Brung apparatus and dechlorinated municipal dilution water.

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Heavy Metal Concentrations in Tissues of Fish from the Three-Reservoir, Toccoa-Ocoee River Drainage, Georgia-Tennessee

LAWRENCE H. LIDEN, JOHN FOSTER III,

ROBERT L. MARTIN AND ERIC L. MORGAN

Tennessee Technological University

Tissue from fish captured in Lakes Blue Ridge, Ocoee and Ocoee Reservoir #3, during 1975, were analyzed for heavy metal concentrations using atomic absorption spectroscopy. Neural, hepatic and gonadal tissues were examined. Statistical evaluations were employed to determine existence of significant differences, of metal concentration by fish, between reference (Lake Blue Ridge), stressed (Ocoee Reservoir No. 3) and recovery (Lake Ocoee) reservoirs.

(169)

Characterization Versus Classification in *Thaspium* and *Zizia*. (Apiaceae).

ANNE H. LINDSEY

University of North Carolina

Thaspium and *Zizia* are problematical genera taxonomically as revealed in their nomenclatural history. Four of the six species have been placed, at one time or other, in both genera. A preliminary character analysis of all six species revealed three levels of character groups: 1) characters possessed by all six species in the two genera; 2) characters diagnostic for each of the two genera, such as fruit ribbed or winged, and other "key" characters; and 3) characters which link *Thaspium trifolium* and all *Zizia* species. Characters of the last group are: the presence of root stock secretory canals, marginal venation type, leaf texture, stomate patterns, pubescence type, umbel number, sex ratio patterns, and pollen size. A consideration of these previously uninvestigated characters and the *Zizia*-like *Thaspium trifolium* raises some doubt as to the actual biological limits of the two genera.

(296)

Distribution of Symbiotes in the
Eastern Wood Roach, *Cryptocercus punctulatus*
(Orthoptera, Blattidae)

DIANA LIPSCOMB AND THOMAS E. SIMPSON
Agnes Scott College

The digestive tract of the eastern wood roach, *Cryptocercus punctulatus*, represents a unique microhabitat for over 20 species of flagellate protozoans. The spatial distribution pattern of species representing the 11 genera of these polymastigote symbiotes was investigated. Identification of populations was determined by serial sections and by dissection of the roach intestine. Microniches were identified by statistical treatment of distribution patterns. Attempts were also made to define specific chemical gradients that may relate to the selection of these symbiotes for certain regions of the tract. Other ecological characteristics of this habitat will be reviewed.

(268)

Observations on the Preference-Avoidance
Behavior of Bluegills to a Sublethal
Concentration of Ammonia

KENNETH S. LUBINSKI
Virginia Polytechnic Institute and State University

Individual native bluegills (*Lepomis macrochirus*) were exposed for 1 hr periods to a sublethal concentration of ammonia in a preference-avoidance chamber. Movements of the fish were monitored using an overhead television camera and a receiver with a superimposed grid of 16 squares on its screen. The number of entries into each square and the number of seconds spent in each square were recorded with a teletypewriter and a minicomputer. The most frequent and obvious behavioral pattern elicited by the ammonia concentration (5.0-7.4 mg NH₃-N/l, of which at least 97% was ionized) was an initial period of quiescence, which for some fish lasted the duration of the test. Bluegills that recovered from this period and swam out of the ammonia area, later returned to it and spent more time there than in the ammonia-free area. Thus, no apparent behavior mechanism that might protect bluegills from the ammonia concentration tested was observed.

(310)

The Effects of Weathered Mirex Fire Ant Baits
to Two Species of Non-target Soil
Macro-arthropods

KUANG YANG LUE AND ARMANDO A. DE LA CRUZ
Mississippi State University

Fifty specimens of the isopod, *Armadillidium vulgare* L. and the millipede *Oxidus gracilis* K., were fed with 4X Mirex fire ant baits which had been exposed in the field for 0 months, 3 months, 6 months, 9 months, and 12 months. Non-toxic baits (i.e., bait without mirex) were used as control. The number of dead animals and animals showing severe symptoms of poisoning were recorded daily for a period of 12 days. Mortalities in *A. vulgare* fed with nontoxic, 0, 3, 6, 9, and 12 months old

toxic baits, were 2%, 18%, 62%, 52%, 64%, and 76% respectively; mortalities in *O. gracilis* were 0%, 6%, 58%, 44%, 52%, and 52%. Animals exhibiting severe symptoms of poisoning as evidenced by irreversible coiling were 0%, 20%, 90%, 76%, 92%, and 84% in *A. vulgare* and 0%, 54%, 100%, 100%, 100%, and 100% in *O. gracilis* after similar feeding exposure. The mortality and poisoning percentages in the more decayed baits are comparatively higher. Residue levels of Mirex in the test animals are reported.

(136)

Organic Matter and Nutrients in Forest Floor
Components of Upland Oak-Hickory and Mixed
Hardwood Forests of Southwestern Illinois

JEFFREY C. LUVALL AND GEORGE T. WEAVER
Southern Illinois University at Carbondale

Quantities and distributional patterns of organic matter and several macro- and micronutrients in components of the forest floor were determined in upland oak-hickory and mixed hardwood forests in southwestern Illinois. Samples were collected following autumn leaf fall from 56-0.04 ha plots which were stratified according to topographic attributes. Boles and large branch components were harvested from three 3.8 m² quadrats in each plot; smaller components of the 01 horizon and 02 horizon components were harvested from six 0.25 m² quadrats per plot. Results were analyzed to test the hypothesis that topographic attributes provided a useful basis for classifying nutrient and organic matter storage patterns in area forest types. This represents one phase of a project to develop a system for classifying forest ecosystems according to functional processes.

(233)

Combined Infections of *Litomosoides carinii* and
Brugia pahangi (Secernentasia: Spirurorida:
Onchocercidae) in Jirds For Screening Potential
Chemotherapeutic Agents

JOHN W. MCCALL AND HANNAH CROUTHAMEL
College of Veterinary Medicine, University of Georgia

Several antifilarial drugs — diethylcarbamazine (DEC), suramin, thiacetarsamide, dithiazanine, and levamisole — were tested for activity against microfilariae and adults of *Litomosoides carinii* and adults of *Brugia pahangi* in combined intraperitoneal infections. Microfilaricidal activity. DEC and levamisole effected a rapid reduction in microfilaremia, but suramin and thiacetarsamide were only indirectly effective. Dithiazanine was not effective. Activity against adults. Suramin was 100% effective against *L. carinii*, but had little, if any, activity against *B. pahangi*. DEC and levamisole were moderately to highly active against both species. Thiacetarsamide was highly effective in killing *B. pahangi*, but was only moderately active against *L. carinii*. Dithiazanine showed moderate activity against *L. carinii*, but had no effect on *B. pahangi*. In general, these results qualitatively compare favorably with those obtained earlier with single infections; however, the adults of *L. carinii* were somewhat more sensitive to drug action in combined than in single infections.

(232)

Collection of Infective Larvae of
Litomosoides carinii (Secernentasia: Spirurorida:
Onchocercidae) by Soaking the Pelts of
Infected Jirds

JOHN W. MCCALL AND JUNG JUN

College of Veterinary Medicine, University of Georgia

Substantial quantities of infective larvae of *Litomosoides carinii* were collected by soaking the pelts of jirds (*Meriones unguiculatus*) previously exposed for a short period to large numbers of infected mites (*Ornithonyssus bacoti*). In each of 2 separate experiments, over 5,000 infective larvae were collected from 5 or 7 jirds that had been exposed for 6 or 7 hours to infected mites. The numbers of larvae migrating out of the pelts were recorded at $\frac{1}{2}$ hour intervals for 3 hours. In the first experiment, the dishes were again examined 16 hours later. The number of larva obtained at each collection rapidly decreased with time, and by 2 $\frac{1}{2}$ hours, 94% of the larvae had migrated out of the tissues. Jirds inoculated subcutaneously with infective larvae collected in this manner presented high mean recoveries of filariae at necropsy i.e., 79% and 60% at 5 and 29 days postinoculation, respectively), and the ranges in worm recoveries were narrow.

(145)

Formalin Toxicity to Insecticide-Resistant and
Susceptible Mosquitofish (*Gambusia affinis*)

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The toxicity of formalin to insecticide-resistant and susceptible mosquitofish was determined by exposing fish from both populations to a series of formalin concentrations in test aquaria. For each formalin concentration fish mortality was recorded on a 12 hr basis for 96 hours. The 96-hr LC₅₀ value for resistant fish was 56 ppm formalin and 131 ppm formalin for susceptible fish. In a second toxicity test in which all test aquaria were aerated no difference in mortality between the two populations was observed. Since formalin is known to bind oxygen thereby reducing the oxygen content of the aquarium water, these data suggest that resistant fish are more sensitive to oxygen stress than are susceptible fish.

(102)

An Oxygen Study of the South River in
Augusta County, Virginia

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A study of oxygen utilization was conducted in the summer of 1975 on a 22 mile stretch of the South River below Waynesboro, Virginia. A total of 13 stations, 5 of which were diurnal stations, were sampled three times at two-week intervals. Station 1, the control station, had the

least average dissolved oxygen fluctuation, 1.1 ppm, and Station 4 had the greatest, 4.1 ppm. Stations 6, 8, and 10 had 1.8, 1.2 and 1.7, respectively. Each of the above stations were diurnal study sites. The 4.1 ppm fluctuation noted at Station 4 is probably attributable to large algal mats at the site. The dissolved oxygen level at Station 1 was generally higher and more stable than the other diurnal stations. Although the dissolved oxygen level had increased by Station 10, which was 15 miles downstream, the original level of Station 1 was not regained. An average of BOD₅₀ readings showed Station 1 to have a 6.5 ppm oxygen demand. The highest average was Station 3 with 12.2 ppm oxygen used. The BOD was reduced to that of Station 1 at Stations 7 and 8 with averages of 6.1 ppm each.

(252)

Geographic Variation and Zoogeography of
Lycosa ceratiola (Araneae: Lycosidae)

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Western Carolina University and University of Florida

The wolf spider, *Lycosa ceratiola*, is endemic to central Florida and inhabits inland, dune-like areas supporting sand-pine scrub or sandhill vegetation. Within this limited range, the epigynum of the female shows marked variation in size and shape. Analysis of this variation revealed three well-defined geographic populations. The distribution of these populations is very similar to that of two species groups in other lycosid genera, the *Geolycosa pikei* complex and the *Sossipus floridanus* species group. The zoogeographic implications are discussed.

(133)

Response of a Longleaf Pine (*Pinus palustris*:
Pinaceae) Plantation to Litter Removal

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In the southeastern United States, the freshly fallen needles from longleaf pine plantations are being gathered and sold to nurseries for mulching and decorative purposes. What effects the litter removal has had on tree growth, size of nutrient pools, and understory response is largely unknown. By analysis of tree cores in areas in which litter was removed, the response of the trees can be observed. The first year following litter removal a reduction of 5% in the width of the annual ring was found when compared to control plots that had no litter removal. The second year following litter removal also showed a reduction in growth but not as great as in the first year. By the third year no effect can be seen. The aspect of the litter removal that is the causative factor of the reduced growth is currently under investigation.

(11)

Macroinvertebrates of the Kanawha River,
West Virginia

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Virginia Polytechnic Institute and State University

The mainstem of the Kanawha River, below South Charleston, West Virginia, has undergone severe degradation due to one of the largest industrial chemical complexes in the nation. A study was conducted to ascertain the distribution and abundance of benthic macroinvertebrates in this area. Thirty Ponar grab samples were taken at each of fourteen sampling sites between river miles 89.8 and 42.9. Of approximately 21,000 organisms collected, about 76% were oligochaetes and 20% were chironomids. Other combined taxa totalled less than 4%. Total taxa per site ranged between 5 and 38, and mean density ranged between 13.3 organisms/m² to 2685.5 organisms/m². Although about 42% of the oligochaetes were unidentifiable immatures, 8 species of Tubificidae, 7 species of Naididae, and representatives of the families Lumbriculidae, Enchytraeidae, and Aelosomatidae were found. *Dero* cf. *obtusa*, *Aulodrilus pigueti*, and *Limnodrilus hoffmeisteri* were the oligochaete species most frequently encountered. The Chironomidae were represented by 3 genera of Tanypodinae, 11 genera of Chironominae (8 Chironomini and 3 Tanytarsini), 1 genus of Diamesinae, and 4 genera of Orthoclaadiinae. The most frequently encountered midge genera were *Polypedilum*, *Procladius*, *Cryptochironomus*, and *Cricotopus*.

(84)

Seed and Seedling Studies on Root Parasites
of the Southeastern United States

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LYTTON J. MUSSELMAN
Old Dominion University

Seeds of the Scrophulariaceae, Orobanchaceae, Santalaceae, Krameriaceae, and Olacaceae were studied with reference to seed morphology, germination requirements, and seedling morphology. Germination of most species is epigeal; all species of hemi-parasites have green seedlings. Seedlings of the Scrophulariaceae are characterized by prominent, actively secreting trichomes. Root hairs are always present on seedlings of the Scrophulariaceae and Olacaceae. The unusually vigorous growth of seedlings roots in some species is described. Preliminary data indicates that extracts of host roots is essential for germination in some holo-parasites and may be beneficial to some hemi-parasites. Methods of inducing germination of dormant seeds are also discussed.

(6)

A Technique Utilizing Crayfish Locomotor
Activity as a Sensor in an Automated
Biological Monitoring System

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E. F. BENFIELD AND J. CAIRNS, JR.

Virginia Polytechnic Institute and State University

Although a rapid biological monitoring system to detect toxic stress has been under development at Virginia Polytechnic Institute and State University for several years, no organisms other than fish have been utilized as sensors. The current apparatus was designed to analyze the electrical signal created by gross locomotor activity of crayfish. Electrodes attached to each end of a chamber pick up the signal, which is then amplified, and sent to an analog to digital converter. The waveform of the digitized signal is then analyzed by a microprocessor. The microprocessor also counts the number of peaks per unit time which is directly related to locomotor activity. This data is periodically transferred to a minicomputer, where it can be accessed for further analysis. The use of crayfish presents several advantages in continuous monitoring of pollutants: 1.) Space requirements are substantially reduced; 2.) Crayfish may be less tolerant than fish to some toxicants; 3.) Using crayfish allows comparative studies with fish, giving some indication of stress to more than one segment of the community.

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A Preliminary Study of Chlorine Toxicity to
Atlantic Menhaden (*Brevoortia tyrannus*) and
Hogchoker (*Trinectes maculatus*)

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AND LEONARD B. RICHARDSON

Academy of Natural Sciences of Philadelphia

Atlantic menhaden (*Brevoortia tyrannus*) and hogchoker (*Trinectes maculatus*) were exposed to chlorine applied on both continual and intermittent schedules. Total residual chlorine concentrations of 0.125, 0.25, 0.50, 1.0 and 2.0 mg/l were applied continuously while 0.5, 1.0 and 2.0 mg/l were introduced intermittently for 15 minutes every 3 hours and 30 minutes every 6 hours. An intermittent test at a concentration of 0.25 mg/l was run for 60 minutes every 2 hours. All tests were conducted at 15-20°C for 96 hours or until 100% mortality occurred.

One hundred percent of the menhaden died in nine of 12 tests (five continuous tests; seven intermittent tests); mortality ranged from 10 to 90% in the remaining three tests. In contrast, 100% mortality occurred in only one of 12 hogchoker tests; mortality ranged from 30 to 70% in four tests and no mortality occurred in the remaining seven tests. Time to death for both species was inversely proportional to the chlorine concentration under both the continuous and intermittent schedules. In general, fish survived longer when exposed to intermittent rather than continuous schedules.

(240)

Constitutive Nature of 5-ketogluconato Reductase of *Gluconobacter suboxydans*

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AND L. B. LOCKWOOD
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NADP⁺-dependent 5-ketogluconate reductase (EC 1.1.1.69) of *Gluconobacter suboxydans* was examined and determined to be constitutive in nature. The enzyme was prepared by sonication of cells grown on 10% glucose-0.25% yeast extract medium. The constitutive character of the enzyme was indicated by a constant specific activity of extracts of cells grown under various conditions.

(67)

Vegetational Changes Following Thermal Alteration of a South Carolina Swamp

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Savannah River Ecology Laboratory

The vegetation of a swamp following thermal alteration, Steel Creek delta, on the Savannah River Plant, Aiken, South Carolina, was studied in order to determine what changes had taken place since cessation of thermal pollution in 1968. Since the same area was studied three years previously, this allows a unique opportunity to follow plant succession in a non-terrestrial habitat. The diversity of the area, based on the Shannon-Weaver index, is lower in 1975 than in 1972. Although major floristic changes have occurred, the dense herbaceous ground cover is still dominated by perennials. No significant increase in the percentage of woody plants was noted. Similarity indices indicate Steel Creek (1975) is 35% similar to the same area in 1972 with much lower similarity to the natural or thermal swamp. Explanations for the slow recovery are discussed.

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Studies of a Unique New Aquatic Phycomycete Parasitic in Insect Eggs

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Randolph-Macon College

Developmental studies have been carried out on a unique aquatic phycomycete found parasitizing the eggs of midges and caddis flies at a small Virginia pond. A rounded to irregularly-shaped thallus is produced which is subsequently converted into a zoosporangium. The organism exhibits an unusual method of zoosporogenesis similar to that reported in some Saprolegniales and Lagenediales. Formation of the single discharge tube is correlated with a vacuolization of the sporangial protoplast so that many nuclei become suspended between vacuoles and remain attached to one another by cytoplasmic strands. Following a contraction of the protoplast each zoospore initial develops flagella and the strands are broken. After swarming within the zoosporangium the biflagellate zoospores are released through the discharge tube. These primary zoospores encyst after a period of motility and zoospores bearing two laterally inserted flagella exit from the cysts and are presumed to initiate infection. Zoospore release has been observed to occur only at late evening or night.

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The Red River Gorge Controversy in Kentucky: A Case Study in Preserving a Natural Area

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The Red River Gorge in Kentucky is located at the western edge of the Cumberland Plateau. The rugged, sharply dissected topography is the result of differential erosion of Pennsylvania and Mississippian rock strata, and edaphic and microclimatic variation adds to the environmental complexity of the Gorge. This habitat diversity is matched by a biological diversity that is unique in the state. Most of the land area is forested with several distinct communities and successional stages represented from the flood plain to the prominent plateau surface. The Red River, a rapid, free-flowing stream, is virtually unpolluted when compared to other regional streams and artificial lakes.

Flooding does occur on the river's plain west of the Gorge, and in the 1960's, federal funds were appropriated for construction of a dam on the river by the U.S. Army Corps of Engineers. The resulting lake would have provided flood control, recreational, and water supply benefits while permanently inundating 15 miles of stream and lower slope habitats in the Gorge. In addition to converting a large section of flowing stream into a lake, this environmental change would have drastically altered the biotic composition of the Red River, endangered some plant and animal populations known to Kentucky only from this area, and permanently covered significant archeological sites. Further, over 50 families would have been displaced by the flooding of their homes and farms.

As plans to build the dam proceeded, opposition also began to develop. The controversy peaked in the 1970's with public hearings, the filings of an environmental impact statement, the threat of lawsuit, and considerable commentary in the press and from court hearings.

This paper discusses the conflict over this natural area. The lessons learned during this struggle should be applicable to similar preservation-"development" issues elsewhere in the Southeast.

(228)

Studies of Genetic Variation in Southeastern *Typha* Populations

SUSAN J. MASHBURN AND REBECCA R. SHARITZ
Savannah River Ecology Laboratory

Two species of *Typha* were investigated using electrophoresis techniques for evidence of heterozygosity on a spatial gradient throughout the southeastern United States. Extensive work by McNaughton, Lee and Fairbrothers, and others indicated the probability that ecotypic variation on a physiological level could be correlated with biochemical genetic variation. Starch-gel electrophoresis of 12 enzyme systems in 74 populations of *T. latifolia* and 52 populations of *T. domingensis* failed to reveal any evidence of heterozygosity. Since *Typha* is a widespread colonizing species, it must exhibit flexibility, either through phenotypic plasticity or on the genetic level. One possibility is that its enhanced fitness may be due, not to a great range of variation at structural loci, but rather to variation at the regulator gene.

(98)

Data Base Structuring and Maintenance for Aquatic Biological and Physical Monitoring

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The success and usefulness of aquatic ecosystem studies often depend on an effective data management system. Aquatic monitoring involves collecting, reducing, and analyzing large amounts of temporally and spatially distributed biological and physical data. Traditional computerized data management systems, which are designed around fixed inputs and outputs, are difficult to use for managing and interpreting biological data. Several general-purpose data base management software systems that have recently become available mitigate input and output constraints at the inception of the monitoring program. The data base need not be rigidly structured, and additions and deletions of parameters through time and space are permitted. The new data base management systems allow fixed format output as well as ad hoc inquiries and heuristic browsing of the data. The applicability of several of these software systems to aquatic monitoring programs will be discussed along with suggestions for structuring and maintaining the data base.

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Crappie Utilization of Stake Beds

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The relative attraction of fish to single and multiple groupings of stake beds was evaluated through cove rotenoning, fishing with submerged trot lines, and sport angling. Stake beds concentrated crappie and other game fish in coves at Center Hill and Cordell Hull Reservoirs, Tennessee. However, the catch for these species in natural cover areas was greater than that in either stake bed or control cove areas. The horizontal distribution of crappie and other game fish caught on trot lines was clumped over the area of the stake beds, whereas the catch of other game fish in control areas was randomly distributed along the entire length of the trot lines. Multiple groupings of stake beds resulted in an increasing concentration of fish with increasing number of stake bed units. In Center Hill Reservoir, the absolute number and biomass of crappie were higher in stake bed coves than in control coves which were rotenoned. At Cordell Hull Reservoir, rotenone samples indicated that crappie were less abundant, both in number and biomass, in stake bed coves than in control coves.

(188)

A Case of Hyperparasitism in the *Megalopyge opercularis* — *Carcelia lagoae* Association. (Insecta)

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Loyola University

The tachinid fly *Carcelia lagoae* (Townsend) is parasitic on the caterpillar and sometimes in the cocoon of

the moth *Melalopyge opercularis* (J. E. Smith). A case of hyperparasitism of a small wasp within the *Carcelia lagoae* pupa is reported here. Two fly puparia were found in one cocoon of *M. opercularis*. On dissection one was found to be parasitized by larvae, but the fly was far enough advanced to be identified as *C. lagoae*. Parasitic larvae could also be seen in the other puparium without dissection. Two weeks later these parasites emerged from the intact puparium and proved to be small wasps identified in the superfamily Chalcidoidea. More specific classification is in progress. The wasps have been observed ovipositing in other *C. lagoae* puparia. The life cycle of this hyperparasite is described and its relationship with the life cycles of *M. opercularis* and *C. lagoae* is considered.

(151)

Purring in *Felis domestica*; Respirometry, Cardiac Rates, and Breathing Rates

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Gas exchange measurements, cardiac rates, and breathing rates were recorded before and during purring in the house cat, *Felis domestica*. These measurements were determined in an attempt to evaluate the physiological effects of purring, as purring is known to be a hemodynamic action and not aerodynamic in origin. Gas exchange rates during purring were not found to be significantly different than before purring (<0.1% difference); whereas, heart rates and breathing rates were found to increase significantly during purring (20% and 24% increase respectively).

(160)

Clinal Variation in *Leucothoë axillaris* (Lam.) D. Don (Ericaceae)

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Leucothoë axillaris (Lam.) D. Don is a semi-woody, ericaceous shrub endemic to the Southeastern United States. Restricted primarily to the coastal plain, *L. axillaris* ranges from Virginia to Louisiana in moist, sheltered pocosins and swamp forests. Throughout the distribution the morphological characters most frequently used for taxonomic separation vary considerably. The majority of these characters form a clinal continuum from extremes at either end of the range. Workers have split various taxonomic entities from this polymorphic species based primarily on variations in leaf shape, inflorescence length, and habit. Most noteworthy are *L. platyphylla* Small and *L. axillaris* var. *ambigens* Fernald and Schubert. Also *L. fontanesiana* (Steud.) Sleum. has, at times, been included as a variety of the coastal *L. axillaris* because of its close taxonomic relationship and the extreme variability of the coastal taxon.

(299)

Mariculture: Hybridization and Selection in Clams, *Mercenaria* spp.

WINSTON MENZEL
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Past observations have shown that F₁ hybrids between the northern (*Mercenaria mercenaria*) and southern (*M. campechiensis*) quahog clams had desirable commercial traits of both parents, faster growth rates of the southern and good keeping qualities in the shell of the northern, when removed from the water. Considerable variation in growth occurred between individuals, presumably under genetic control. In present investigations, hybrids and backcrosses were made of the two species from original wild parents secured from the Atlantic and Gulf of Mexico coasts. Certain selected crosses showed about 40% faster growth rates than had been obtained previously—to commercial size within 15 months from time of spawning. Only limited progeny testing has been done.

(214)

Genetic Analysis of Two Polymorphic Protein Systems in Natural Populations of Brook Trout, *Salvelinus fontinalis*

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Virginia Commonwealth University

Four isolated natural populations of brook trout, *Salvelinus fontinalis* (Mitchill), from the Tye River drainage of Virginia were examined for genetic divergence. Phenotypes for two polymorphic protein systems, soluble lens proteins and serum transferrins, were determined by polyacrylamide gel electrophoresis. Observed allele frequencies from the two systems were used to calculate expected values according to the Hardy-Weinberg Law, in order to determine whether the populations are in genetic equilibrium. Gene frequency analyses of the two polymorphic systems were compared on an inter-stream basis in an attempt to disclose differences that make the various populations distinguishable.

(65)

Effects of Hurricane Processes on Insular Tree Species

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The barrier features of the Gulf Island's National Seashore (Mississippi-Alabama) are primarily forested by Slash Pine, *Pinus elliotii*, although small groves of Live Oak, *Quercus* spp. are also present. As has been previously reported, various aspects of the marine/insular environment affect these taxa in many ways, e.g., lack of usual inland hardwood dominants, reproductive patterns, and age/size classes. Recent data from increment cores, canopy morphology/damage, forest conformation and both ground reconnaissance and aerial photographs amplify these initial observations, but different conclusions are drawn regarding causality. For example, our results suggest that recurrent marine perturbation, viz., hurricanes, rather than fire is the significant factor in both maintaining the aforementioned conifer dominance as well as creating the distinct age groupings.

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Spatial and Temporal Constructs of Genetic Heterogeneity in a Population of White-tailed Deer (*Cervidae*)

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Using starch-gel electrophoresis, 26 proteins encoded by 25 structural loci were assayed from tissue samples taken from 700 white-tailed deer during the fall and spring of 1974-75. All samples were taken from within the 300 sq. mi. Savannah River Plant near Aiken, S.C. Heterozygosity and allelic frequencies are compared between age and sex classes with respect to associated reproductive and survivorship rates in the herd. Genetic indices (e.g. heterozygote distribution) are discussed in relation to sex, cohort and habitat differences and to recent demographic characteristics described for this population.

(23)

Phytoplankton and Periphyton Productivity of the Cumberland River and Dixon Creek in the Vicinity of the Proposed Hartsville Nuclear Power Plant

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Tennessee Technological University

As part of the preoperational study for the proposed Hartsville Nuclear Power Plant, productivity of phytoplankton and periphyton was studied at four sites on the Cumberland River and one site on Dixon Creek, Trousdale County, Tennessee. Samples of phytoplankton and periphyton were taken monthly with a Van Dorn bottle and with artificial substrate samplers. Chlorophyll a concentrations were used to estimate productivity. Phytoplankton and periphyton productivity varied considerably over the twelve month study period. Maximum productivity for both phytoplankton and periphyton occurred during July and August, while minimum periphyton production occurred during the spring flood period. These periods indicate that phytoplankton and periphyton productivity correlate with turbidity, temperature, and day length.

(127)

Abundance, Species Occurrence, and Diversity of Demersal Fish in Central Chesapeake Bay, 1969 through 1974

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Demersal fish were sampled monthly over a 6-year (1968-1974) period between Kenwood Beach and Cove Point on the Maryland Western Shore in the central portion of Chesapeake Bay. A total of 286,372 fish representing 48 species was collected. *Anchoa mitchilli* (bay anchovy) dominated the catch each year, averaging 64.9% of all fish collected. A total of 68,034 (23.2%) *Leiostomus xanthurus* (spot), 7,564 (2.6%) *Micropogon undulatus* (Atlantic croaker), and 7,567 (2.6%) *Trinectes maculatus* (hogchoker) was collected with 17,348

(6.0%) fish distributed among the remaining 44 species. Seasonal cycles in species occurrence and abundance are well developed with greatest numbers of fish occurring during the fall months and fewest during the winter months. Species diversity, as measured by the richness index (d) and the Shannon-Weaver information theory index (H'), do not show well defined seasonal cycles. Annual cycles in salinity, temperature, and dissolved oxygen in the sampling area are presented and related to changes in community structure.—*This research was supported by Baltimore Gas and Electric Company, Baltimore, Maryland.*

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A Comparison: Ponar Grab Versus Hester Dendy Sampler in a Riverine System

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Tennessee Technological University

Dredging with a Ponar grab is a rather extensive operation as compared to the artificial substrate samplers in biological assessment of a river system. Though each technique will be bias in the collection of certain genera, there should be a test of the effectiveness of each sampling technique in assessing the important ecological information of benthic macroinvertebrates. For the study, a monthly collection of grab and artificial substrate samples were taken in the Clinch River, Anderson County, Tennessee. The findings of this project will be discussed.—*This work was supported by the Exxon Nuclear Corporation.*

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Effects of Size on Seasonal Changes in Food Selection and Condition Factor of Small Bluegill, *Lepomis macrochirus*, Rafinesque

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During the period September 1974 to August 1975, over 6300 small (19mm-100mm) bluegill were seined or trapped from a five acre pond near Blackstone, Virginia. Weight and length were recorded from all fish. More than 2300 of this total were analyzed for stomach content. Seasonal changes were noted and compared. Cladocera, copepods and chironomids were used extensively throughout the year by all size classes. Insect use increased with size and with season into the summer, with Dipterans being most prominent. Change in condition factor and length-weight relationships were also compared throughout the year.

(83)

Host Range and Host Specificity of Parasitic Scrophulariaceae of the Southeastern United States

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WILLIAM F. MANN, JR.
Southern Forest Experiment Station

STEVEN D. RICH
Old Dominion University

The Scrophulariaceae is the largest family of root parasites in the Southeastern United States with 11 genera and about 30 species found in a diversity of habitats. While many species may have a wide host range in terms of numbers of species attacked, field observations indicate that the frequency of attachments to certain host species is much higher than to roots of other species that are equally available. Host specificity was studied by growing parasites in greenhouse culture with a wide range of assorted woody hosts of commercial importance in the South. We tentatively propose three categories of host specificity: (1) species which attach to and penetrate only one host or host family, (2) parasites that show a definite preference to certain hosts but which will attach to a wide range of species, and (3) species that are apparently promiscuous in host selection. Examples of each group are given. To date, we have not found any species which will mature without attachment to a host.

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Germination and Cataphyll Movement in *Ximenia americana*

LYTTON J. MUSSELMAN
Old Dominion University

Ximenia americana L. (Olacaceae) is a common root parasitic shrub of peninsular Florida. The large seeds germinate readily; host influence is not necessary for germination. The first formed leaves are awl shaped, green cataphylls. Shortly after germination, the two lowermost cataphylls grow down into the groove between the cotyledons formed by the growth of the epicotyl. This phenomenon, apparently unknown elsewhere in seed plants, was first described by Heckel in 1899 who indicated that an actual fusion of cataphyll-cotyledon tissue took place. Present studies indicate that no fusion of tissue takes place. The possible role of light in cataphyll behavior is discussed.

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Induction of Photosensitivity in Dark-Germinating Lettuce Seeds

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Lactuca Sativa var. *Mesa* seeds become photodormant when exposed to 24 hours of continuous far-red light. Gibberellic acid and thiourea stimulate germination in these induced photodormant seeds. Inhibitors such as DCMU, PMS, and hydroxylamine prevent the induction of photosensitivity during the 24 hours of continuous far-red light exposure. The requirements of ATP for induction of photodormancy in these seeds will be discussed.

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Numerical Cladistics of the Plecoptera (Insecta)

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A numerical cladistic analysis of Plecopteran relationships is undertaken. The characters utilized are those employed by Zwick in an earlier (1973) study on Plecopteran phylogeny. Zwick relied on the nonquantitative methodology of Hennig (1966) to construct a cladogram depicting the branching sequence of the major taxonomic groups within the Plecoptera. In this present study numerical methods for constructing cladograms include those for forming Wagner networks and trees. In addition various strategies for dealing with the placement of OTU's with missing character states and for discerning the location of a group ancestor are explored. In order to compare evolutionary rates in different groups of organisms an evolutionary step index is proposed. The computer generated cladograms based on numerical approaches are compared to that constructed by Zwick and the differences as well as similarities are noted.

(309)

Responses of the Freshwater Shrimp, *Palaemonetes kadiakensis*, to Thermal Stress

DAVID H. NELSON
Savannah River Ecology Laboratory

Freshwater shrimp acclimated to room temperature and different constant temperature regimes (24°, 26°, 28°, 30° and 32°C) were tested to assess their ability to thermoregulate behaviorally and to characterize the limits of their thermal tolerance. Most specimens placed in a horizontal gradient (18°-36°C) selected temperatures from 28° to 32°C. Apparent differences in "preferred" temperatures among the acclimation groups followed no consistent trend. Thermal preferences were considerably more variable than thermal tolerances. Thermal tolerances (critical thermal maxima: CTM) ranged from 37° to 40°C; values were directly related to the acclimation temperatures. Specimens tested to determine the critical thermal maxima demonstrated several responses to thermal stress which are described and compared: 1) initial disorientation, 2) complete disorientation, 3) beginning of tail fold, 4) end of tail fold, and 5) loss of motion. In all of these categories, variances for CTM's were greater for specimens acclimated to room temperature than for those acclimated to constant temperature regimes.

(250)

Use of the Scanning Electron Microscope in the Identification of Tardigrades (Phylum: Tardigrada)

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East Tennessee State University

Tardigrades were killed with hot ethanol, dehydrated in absolute isopropanol, transferred to amyl acetate, and dried by the critical point method with CO₂. Individuals were mounted on SEM stubs, coated with 300 Å of gold-palladium, and photographed with an ETEC Auto Scan U-1 scanning electron microscope at the University of California at Davis. Species were identified by external morphological characters such as pore size and distribution, cuticular patterns, mouth structures, and claws. Verification was obtained by removing specimens from SEM stubs and mounting the individuals in Hoyer's medium on microscope slides. Similar species in the genus *Macrobiotus* were separated with this technique by correlating claw lunules and cuticular pores (visible with the SEM) with the buccal apparatus (observed with phase microscopy) of the same individual.

(19)

An Ecological Study of Three Seagrass Species in an Estuarine Area Affected by Thermal Effluents From a Fossil Fuel Electrical Generating Plant

JOHN CHARLES NEMETH
Law Engineering Testing Company

In September, 1975 four seagrass bed zones occurring in a thermally affected area of West Bay near Panama City, Florida were mapped and characterized by quantitatively measuring the standing crop biomass of seagrass species present. In addition to dry weight biomass (g/m², 75C) of seagrasses, substrate quality, water depth, and water quality conditions observed during the study period are also presented.

(208)

The Fishes of the Northern Rim of the DeSoto Canyon

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The DeSoto Canyon is the major geologic feature of the Gulf of Mexico and extends northward to within 32 km of the Florida panhandle. The steep northern slope of the Canyon is studded with coral, shell and sponge bottom, and its most dominant feature is a 5 m coral ledge, located in about 40 m.

The fish fauna of this area is in sharp contrast to that of adjacent waters of comparable depths. Collections include nearly 100 species, of more than 50 genera. These are mostly tropical forms and indicate that the northern Canyon is similar to the Florida Middle Grounds and the Texas Flower Garden Bank. Thus, a third tropical outpost is recognized in the northern Gulf of Mexico.

(154)

Ion Levels in Plasma and Urine, and Urine Volume in Channel Catfish, *Ictalurus punctatus*, Transferred from Freshwater to Various Environmental Salinities

VIRGINIA M. NORTON AND KENNETH B. DAVIS
Memphis State University

Plasma sodium and chloride concentrations of channel catfish held at 23 ± 2 C, and transferred from freshwater to saltwater increased when the environmental ion concentration exceeded normal freshwater plasma ion levels. Acclimation in saltwater which was hyperionic (Na = 149, Cl = 145 mEq/l) to the normal plasma ions (Na = 137, Cl = 115) of freshwater fish required 15 days; 3 days were required for acclimation in a medium which was isonatremic and hyperchloremic, but in isoionic medium no change in plasma ions occurred. Handling did not affect plasma sodium and chloride of freshwater fish.

Fish acclimated 16 weeks in isoionic saltwater responded no differently when exposed to hyperionic NaCl than fish transferred directly from freshwater to the hyperionic saltwater. A significant decrease ($p < 0.001$) of plasma sodium and chloride occurred in all saltwater to freshwater transfers.

Fish acclimated 7 weeks to a hyperionic medium produced small amounts of urine slightly hypoionic to plasma. Fish in freshwater produced a large volume of dilute urine. Urine osmolality to plasma osmolality ratios were 0.85 and 0.07 respectively.

(24)

Crawfishes of the Atchafalaya Basin, Louisiana, With Emphasis on Those Species of Commercial Importance

TIMOTHY P. O'BRIEN
Louisiana State University

A study of the crawfishes associated with the varied habitats of the Atchafalaya Basin (the largest natural producer of crawfish in the United States) was conducted from September, 1973 through July, 1975. Crawfishes were collected by means of funnel traps (3" mesh hardware cloth), seines and dip net. Species composition of Atchafalaya crawfishes and life history information of the commercially important species are presented. Four thousand six hundred and six specimens representing seven species were found to occur within the Basin. In order of decreasing abundance they were: *Procambarus clarkii*, *Procambarus acutus acutus*, *Orconectes lancifer*, *Cambarellus shufeldtii*, *Cambarellus puer*, *Orconectes palmeri longimanus*, and *Cambarus diogenes diogenes*. Cypress-tupelo gum swamps, sluggish flowing bayous, willow swamps, lakes and lake shores, man-made canals, floodway protection levees and riverine habitats were found to be representative crawfish habitats. Habitat preferences have been determined for commercially important species.

(353)

The Yellow Light — Absorbing Pigment, p^Y , of the *Protosiphon* Photoreversible Pigment System

JOSEPH C. O'KELLEY AND JOHN K. HARDMAN
The University of Alabama

The photoreceptor for yellow light in the photoreversible pigment system of *Protosiphon botryoides* Klebs is a protein with molecular weight of about 8900 daltons. A colorless form of this molecule appears to contribute one or more electrons needed for a blue (430 nm) light photo-reduction of flavin, concomitantly becoming oxidized and transformed into a blue-colored form that absorbs yellow light (580 nm). This form of the molecule can be reduced by mercaptoethanol to the colorless state. A moiety with properties of a nucleotide can be separated from the polypeptide portion of this molecule by electrophoresis. After electrophoresis it can be added back to restore photobiological activity lost when the components are separated.

(73)

Modified Ivy Bleeding Time in Male and Female College Students Before and After Submaximal Exercise

DONALD A. OLEWINE, JOHN A. RODRIQUEZ-FEO,
PATRICK K. MCSHANE AND H. WAYNE SMITH
Georgia Southern College

Numerous studies have reported increases in both the coagulability and the fibrinolytic activity of blood following exercise. Such data are based on *in vitro* tests which may not measure conditions *in vivo*. Bleeding time has usually been reported to increase after exercise. Such studies are complicated by differences in the duration and intensity of exercise as well as in the physical condition of the subjects. Using a semiautomatic device two scratches 5 mm long and 1 mm deep were made on the forearm while maintaining a cuff pressure of 80 mm Hg. Every 30 seconds torn filter paper was placed near the scratch until bleeding could no longer be detected. All subjects performed the Balke Step Test which was terminated when the heart rate reached 180 beats/min. From exercise data maximal oxygen consumption was estimated. In males (N = 20) bleeding time (min.) was 3.8 ± 0.5 at rest and 4.9 ± 0.6 after exercise ($\bar{x} \pm S.E.$). In females (N = 17) bleeding time (min.) was 4.5 ± 0.6 at rest and 4.9 ± 0.4 after exercise ($\bar{x} \pm S.E.$). Estimated maximal oxygen consumption (ml./kg./min.) was 36.2 ± 1.1 in males and 31.8 ± 0.9 in females ($\bar{x} \pm S.E.$).

(187)

Chemosterilization of *Dermacentor variabilis*
(Acari: Parasitiformes: Ixodidae): Effects
of Metepa on Selected Developmental
Stages of Nymphs

RICHARD L. OSBURN AND JAMES H. OLIVER, JR.
Georgia Southern College

Nymphal American dog ticks were treated with three different concentrations of metepa, an alkylating agent, at four developmental stages. Concentrations employed were 1 µg/µl, 3 µg/µl, 5 µg/µl and a control. Unfed nymphs (N-1) were treated, allowed to feed and monitored for ecdysis. No ecdysis occurred in experimental N-1 ticks at any level. Nymphs were also treated 1 day postengorgement (N-2), 7 days postengorgement (N-3) and 14 days postengorgement (N-4). The N-2 experiments failed to ecdyse at any level, while N-3 and N-4 groups successfully ecdysed at all 3 treatment levels. Matings of all possible combinations of adults resulting from ecdysis in the N-3 and N-4 groups produced normal egg masses and normal hatchability.

(314)

A Biological Study of *Littoridina Sphinctostoma*
(Gastropoda: Hydrobiidae) in Lake
Pontchartrain, New Orleans, Louisiana

ANNA PAINE
University of New Orleans

An anatomical study, including the reproductive and digestive systems, was made on organisms collected from February, 1975 through January, 1976. Total length and width, number or whorls, sex, and observance of parasites was made. Histograms were compiled from the results. Collections of *Littoridina* were made bimonthly and biological associations as well as water chemistries were noted.

(128)

Grass Cuticles: A New Paleoecological
Tool for East African Lakes

PATRICIA G. PALMER
Louisburg College

Reconstruction of past vegetation in grassy environments of tropical Africa is hindered by the indistinguishability of grass pollen grains. For these regions, it is necessary to use other fossil material (e.g. grass leaf fragments) to obtain additional paleoecological data. Since many core samples from East African lakes are rich in cuticular fragments of grasses, the identification of these fragments can provide paleobotanical information to complement pollen studies. Light microscopy and scanning electron microscopy are used to identify fossil cuticles to the level of subfamily, tribe or genus. This new technique provides a much-needed source of information for reconstructing the past vegetation and past climate of regions where grasses are important elements in the fossil record.

(70)

The Effects of Clay Ingestion (Geophagia)
on Pregnant Rats

E. CHARLENE PATTERSON AND D. J. STASZAK
Georgia College

Geophagia, in the form of clay-eating, is often observed during pregnancy in the human population. The intent of this study was to determine the effects of clay ingestion on pregnant laboratory rats. Thirty-six Sprague-Dawley female rats were divided into three groups: control, kaolin diet, and iron-supplemented kaolin diet. The animals fed the kaolin diet exhibited definite reductions in the hemoglobin level and red blood cell counts, thus indicating the production of anemia. In contrast, the animals fed the iron-supplemented kaolin diet maintained hemoglobin levels and red blood cell counts within the normal range and comparable to the levels of the control group. There was no evidence of any growth depression nor unusual weight gain, prematurity, nor increased gestation period in the experimental animals. There was a significant reduction in the birth weight of the pups born to kaolin fed animals as compared to the other groups.

(235)

Passive Transfer of Immunity to
Hymenolepis nana (Cestoidea: Cyclophyllidea)

SHARON PATTON
University of Kentucky

Blood was collected from donor white mice 14 days after an initial infection with *H. nana* eggs. Fewer cysticercoids developed in mice that were intraperitoneally injected with 1 ml amounts of this serum immediately prior to ingestion of 10,000 eggs than in controls injected with normal serum before egg ingestion. The protective effect, lasting less than six hours, was not prolonged by increasing the amount of serum injected. The injection of serum collected after additional egg challenges extended the protective period to 35 days. Mice intraperitoneally injected with 1.4×10^8 spleen cells collected 14 days after an initial infection with eggs, first showed a reduction in the number of cysticercoids when there was a 24 hour interval between cell injection and egg inoculation; the reduction was marked at three days and remained for 10 days. The injection of spleen cells collected after two egg challenges produced similar results. Spleen cells from infected mice were frozen and thawed before injection. These cells were not effective against egg challenge.

(197)

Leaf Degradation and the Effect of Power
Plant Discharge on Leaf Decomposition

ROBERT W. PAUL, JR. AND E. F. BENFIELD
Virginia Polytechnic Institute and State University

The biological decomposition of sycamore (*Platanus occidentalis*) leaves placed in the New River (Giles County, Virginia) was examined. Seasonal and 30 day degradation rates and the effect of a fossil fuel power plant effluent on the decomposition process in a large

riverine system were assessed. Degradation, on the basis of percent weight loss, was essentially complete after 90 days, while leaf processing under the influence of the effluent during the first 30 days was reduced. Although leaf processing rates were highly variable, it is probable that microbial and physical action is the dominant force in leaf degradation with macroinvertebrates playing a minor role in the decomposition of leaves in large river systems.

(7)

The Structure of a Macroinvertebrate Community in a Virginia Bog

ROBERT W. PAUL, JR., EDWIN M. EUDALY,
DAVID L. KUHN, AND WILLIAM F. RUSKA, JR.

Virginia Polytechnic Institute and State University

The macroinvertebrate community structure of Big Soft Sleep Bog (Giles County, Virginia) was examined to compare the fauna of a woodland tributary to the fauna of a bog stream, and to compare spring community structure with summer community structure values obtained in previous studies. Four stations within the influence of the bog and one woodland tributary station were sampled. Except in the case of pH, water chemistry results showed no significant difference between bog and woodland streams. The bog stream exhibited a gradual transition in substrate composition from sand to small boulders while the woodland stream was characterized by gravel and heavy detritus input. At all stations community structure demonstrated a marked tendency toward "shredder" species, however, the most prominent leaf degraders occurred in the woodland stream. No significant difference was observed between spring and summer macroinvertebrate assemblages.

(103)

The Effects of a Heated Power Plant Discharge on a Macrobenthic Community

ROBERT W. PAUL, JR. AND JAMES H. WILSON
Virginia Polytechnic Institute and State University

In order to evaluate the effects of a heated waste water discharge on a benthic macroinvertebrate community, a one year study was conducted on the New and East Rivers in the vicinity of Appalachian Power Company's Glen Lyn fossil fuel generating plant in southwestern Virginia. Six stations were sampled monthly with D-frame aquatic dip nets and a diversity index was used to analyze the data. Changes in community structure were also examined by means of presence-absence comparisons. Results indicate that in the summer months when water temperatures approach 34°C (an increase of 8°C over ambient) where there is an overall reduction in community diversity in the heated discharge. Cool water organisms such as mayflies and stoneflies become rare or are absent while there is an increase in the percent composition of chironomid larvae, compared to the reference stations. The heated discharge seems to have little or no effect at other times of the year.

(223)

Loss of Nutrients from Leaf Litterfall as Affected by Exposure to Rainfall

JOHN PEARSON AND GEORGE T. WEAVER
Southern Illinois University at Carbondale

Freshly fallen leaf litter was collected and placed in baskets exposed to natural rainfall over a four-week period (October-November) in an oak-hickory forest of southwestern Illinois (Ozark Hills section, Union County). Samples from each of six plots (three north slope, three south slope) were collected weekly and analyzed for contents of several macro- and micronutrients to determine the magnitude of nutrient loss due to leaching by rainwater. This may allow calculation of correction factors for nutrient losses from litter exposed to leaching processes during intervals between collections of litterfall from sampling baskets.

(284)

Observations on the Genus *Macbrideola* in Georgia (Myxomycetes)

LEVESTER PENDERGRASS AND LAFAYETTE FREDERICK
Atlanta University

IVAN L. ROTH
University of Georgia

Macbrideola, a small genus of myxomycetes, consisting of 5 species, is characterized by its minute sporangia with scanty capillitia arising from the tip of the columella. The species are known primarily from moist chamber culture of living tree bark and are considered to be restricted in distribution. In our more than five-year study of Georgia myxomycetes from bark of living trees, growing in the environs of metropolitan Atlanta, all 5 species of *Macbrideola* have been found. This is the first report of species of *Macbrideola* in Georgia and the second report of two of the species in this country. Three of the species, viz., *M. cornea*, *M. decapillata*, and *M. scintillans* have appeared once on bark of *Quercus falcata*, *Q. stellata*, and *Q. alba*, respectively. *M. martinii* has been found once on bark of *Acer negundo* and *Carya ovata*, and *M. synsporos* has appeared occasionally on bark of *Carya ovata*, *Liquidambar styraciflua*, and *Quercus stellata*. To further delineate the nature of morphological differences between species in the genus, scanning electron microscope studies have been conducted.

(58)

Nitrogen and Phosphorus as Potential Limiting Factors of Net-Productivity in an Old-Field Plant Community

JOHN E. PINDER, III
Savannah River Ecology Laboratory

To test the hypothesis that nitrogen and phosphorus are limiting factors for old-field plant community productivity sodium nitrate and superphosphate fertilizers were hand broadcasted onto small plots of old-field vegetation dominated by perennial-grasses of the genera *Andropogon*, *Leptoloma* and *Panicum*. Fertilizers were ap-

plied weekly from 9 July 1971 to 4 September 1971. The addition of nitrogen increased the 11 September 1971 standing crops from 166.8 g·m⁻² to 244.8 g·m⁻², whereas the addition of phosphorus did not have a measurable effect on plant growth. Nitrogen and phosphorus applied in conjunction did not increase plant growth more than the application of only nitrogen. Nitrogen addition did not cause a significant change in potassium, calcium or magnesium concentrations in the vegetation. However, phosphorus concentrations were significantly lower on plots receiving nitrogen. The reduced phosphorus concentrations suggest that phosphorus may become limiting if sufficient nitrogen is applied.

(49)

Stimulatory Effects of an Herbivorous Fish,
Tilapia aurea (Steindachner) on the
Productivity of the Phytoplankton Community
in Fertilized Microcosms

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*Institute of Marine Sciences,
University of North Carolina*

Tilapia aurea, a phytoplankton feeding fish, was tested for its effect on the productivity of the phytoplankton community of fertilized, artificial pools, and its ability to limit blue-green algae. The study was conducted over an eight-week period at the Fisheries Research Unit of Auburn University. Four of eight 0.0007 ha plastic pools with earthen bottoms were each stocked with 20 *T. aurea* (34,600 fish/ha). All microcosms received 20 µg/ha 20-20-5 fertilizer twice a month. Chlorophyll *a* determinations were made weekly. Average net production in the presence of *T. aurea* was four times greater than in unstocked pools. This increase was attributed to more rapid nutrient cycling and the elimination of competing macrophytes by *T. aurea*. Blue-green algae growth was reduced. Zooplankton production appears to have been stimulated, presumably by increased particulate organic matter in the stocked pools. These effects were also produced by *Cyprinus carpio*, *Dorosoma petenense* and *Lepomis macrochirus* in fertilized microcosms.

(179)

Yellowwood (*Cladrastis lutea*, Fabaceae): an
Example of a Nationally Threatened Species

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Western Carolina University

Yellowwood, a tree of the pea family, is distributed sporadically across the ancient Ozark-Appalachian landmass from Oklahoma north to Indiana, east to North Carolina, and south to Alabama. It is a relict species dating from the Eocene Period and is presently restricted to river bluffs and cove forests. It is poorly competitive with modern forest species and is able to survive in climax forests primarily by vegetative reproduction. Its seed production is irregular and most populations indicate poor seedling establishment. Forest managers generally consider it a "weedy" timber species and remove it from timber lands. Continuing the exploitation of the saplings for nursery stock further threatens the continuation of natural populations.

(203)

Colonization of Artificial Substrates by
Protozoa in a Small Cave Stream; Tawney's
Cave, Giles County, Virginia

JAMES L. PLAFKIN
Virginia Polytechnic Institute and State University

A small stream running through Tawney's Cave, Giles County, Virginia, was chosen as the site for the study of protozoan colonization within a physically restrictive though comparatively constant environment. Between December 14, 1974 and June 16, 1975, 183 identical polyurethane artificial substrates anchored along the stream bottom were exposed to various periods of colonization by protozoa. Substrates were considered in five unique series according to date of initial placement and position within the stream. Colonization curves, illustrating the accumulation of species per substrate with time, show strong similarity between series and indicate that seasonal fluctuations in stream flow have little effect on this colonization process. In contrast to several previous studies, stable equilibrium numbers were never established in any of the five series. Significant diminution of species numbers over extended exposure periods correlates well with the accumulation of inorganic sediment.

(226)

Geo-botanic Ecosystems:
A New Map of Georgia

GAYTHER L. PLUMMER
University of Georgia

Satellite imagery, direct photointerpretation and extensive ground travel were combined to produce a multi-colored mosaic at a scale of 1:500,000. Twenty-three vegetation patterns are illustrated, including one for croplands, in relation to geomorphological features of the terrain. The map accentuates outstanding macroecosystems. Ecosystems are distinguished by the variability observed in subtle images that results from reflectance-absorption spectra of vegetation as well as wet, or dry, soils. Outstanding features include ancient shoreline habitats, pre-Pleistocene embayments, buried limestone areas, several kinds of sand hills, various faults, the Copperhill impact, some undetermined landforms, perhaps an ancient mountain range, and responses of vegetation to mountain environments. Agri-ecosystems responded to geomorphological patterns, as did silvicultural regions, particularly when the federal acreage reserve program was functioning—1957-1974. Applications and benefits of this map will be discussed relative to long-term developments.

(206)

Planktonic Responses to an Industrial Effluent

GLORIA R. POLLARD, R. A. POLLARD
AND H. L. STIREWALT
Augusta College

Plankton samples were obtained above and below an industrial effluent on the Savannah River during the summer of 1975. Six samples from which thirty-six subsamples were taken provided the data for qualitative and quantitative comparisons. Application of Student's t-test and the Mann-Whitney U-test demonstrated significantly higher populations of algae at the below station. Palmer's algal-pollution index allows an interpretation of the results which supports an increase in the number of rotifers.

(42)

Observations on Oviposition and Incubation of the Alligator Snapping Turtle, *Macrolemys temminki* (Chelydridae), in Georgia

VERNON N. POWDERS
Georgia Southwestern College

Observations were made on one female *Macrolemys temminki* as she deposited eggs on the bank of the Muckalee Creek, Sumter County, Georgia. The female (13.5 kg.) was discovered at 0930 hr. (EST) in the last phases of nest preparation. Egg-laying commenced circa 1000 hr. and was completed by 1300 hr. Nine eggs were deposited in the nest. The date was 3 June 1975. The completed nest was excavated and eggs and nest were measured. One egg was taken to the laboratory and the other eggs were replaced in the nest. The laboratory egg failed to develop. The nest site was visited twice during September (15 and 25) and appeared undisturbed. On 22 October 1975 an escape tunnel was noted. The nest was excavated and three eggs were found to be dehydrated with no apparent development having occurred. Two eggs contained full term fetuses; however, the fetuses were dead. Fragments of the three remaining egg shells were discovered thereby leading to the belief that three turtles successfully hatched and escaped from the nest. A discussion of incubation time, behavior and general biology of the turtle will be presented.

(137)

Flux of Oceanic Derived Cl^- and Ca^{++} in a North Carolina Barrier Island Maritime Forest

C. EDWARD PROFFITT AND VINCENT J. BELLIS
East Carolina University

The flux of Cl^- and Ca^{++} through a maritime forest has been monitored since October, 1974. Parameters being measured are windborn salt spray, rainfall, throughfall, stemflow, humus compartment, soil compartment, standing water and ground water. Collecting stations have been installed along a transect from Atlantic Ocean to Bogue Sound. A Cl^- and Ca^{++} budget will be developed from this data.

Meteorological inputs, the major source of the system's Cl^- and Ca^{++} , have been greatest immediately behind the foredune ($4.49 \text{ gCl}^- \text{ m}^{-2} \text{ day}^{-1}$ and $0.19 \text{ gCa}^{++} \text{ m}^{-2} \text{ day}^{-1}$). Comparable mean values for a station 366 m back from the ocean were $0.041 \text{ gCl}^- \text{ m}^{-2} \text{ day}^{-1}$ and $0.006 \text{ gCa}^{++} \text{ m}^{-2} \text{ day}^{-1}$. Atmospheric salt inputs to date along this South facing beach have been slightly greater during summer months. Humus is a major storage compartment for the ions and leaching through the soil is the major output of Cl^- and Ca^{++} from the system.

(110)

The Effect of Acid Mine Drainage on Zooplankton Communities

MARSHA ANN RADER AND GEORGE M. SIMMONS, JR.
Virginia Polytechnic Institute and State University

Lake Anna is a 13,000 acre reservoir and lagoon complex located near Mineral, Virginia. Contrary Creek, which drains into the reservoir, is particularly significant in the zooplankton studies of the complex. For almost 100 years Contrary Creek has been subjected to extensive acid mine drainage from old pyrite mines. Chemical analyses have shown high concentrations of heavy metals, particularly iron, zinc, and copper, in the Contrary Creek arm of the reservoir. Analysis of zooplankton collections made from Contrary Creek showed a lower density and diversity in the zooplankton species, when compared with the zooplankton communities in other parts of the lake not affected by the acid mine drainage. Even though all taxonomic groups of zooplankters were affected, rotifers showed the greatest susceptibility to the conditions in the Contrary Creek arm. — *This research was supported by the Virginia Electric and Power Company.*

(131)

Cation Analysis of Throughfall, Ground Water, and Soil From Two Forested Floodplains

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AND J. DUVALL HAY
Emory University

Samples of canopy throughfall, ground water, and soil were collected from upstream-downstream floodplains along Lower Three Runs Creek, near Barnwell S.C., in the upper coastal plain. Concentrations of Na^+ , K^+ , Ca^{++} , Mg^{++} , and Zn^{++} were determined in 18 months of ground water collections, in 12 months of precipitation, and on 200 soil samples. The upstream site, Patterson Mill, is a Black Gum — Ash forest while Martin-Millette, 15 km downstream, is a Cypress forest. Throughfall cation influx (kg/ha/yr) was similar between sites for Na^+ (3.8-4.7), Ca^{++} (10.4-12.7), and Mg^{++} (4.6-3.6). Potassium influx upstream was 19 kg/ha/yr as compared to 27 kg/ha/yr downstream. In addition to the potassium difference, throughfall elemental flux at both sites showed definite seasonal trends. There were differences in ground water cation concentrations between sites with Na^+ and Zn^{++} concentrations greater upstream while K^+ , Ca^{++} , and Mg^{++} concentrations were greater downstream. Exchangeable soil cation concentrations differed between sites with 2-4 times greater concentrations downstream.

(135)

Spruce Fir Invasion of Andrews Bald

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The University of the South

Andrews Bald, located in the Great Smoky Mountains National Park has long been one of the most popular of the Southern Appalachian grass balds. It has been an attraction for tourists as well as botanists such as Wells, Mark, Gilbert, Bruhn, and Radford. With the establishment of the park and the elimination of grazing in 1931, there has been a very gradual invasion of the dominant climax species, spruce (*Picea rubens* Sarg.) and fir (*Abies fraseri* (Pursh) Poir.). This invasion is a threat to the bald vegetation unless the park management can manipulate the forces of plant succession. This report deals with a study of invasion rates of spruce and fir. It also discusses techniques for mapping, and presents a new theory of the origin of grass balds.—*This study was supported by the National Park Service.*

(144)

Floristics of Relatively Pure Stands of *Planera aquatica* Walter ex. J. F. Gmelin (Ulmaceae)

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University of South Carolina

Six stands of water elm, *Planera aquatica*, in the Congaree River floodplain of South Carolina, varying in size from 7000 m.² to 400 m.², were sampled with 44 ten-by-ten meter quadrats (for trees), 44 five-by-five meter quadrats (for shrubs and vines), and 88 one-by-one meter quadrats (for forbs). *Planera aquatica*, the expected dominant, had an importance value (I.V.) of 175.9 and a frequency of 100 percent. *Fraxinus americana* was *Planera's* most important associate (I.V. = 51.0) and was the only other species found in more than 60 percent of the quadrats. Shrub cover was usually sparse and *F. americana* was the most important shrub species. Vine and herbaceous vegetation were very sparse. Since *Planera* requires an "open" canopy for best development, these areas probably develop only after its usual shade-producing associates (*Nyssa aquatica*, *Taxodium distichum* and *Populus heterophylla*) have been removed by such means as lumbering.

(200)

The Ecology of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina

S. E. REED, G. J. DAVIS AND M. M. BRINSON

East Carolina University

The ecology of the submerged vascular plants and filamentous algae of the Pamlico River estuary, N.C. was studied from July, 1973, through August, 1974. Line transects and random quadrats were used to sample biomass and community species composition. Benthic aquatic macrophytes were generally restricted to the shallow, sandy littoral of the upper oligo-mesohaline re-

gions of the estuary. Community composition was correlated with the salinity gradient. Most of the biomass was concentrated at depths around one meter. High turbidity apparently limited growth at greater depths while growth in shallower areas may have been limited by occasional exposure of the substrate during wind tides. A direct relationship was found between water temperature and the biomass of most major species. Maximum biomass occurred during the months of September and October with minimal biomass in February. Biomass and growth patterns were correlated with fetch.—*This research was supported in part by a grant from the Water Resources Research Institute of the University of North Carolina.*

(172)

Rare, Threatened and Endangered Species Data and Computer Information Systems Developed by the Corps of Engineers, Waterways Experiment Station

ANTHONY REKAS

Corps of Engineers Waterways Experiment Station

(No abstract received)

(345)

Spectrophotofluorometric Analysis of Aniline Blue (w.s.) Specificity: Is Callose a Glycoprotein?

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Virginia Commonwealth University

The fluorochrome aniline blue, w.s., is used to detect callose in plant cells. Early analysis of callose indicated that it is a β , 1-3 glucan; later, callose was found to exist in two forms and recent experiments have suggested that callose may be a glycoprotein. In order to determine if aniline blue complexes with β , 1-3 glucan, the dye was first subjected to spectrophotofluorometric analysis. First, aniline blue, alone, was found to emit fluorescence at 445 nm (± 5) when excited at 315 nm. No increase in the size of the fluorescence peak was observed when aniline blue was mixed with laminarin, a β , 1-3 glucan. Significant increases in peak height were observed when aniline blue was mixed with bovine serum albumin. Denaturation and pronase treatment of BSA, however, reduced the emission peak below that of the aniline blue alone. The results indicate that aniline blue does not complex with the β , 1-3 glucan, laminarin, but does complex with a protein, as indicated by its reaction with BSA. This suggests that callose is a glycoprotein.

(258)

Aspects of the Life History and Ecology
of *Procambarus alleni* in the Everglades
(Crustacea: Decapoda: Astacidea)

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University of Miami and

Central and Southern Florida Flood Control District

Studies in three South Florida habitats have elucidated major features of the life history of the crayfish *Procambarus alleni*. Eggs are laid in burrows from March through May, with a peak in April. A minor reproductive peak also occurs from October through December. The number of eggs laid per female is proportional to carapace length. Young are hatched in April and May and normally molt through stage III in the burrows. Rapid growth begins with the rise of the water table above the surface in May to August. Maturity is usually reached by the first winter, at a variable size of 15-30 mm carapace length. Maximum size is about 45 mm carapace length. Average size varies with population and habitat and ranged from 20-30 mm carapace length at the end of the growing season. Hydroperiod and food availability appear to be major factors affecting growth rates.

(340)

Preliminary Comparative Studies on Haustorial
Development and Seedling Morphology in
Witchweed (*Striga asiatica*) and Hemp
Broomrape (*Orobanche ramosa*)
(Angiospermae; Schrophulariales)

STEVEN D. RICH

Old Dominion University

Ten day old seedlings were studied with standard methods of light microscopy to determine early stages in the development of the primary haustorium. Features common to both include a lack of root hairs and root cap; other aspects of anatomy are similar to typical dicot roots. Witchweed seedlings possess druses while hemp broomrape seedlings do not. The first indication of development of the primary haustorium is a swelling of apical parenchyma cells, with unusually large nuclei, followed by attachment and penetration of host tissue. In seedlings grown in culture without hosts, using synthetic germination stimulants, the haustorium lacks xylem. Xylem apparently develops only after attachment to a suitable host.

(262)

Mortality of Atlantic Menhaden (*Brevoortia
tyrannus*) Exposed to Chronic Hypoxia

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AND DENNIS T. BURTON

Academy of Natural Sciences of Philadelphia

Atlantic menhaden (80-200 mm total length) acclimated to 27-28°C and approximately 6.0 mg O₂l⁻¹ were exposed to dissolved oxygen concentrations of 0.75, 1.0, 1.25 and 1.5 mg O₂l⁻¹ for 96 hours. Oxygen concen-

trations were reduced from 6.0 mg O₂l⁻¹ to the desired level at a rate of 0.25 mg O₂l⁻¹hr⁻¹. A vacuum degassing system was used rather than nitrogen displacement techniques to avoid possible gas bubble disease. Preliminary analysis of the data indicate that the 96-hour LC₅₀ (i.e. the concentration at which 50% die) occurs at approximately 1.2 mg O₂l⁻¹.

(141)

Forest Composition of a Mixed Mesophytic
Forest in Laurel County, Kentucky

MARGARET E. RINGLAND

Western Kentucky University

Study plots in the Rock Creek Natural Area showed the vegetation to be typical of gorge systems in the Cumberland Plateau. *Tsuga canadensis* and *Rhododendron maximum* were the dominant species. *Tsuga* average 69.6 trees per hectare with the understory of *Rhododendron* represented by 184,000 stems per hectare. In a total plot area of 1.25 hectares, total basal area of the trees (boles greater than 10 cm dbh) was 28.6 square meters. Comparison of the different size classes of trees showed the system to be a stable climax community.

(34)

The Relationship Between Surface Suspended
Sediment and the Total Suspended Sediment
in a Reservoir Water Column

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Studies were made on four northern Mississippi reservoirs to determine the relationship between the concentration of suspended sediment in the surface water and the total amount of suspended sediment in a one square meter vertical column of reservoir water. The total amount of suspended sediment in the water column was estimated by multiplying the concentration of suspended sediment in surface water by the volume of water in the water column. A better estimate of the total amount of suspended sediment in the water column was determined by an integration using measurements of suspended sediment made at 1 to 3 meters intervals through the total depth of the water column. Regression analyses showed the relationship between the surface estimated suspended sediment and the more refined estimate of the total suspended sediment in the water column to be highly significant with a correlation coefficient of 0.94. These studies indicate that the concentration of suspended sediment at the surface can be used to estimate total suspended sediment in the underlying vertical water column.

(221)

Size-class Structure of a Bottomland Hardwood Forest in Southern Illinois

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Diameter distributions were analyzed in a disturbed and relatively undisturbed portion of a mature floodplain forest in Southern Illinois. Data from over 2500 trees in each area were used to calculate a negative power curve regression of frequency vs. diameter class. Coefficients of Determination of 89% and 82% were obtained for the disturbed and undisturbed portions, respectively. *Sassafras albidum*, *Ulmus rubra* and *Acer negundo* showed an all-aged distribution in the undisturbed area and a more even-aged pattern in the disturbed portion, while *Acer saccharum* was all-aged in both areas. This implies that regeneration of the three former taxa is different in the two areas. Results suggest that the Coefficient of Determination is not always an accurate index of the magnitude of past disturbance in the stand.

(234)

Biochemical Studies on a Mitochondrial Peroxidase from *Hymenolepis diminuta* (Cestoda)

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A mitochondrial peroxidase was observed in *Hymenolepis diminuta* using o-dianisidine as a hydrogen donor. The majority of peroxidase activity is recovered in mitochondria isolated by differential centrifugation; when isolated mitochondria are sonicated the majority of the peroxidase activity is found in the membranous fraction. Kinetic parameters, such as the effect of pH, substrate concentration, and inhibitors were studied; optimal storage conditions for the enzyme were also determined. The specificity of the peroxidase assay was assessed in order to rule out the presence of catalase, and peroxidase activity was demonstrated by other methods, as well. This study confirms previous cytochemical studies on the presence of a mitochondrial peroxidase. A model for the action of this peroxidase is proposed.

(207)

A Preliminary Survey of the Fishes of the Petit Jean River System, Arkansas

HENRY W. ROBISON

Southern State College

The Petit Jean River arises in extreme westcentral Arkansas on the northern slope of the Ouachita Mountains in the Interior Highlands and flows eastward into the Arkansas Valley to meet the Arkansas River. The present survey was initiated to determine the species composition, species diversity, and distribution of the fish fauna within the Petit Jean River system. Investigation of the system has revealed a diverse ichthyofauna of 76 species representing 17 families. New state distributional records are given. Several species which were previously

known from north-bank tributaries of the Arkansas River and as disjunct populations in the Ouachita River system, including *Etheostoma blennioides* and *E. zonale*, were discovered in the Petit Jean River system, thus extending their known ranges within Arkansas and filling in vital gaps in their state distributions for future zoogeographic studies.

(112)

Primary Production and Degradation Rates of Submergent and Emergent Macrophytes of the New River, Glen Lyn, Virginia

JOHN H. RODGERS, JR., KENNETH L. DICKSON,
AND JOHN CAIRNS, JR.

Virginia Polytechnic Institute and State University

Primary production was estimated by standing crop removal of *Elodea nuttallii* (Planch.) St. John, *Potamogeton crispus* L., *Heteranthera dubia* (Jaquin) MacM., *Podostemum ceratophyllum* Michaux, *Typha latifolia* L., and *Justicia americana* (L.) Vahl. Standing crop samples were sorted into roots, shoots, and fruits (when present). Fresh weights, dry weights, and ash-free dry weights were determined. Distributions were recorded and areas covered were estimated and mapped. Degradation rates were determined by placing known weights of each species in containers (polystyrene with 1 cm diameter holes) which were placed in the river and subsequently removed over time. Colonization of the decomposing plant materials by microorganisms was followed over time using ATP. *T. latifolia* was found to have the largest standing crop per unit area but had the slowest degradation rate of the macrophytes studied. *H. dubia* was intermediate in biomass per unit area but had a relatively rapid decomposition rate and apparently played a significant role in nutrient cycling in this system.

(33)

Laboratory and Field Studies of Sulfur-35 Sulfate Assimilation by Periphytic Organisms

JOHN H. RODGERS, JR., KENNETH L. DICKSON,
AND JOHN CAIRNS, JR.

Virginia Polytechnic Institute and State University

Organisms composing epilithophyton of the New River, Glen Lyn, Virginia, were cultured and studied to aid in interpretation of data obtained in field studies of *in situ* sulfur-35 sulfate assimilation. Since current or physical mixing played a large role in the apparent assimilation rates, light and dark chambers were designed which allowed changes in mixing to approximate site specific situations. Parallel field studies using inorganic carbon-14 revealed a fairly constant assimilation ratio (C:S) spatially as well as seasonally. The cellular carbon to sulfur ratios for periphytic organisms from the New River were less variable than the assimilation ratio. In the laboratory under dark conditions, cultures of algae grown on an inorganic medium took up less than 1% of the sulfate as was assimilated in the light. No significant difference was found between sulfate assimilation in the light or in the dark by bacteria and some fungi that were investigated. Implications for partitioning functional autotrophic and heterotrophic periphyton biomass will be discussed.

(286)

Evaluation of the Germ Tube Test for the Separation of *Candida albicans* from *Candida stellatoidea*

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Western Kentucky University

Candida albicans is a pathogenic yeast frequently encountered in the medical laboratory. A survey taken by mail of 110 Kentucky hospital and clinical laboratories demonstrated considerable variations in the methods by which this organism is identified. The germ tube test is the most frequently used procedure. However, the methodology involved in this technique varies extensively. It is the purpose of this paper to establish through literature review and laboratory experimentation a standardized method by which the germ tube test can be performed quickly and accurately in the laboratory. Problems are often encountered in differentiation between *C. albicans* and the closely related *C. stellatoidea*. Comparisons are made for differentiation of these two taxa.

(331)

Effects of Amphetamine on *Drosophila melanogaster*

CAROL A. RUBIN, JAN DEBERRY,
CHARLES BIGGERS, AND PAUL DENCARNACAO
Memphis State University

Amphetamine was found to depress the rate of development of *Drosophila melanogaster* as a function of increasing percentage of drug. X^2 test showed significance at $<.001$. The flies were allowed to oviposit in five varying percentages of amphetamine solution and one control solution for a period of 120 hours and then transferred to six bottles each containing normal solution for another 120 hours. The rate of development of the larvae deposited in each solution was observed. The experiment was repeated and a double blind method of medium preparation was utilized. It was postulated that the depression of development was due to the effects of amphetamine on the endocrine system causing an abundance of neotenin secretion from the corpora allata.

(184)

Preliminary Study of Gametogenesis and Fertilization in *Cosmocercoides dunkae* Holl, 1928 (Phasmidia: Cosmocercioidea)

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College of Charleston

G. L. RONEY
The Citadel

Diploid and haploid Chromosome numbers were determined for males (nine, five and four) and females (ten, five) of *Cosmocercoides dunkae*. Oogonial nuclei in the vegetative zone contain ten diffuse chromatin masses. A short germinative zone follows, characterized by clumped, deeply staining chromosomes in primary oocyte nuclei. In the transition zone, diakinetid and prometaphase chromosomes form rings and 5 tetrads can be seen. Growth is completed in the growth zone. After sperm penetration, two meiotic divisions occur, resulting in one functional ovum with 5 chromosomes and two polar bodies. Male and female pronuclei unite to form a fusion nucleus prior to the first mitotic division.

In the male, spermatogonia in the vegetative zone contain nine diffuse chromatin masses. Primary spermatocytes in the germinative zone have a solid mass of clumped chromatin. In the transition zone, primary spermatocytes in metaphase I clearly contain 4 autosomal tetrads and one X dyad. Division results in secondary spermatocytes which contain either four or five distinct structures. Subsequent spermatids contain either 4 autosomes and one X or only four autosomes.

(344)

Development of Ruptured Petioles in Sublethal Hybrids of *Hibiscus* (Malvaceae)

GWEN RONEY, LORAN C. ANDERSON,
AND L. RAYMOND FOX
Florida State University

Crosses between *Hibiscus moscheutos* and F_1 's of *H. coccineus* X *H. militaris* result in lethal and sublethal progeny. Surviving sublethal progeny are variable in symptom expression (which appears to be environmentally modifiable). Symptoms include stunted growth, starch accumulation in leaves, foliar epinasty, and rupture of the petiole and leaf midvein. These symptoms are related to high sugar content of the leaves; the sublethals are apparently unable to translocate photosynthate. Petiolar rupture is preceded by excessive starch accumulation in the leaves followed by the proliferation of vascular tissue, primarily phloem, in the petioles. The adaxial petiolar lesion is usually followed by cork formation. In extreme cases, ruptured petioles are nearly flat rather than cylindrical; the vascular bundles are similarly flattened and amphicribal, and the phelloderm is extensive.

(104)

The Usefulness of Enzyme Inhibition for Screening Petroleum Effluents

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Virginia Polytechnic Institute and State University

The feasibility of using the inhibition of enzymes to monitor industrial effluents was investigated. The method has several of the criteria required for a valid bioassay system. The assay can be completed in a short time, usually less than 30 minutes. Materials required for the assay are of minimal cost, and the relative simplicity of the method makes it highly reproducible and widely useful.

Nine enzymes were tested for their sensitivity to an arbitrary reference mixture (ARM). The ARM was prepared in both soft water (50 ppm) and in 25% sea water (9 ppt). The inhibition by ARM was not altered by the diluent used. No inhibition was observed for malic dehydrogenase, mannosidase, amylase, isocitrate dehydrogenase or glutamic dehydrogenase. Those enzymes inhibited by 2X concentration of ARM glucose-6-phosphate dehydrogenase (47%), alkaline phosphatase (30%), 6-phosphogluconate dehydrogenase (22%), and cholinesterase (11%). The ARM was not a general inhibitor of all enzymes and it interacted differently with each enzyme. In comparing glucose-6-phosphate dehydrogenase inhibition to the 24 hr LC₅₀ values obtained for freshwater and marine organisms we can array them from most to least sensitive: invertebrates, enzymes, and fish. This research was supported by a contract from the American Petroleum Institute.

(325)

The Effects of Monochromatic Ultraviolet Light On Mammalian Cell-Herpes Virus Capacity

EDWARD L. RYAN AND THOMAS P. COOHILL
Western Kentucky University

The capacity of African Green Monkey Kidney Cells (CV-1) to host Herpes Simplex Type 1 after the host is irradiated with ultraviolet light was investigated. Cells were irradiated with monochromatic light (6nm half-bandwidth) in the region 230-380nm. An action spectrum for inactivation of capacity with increasing exposure of light to the cells is presented.

(212)

Preliminary Observation on the Fishes of the Atchafalaya Basin, Louisiana

DUGAN S. SABINS
Louisiana State University

A survey of the fishes of the Atchafalaya Basin, a dynamic subtropical lowland in South Central Louisiana, was initiated in Fall 1973 in conjunction with a larger limnological survey of the same area. Fishes have been collected monthly with an array of gear including seines, trammel nets, hoopnets, electric shocker, rotenone, dipnets and funnel traps. To date 85 species representing

25 families have been collected in Atchafalaya Basin waters. Combined with those species reported from the Basin during other studies, 108 species of fishes representing 32 families are now known to occur in the Basin between Simmesport and Morgan City. The most abundant species in seine collections so far are adults and juveniles of mosquitofish, silverside intergrades (*Menidia* sp.), bullhead minnow and pugnose minnow, and juveniles of bluegill, warmouth, and channel catfish. Frequently occurring species in trammel net catches are adults of the spotted gar, bowfin, smallmouth buffalo, black crappie and redear sunfish. Distributional patterns and food reproductive habits of the more important species are presented along with other unique aspects of the ichthyofauna.

(278)

Artificial Creation of a Fern Taxon, *Dryopteris atropalustris*

DAVID W. SAMPSON
Old Dominion University

Dryopteris atropalustris (Aspidiaceae) was first described by J. K. Small in 1938 based on a specimen collected in the Great Dismal Swamp. Since that time only a few specimens have been collected. This taxon is characterized by a wide frond outline, large pinnae, and reduced numbers of sori, which are usually restricted to the uppermost pinnae. In 1974, W. H. Wagner, Jr. suggested that *D. atropalustris* may be an aberrant form of the log fern, *Dryopteris celsa*, which is abundant in areas of the Dismal Swamp. During the growing season of 1975, fronds were removed from *D. celsa* in order to examine the morphology of the late formed fronds. The new (or "late") fronds in many cases resembled *D. atropalustris*. Other morphological and cytological data are presented.

(183)

Rediscovery of the Sharphead Darter, *Etheostoma acuticeps* Bailey, in the Lower Nolichucky River, Tennessee

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Etheostoma acuticeps Bailey, a little-known percid fish formerly known from the Holston and Nolichucky (Toe) river systems in North Carolina, Tennessee, and Virginia, was thought to be extinct following impoundment of South Holston Reservoir in the early 1950's. Recent discovery of a persistent but apparently very small population in the South Fork Holston River, Washington County, Virginia (Jenkins, et al., in press), resulted in its being suggested for "endangered" status by southeastern ichthyologists meeting in Tallahassee, Florida, in fall of 1974. The recent discovery of an apparently thriving population of the sharphead darter in at least ten river miles of the lower Nolichucky River, Tennessee, has allowed additional insights into its biology. Excessive siltation of the upper portion of the Nolichucky system in

North Carolina and Tennessee by mining activities in North Carolina are suggested as being responsible for the elimination of *E. acuticeps* and probably additional species of the subgenus *Nothonotus* from the upper Nolichucky River. Other *Nothonotus* sympatric with *E. acuticeps* in the lower Nolichucky are *E. canurum* (Cope), *E. rufilineatum* (Cope), and *E. maculatum vulneratum* (Cope). Reevaluation of the status of *E. acuticeps* from "endangered" to "threatened" is considered.

(51)

Status of Atlantic, *Acipenser oxyrhynchus*, and Shortnose, *A. brevirostrum*, Sturgeons in North Carolina (Pisces, Acipenseridae)

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Two sturgeons, the Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*), once inhabited North Carolina waters. *A. brevirostrum* was always considered rare or was unrecognized by fishermen. Today it is believed extinct in North Carolina. *A. oxyrhynchus*, prior to 1900, contributed at least 436,900 lbs (198,174 kg) valued at \$18,894 in 1880 to the commercial fishery. A shift in gear use, primarily from gill nets and seines (1880 to 1902), occurred to otter trawls and gill nets (since 1967). At the turn of the century specimens of 500 lb (225 kg) and 12 ft (3.7 m) were common, while today sizes rarely exceed 380 lb (172 kg) or 8.5 ft (2.6 m). Otter trawls and a single (Bogue Inlet) gill net fishery in Carteret County now account for most landings. Changes in estuarine habitats probably influenced the demise of the shortnose and reduced Atlantic sturgeon populations. Movements of *A. oxyrhynchus* are extensive. Both species have been placed on the national and IUCN rare and endangered species lists.

(41)

Trailing Mud Turtles, *Kinosternon subrubrum* (Chelonia: Kinosternidae), Around an East Alabama Farm Pond

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Union College

JAMES L. DOBIE
Auburn University

The overland travels of eastern mud turtles (*K. s. subrubrum*) moving around an east Alabama farm pond were studied from May 1973 to March 1974. Animals moving from the pond onto land were captured in pitfall traps along a drift fence and fitted with a specially designed thread trailing device which was used to monitor their wanderings beyond. Seventeen turtles (nine males and eight females) were trailed from 1-155 days each (average 28 days each) yielding charts and numerical

data on 476 individual daily terrestrial movements occurring throughout the annual cycle. Two phases of overland movement were detected: 1) a spring-summer phase beginning in early April and lasting through September and 2) a fall-winter phase beginning in early October and lasting until the end of March. During the spring-summer phase, distances traversed by females averaged about twice those of males and the trails laid by both sexes were characteristically convoluted, non-directional and searching in nature. During the fall-winter phase, distances moved averaged about the same for both sexes and trails laid were generally fairly straight and seemingly oriented. The nature of overland travels recorded during the spring and summer were due in part to females searching for nesting sites. Wandering movements with the purpose of finding food may have also contributed. The nature of overland travels recorded during the fall and winter seem to be clearly the result of movements to and from terrestrial hibernacula.

(124)

Reproduction of Walleye in Center Hill Reservoir, Tennessee

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Observations regarding the reproduction of walleye in Center Hill Reservoir were made during the winter and early spring of 1975. A definite pattern of migration to the headwaters of the reservoir was shown. The males arrived first and remained throughout the spawning season. Females made only brief visits to the spawning grounds before returning to the reservoir. Spawning behavior, water temperature, water fluctuations, and spawning substrates were recorded.

(339)

Comparison of Megasporogenesis in Species of *Oxalis*, *Ludwigia*, and *Cassia* Class: Angiospermae

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University of South Carolina at Aiken

Factors which potentially influence the consistent development of a specific tetrad into the functional megaspore are examined. Nuclear position and uneven cytoplasmic distribution during meiosis are considered and variations at the megasporocyte, dyad, and tetrad are noted. Selection of the three species was based on the diversity found in their megagametophyte development. *Oxalis* follows both monosporic and bisporic types of development, *Ludwigia* follows the monosporic Oenothera type, and *Cassia* follows the monosporic Polygonum type. Nuclear position in the megasporocyte was found to be random for *Oxalis* but more consistent for *Ludwigia* and *Cassia*. The polarized position of the megasporocyte nucleus result in uneven cytoplasmic distribution in the dyad. The functional megaspore of *Ludwigia* develops from the larger micropylar dyad cell while the functional megaspore in *Cassia* develops from the larger chalazal dyad member.

(251)

The Deep-Cape Fear Rivers of North Carolina as a Distributional Boundary for Millipeds

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The Cape Fear River and its major tributary, the Deep River, divide the eastern piedmont of North Carolina into northern and southern sections. Thirty-five millipede species inhabit this region, of which 17 occur primarily on one side of the divide. For only three species, however, is the disparity considered significant: *Andrognathus corticarius* Cope, *Apheloria tigana* Chamberlin, and *Sigmoria latior* (Brölemann). *Andrognathus corticarius*, common in the southern section, is known from only two localities north despite intensive efforts to find it. *Apheloria tigana* is common in both sections, but the populations display distinct differences in color pattern. South of the rivers, most individuals display middorsal spots on every segment, whereas north, the majority have spots on only the posteriormost segments. The nominate subspecies of *Sigmoria latior* is restricted to the northern section, whereas intergrade populations occur south. The Deep-Cape Fear Rivers appear to represent a distributional boundary for these three millipeds.

(4)

Effects of Light Intensities, Wavelengths, and Photoperiods on the Toxicity of Chromium to *Daphnia pulex* (Cladocera)

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Adult *Daphnia pulex* were exposed to chromium concentrations ranging from 0.018-0.180 ppm under light intensities of 0, 1.7, 3.5, 7.0, 14, 28, 55 and 1000 ft-c, photoperiods of 0, 8, 12, 16 and 24 hours of light, and blue, green and red wavelength ranges. Effects of these variables were evaluated using calculated 24, 48 and 72 hour LC₅₀ values. There was no significant trend in toxicity observed under the various light intensities. After 24 and 48 hrs chromium toxicity was increased at 16L:8D, 8L:16D and 24L:OD photoperiods and decreased at the remaining photoperiods. No differences in toxicity due to photoperiod was observed after 72 hours. Toxicity was significantly higher under the red than under the blue wavelengths. After 24 hours chromium toxicity was the least under green wavelengths but after 48 hours it was the most toxic.

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Effects of Short Term Temperature Shock on Growth, Molting, Reproduction and Survival of *Daphnia pulex* (Cladocera)

SARA R. SHERBERGER, ARTHUR L. BUIKEMA, JR.
AND JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University

In a simulated entrainment study, first instar *Daphnia pulex* were exposed to a 10°C temperature increase for 12 minutes and then returned to ambient temperature (20°C). Shocked and control *Daphnia* were placed in a growth chamber and monitored daily for their entire life cycle for survival, growth rate, molting rate, reproduction and for number, growth and survival of young. Results indicate that a higher proportion of shocked *D. pulex* died before reaching the fourth instar and they produced their first brood one instar earlier than did the controls. Under conditions of feeding stress shocked *Daphnia* produce fewer and weaker young. There were no differences in growth rate and molting rate between shocked and control animals.—This research is supported by a contract from the Energy Research and Development Administration.

(332)

The Meiotic Events of a Sterile *Lilium* Hybrid (*Lilium*, Angiospermae)

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The sterile *Lilium* hybrid *Lilium* × 'Black Beauty' is a hybrid of *Lilium henryi* (Baker) × *Lilium speciosum* var. *punctatum* (Thunberg.) and has irregular meiosis as shown in metaphase I. The diploid number is 12, but the number of bivalents in metaphase I is irregular varying from zero to five. In an effort to learn the cause of this irregularity of the metaphase I stage, a light and electron microscope study of prophase I was undertaken. The leptotene and zygotene stages were found to be normal with synaptonemal complexes found in late zygotene. Light microscopy revealed abnormalities in pairing beginning in early pachytene and continuing through meiosis. Electron microscopy indicated abnormalities in the synaptonemal complex beginning in mid-pachytene and continuing throughout prophase I. These findings indicate that the hybrid is desynaptic. These abnormalities are described and their significance is considered.

(29)

Population Growth and Productivity of
Corbicula manilensis (Philippi) in the Alta-
maha River, Georgia (Bivalvia: Corbiculidae)

JAMES B. SICKEL
Murray State University

Since its first discovery in the Altamaha River in 1971 to the fall of 1974, the Asiatic clam, *Corbicula manilensis*, has increased in numbers from a few individuals to more than 2500/m² in favorable habitats. The average clam grew to a length of 13mm in the first year and to 21mm after two years of growth. From April, 1973 to October, 1974 clam biomass from a 15m transect and measured as tissue dry weight increased from 2.18 g/m² to 39.1 g/m². Caloric content of clam tissue was 5.02 kcal/g dry weight. Shell length (L) provided a good estimate of tissue dry weight (W) using the regression equation $\log_{10}W = 3.18(\log_{10}L) - 2.26$ which had a correlation coefficient of 0.99 for 66 clams ranging in length from 4.5mm to 26mm. — *This work was supported in part by a research grant from Georgia Power Company and was conducted at Emory University.*

(111)

Time Until Death Bioassay Assessment of
Individual and Combined Effects of Low
pH and Aluminum Concentrations on
Three Stream Organisms

JEFFREY D. SINKS AND ERIC L. MORGAN
Tennessee Technological University

An acute toxicity bioassay measuring the lethal effects of five concentration ranges of aluminum on three organisms was performed under dynamic flow thru conditions. Frequently, in natural systems, a pH shift accompanies the introduction of aluminum. The pH level at which aluminum is soluble may be partially or totally responsible for the toxic effects noted. For this reason, this study, which used aluminum chloride as an aluminum source, was followed by an assay using HCl to alter the pH without toxic interference from the aluminum. The dilution water, of moderate hardness, was taken from a stream in KeKalb Co., Tennessee. The organisms used in this study, a species of planaria, a species of isopod and a larval species of salamander were all collected from this system. Water temperature was maintained in a range surrounding the temperature values of the stream. A correlation of the two studies and a discussion of the results will be presented. — *This work was supported by Aquatic Ecology Fund.*

(195)

Primary Production, Nutrient and Plant
Pigment Distributions for an "Offshore
Estuary" in Louisiana

FRED SKLAR, EUGENE TURNER AND JOHN DAY
Louisiana State University

Primary production was measured in continental shelf waters 15 km west of the Mississippi Delta using *in situ* and incubator C¹⁴ techniques developed by Stecman-Nielsen (1952). The location of the sampling sites allowed regular measurement of "green" coastal waters and "brown" bay water. Preliminary results indicate annual surface productivity rates of 170 gC m⁻³ for brown water and 106 gC m⁻³ for green water. The interface between the water masses had 14-89% higher productivity levels. Seasonally, the highest productivity was in May, 1975 (170 mgC m⁻² hr⁻¹) and the lowest in November, 1974 (11.5 mgC m⁻² hr⁻¹). There is an apparent correlation between chlorophyll a and productivity, with the highest concentration in May, 1975 (26.6 mg m⁻³) and the lowest in November, 1974 (0.75 mg m⁻³). Dissolved inorganic carbon, critical to the productivity calculations, varied from 10.0 gC m⁻³ to 33.5 gC m⁻³.

(81)

Osmoregulation in the Leeches *Macrobdella
ditetra* and *Haemopsis marmorata*

JAMES W. SMILEY AND ROY T. SAWYER
College of Charleston

The osmoregulatory capabilities of *M. ditetra* and *H. marmorata* at three different salinities (10%, 20% and 30% sea water; 100% sea water = 32.4‰) and at three different temperatures (0°C, 20°C and 35°C) were determined by measuring weight change after transfer from pond water. At all salinities osmoregulation was temperature dependent with the greatest weight losses occurring at 35°C and the least weight losses occurring at 0°C. For example, *M. ditetra* in 30% sea water at 35°C lost an average 32% of initial body weight after 240 minutes; but lost only 7.5% of initial weight after the same period of time at 0°C. These seemingly anomalous results may be explainable by the increased secretion of mucous which occurs at lower temperatures. The mucous may serve as an osmotic barrier, isolating the leech from its environment.

(322)

Kidney Fat as a Predictor of Body Condition
in White-tailed Deer (Cervidae)

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The kidney fat index (KFI) is positively correlated with the amount of body fat in white-tailed deer. The amount of body fat was determined by extraction from whole body homogenates. The KFI can be used to estimate the caloric reserves of individual deer using either whole body wet or dry weight. Percent body fat ranged from 3.4 to 18.1% of the whole body dry weight in the 40 deer analyzed. Use of this type of index for the body condition of other animals will be discussed.

(90)

The Vascular Flora of Long Island

RICHARD STALTER
St. John's University

The most complete book dealing with the flora of Long Island is that of Jelliffe (1899), who compiled a list of approximately 1350 different plants native to Long Island. The late Norman Taylor attempted to revise the work of Jelliffe. Dr. Taylor's unpublished work lists 1694 plants and along with his taxa is presently at the Bronx Botanical Gardens. The present work, based primarily on herbarium records at the Brooklyn Botanical Gardens and collections by the author, lists 1783 plants that are indigenous to or established on Long Island and represents the most complete work on the flora of Long Island. The list of species in the present work is currently stored on tape at the Computer Center at St. John's University. The data is housed in 18 files, each file varying in length from 12 to 26 units, depending upon the nature of the information.

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A New Form of *Phoxinus* (Cyprinidae) from the Upper Tennessee System

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University of Tennessee

Since the early 1960's a new *Phoxinus oreas*-like form of cyprinid has been known from the upper Tennessee River system. It occurs sporadically in small streams from the vicinity of Chattanooga northeastwardly through the headwaters of the Tennessee system. Taxonomic status and relationships with *Phoxinus oreas* (Cope) are discussed. Zoogeographical considerations are made concerning the new form in conjunction with *P. oreas* and *Phoxinus erythrogaster* (Rafinesque) including its probable origins and dispersal. Yet another undescribed form of *Phoxinus*, apparently quite unrelated to *P. oreas*-like forms, occurs in adjacent eastern Kentucky, and it is briefly discussed.

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Some Effects of Elevated Temperatures on the Golden Shiner, *Notemigonus crysoleucas* (Pisces: Cyprinidae)

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R. S. HARVEY
E. I. du Pont de Nemours and Co.
Savannah River Laboratory

Similar populations of the golden shiner were maintained in artificial pools for two years. One pool was supplied with unheated creek water and the other pool was supplied with heated creek water (5°C above ambient). Stomach analysis revealed that midges were the dominant food organisms. Application of Student's t-test and the Mann-Whitney U-test indicated no signifi-

cant differences in the number of organisms in the stomachs nor in the number of organisms comprising the macroinvertebrate community. The condition factor and the gonad weight for both sexes were depressed in the fish of the heated pool. Gonad volume was depressed among the females in the heated pool.—*The Savannah River Laboratory is operated by the E. I. du Pont de Nemours & Co. under Contract AT(07-2)-1 with ERDA.*

(165)

A Taxonomic Review of *Anthraenantia* (Gramineae)

HARRY J. STONE
Vanderbilt University

The genus *Anthraenantia* comprises two North American species distributed on the Atlantic and Gulf Coastal Plain from North Carolina to Texas. Largely allopatric by virtue of strong habitat preferences, the two species are occasionally represented in close proximity owing to local habitat intergradation. The latter, together with morphological similarities and the use of erroneous technical differences, have contributed to continued taxonomic confusion concerning the constituent elements. A survey of the morpho-geographical variation, based upon a wide representation of herbarium specimens, supplemented by field observations in critical areas, was made preliminary to a biosystematic study of the group. This survey resulted in the identification of a combination of criteria that circumscribe three taxa. *Anthraenantia rufa* (Ell.) Schult. comprises the first and *Anthraenantia villosa* (Michx.) Beauv. comprises the second and third of the taxa.

(71)

Comparative Solubilities and Electrophoresis of Arctic Microtine Hemoglobins

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Hemoglobin of *Microtus oeconomus*, *M. pennsylvanicus pullatus* and *M. xanthognathus* showed identical two band patterns on electrophoresis while *M. p. tananaensis* showed a single hemoglobin corresponding to the major band of the others. *Dicrostonyx rubricatus* and *D. stevensoni* exhibited identical patterns different from *Microtus* species. *Lemmus sibiricus* had a slow hemoglobin component with mobility different from the slow one of the *Microtus* species while the fast component appeared to be the same. Electrophoresis of individual globin chains indicated a large degree of similarity between the species studied, although there were significant differences in chain composition paralleling the differences in hemoglobin patterns. The minor hemoglobin band in *Microtus* is the result of a second alpha chain. Salting-out studies indicated differences between hemoglobins that were not detectable by electrophoresis of either whole hemoglobins or isolated chains. The major hemoglobin components of *M. pennsylvanicus* and *M. xanthognathus* were considerably less soluble than either the corresponding unfractionated hemolysates or purified minor components.

(227)

A Comparative Study of Northeastern and Southeastern Ecotypes of *Typha latifolia* (Typhaceae)

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University of Georgia

Typha latifolia is a highly successful pioneer in aquatic communities. A comparative study of the morphology and enzyme profile of this species in northeastern and southeastern United States investigated the relative degree of polymorphism at both the phenotypic and genotypic levels in widely distributed populations. Morphological characters demonstrated changes along environmental gradients both within and between northern and southern populations. Low genetic variability was found to exist and did not appear to be associated with specific environmental factors. The limited number of genotypes found are suspected to be the result of genetic drift and selection in the isolated populations leading to fixation of a highly adaptive and flexible genotype.

(39)

South American Killifish Species, A Question of Time and Place (Cyprinodontidae)

DONALD C. TAPHORN
University of Florida

The genera *Austrofundulus*, *Rachovia*, and *Pterolebias* are annual killifish from northern South America. A brief survey of the species and their habitat is given, and discussed in relation to the conventional concept of biological species.

(17)

Emergence Patterns, Distribution and New State Records of Fishflies in the Eastern United States (Megaloptera: Corydalidae)

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Marshall University

W. D. WATKINS
Ashland Oil Corporation

J. T. GOODWIN
USAF Environmental Health Laboratory

Emergence patterns, 45 new state records, and the distribution of 7 species of eastern fishflies are presented after the examination of 3358 specimens from 38 states. The lentic species, *Chauliodes rastricornis* from 36 states and *C. pectinicornis* from 34 states, emerge with regional variations from January-December and February-November, respectively. *Nigronia serricornis*, an inhabitant of streams with high to intermediate gradient in 30 states, emerges from March through October. *Nigronia fasciatus*, an inhabitant of small, woodland brooks, is restricted to 21 states and emerges from April through July. *Neohermes concolor* occurs in 21 eastern states

and emerges from April through August. *Neohermes angusticollis* and *N. matheri* are rare fishflies. *Neohermes angusticollis* is found in Georgia and South Carolina and emerges from April through June, whereas *N. matheri* is endemic to Mississippi and emerges in May and June.

(78)

Haemolymph Proteins and Their Incorporation Into the Cuticle

NANCY TAYLOR, RICHARD R. MILLS
AND GERALD C. LLEWELLYN
Virginia Commonwealth University

Protein incorporation into the newly forming insect cuticle has been extensively studied. Evidence suggests that the proteins come from either the blood proteins or the epidermal cells. Experiments were designed to determine which is the case. Incorporation rate of labelled blood proteins and labelled amino acid were compared. Implications to cuticle protein origin are discussed.

(87)

Variation in North American *Asplenium platyneuron* (Aspleniaceae)

W. CARL TAYLOR, ROBERT H. MOHLENBROCK,
AND FREDDA J. BURTON
Southern Illinois University

Asplenium platyneuron (L.) Oakes is one of the most common of the North American Spleenworts. At least nine subspecific names have been erected for variations of frond and pinna form in this widespread species. Study of a) type or authentic material, b) descriptions of the taxa, and c) numerous collections of *A. platyneuron* throughout eastern and central North America indicates that *A. platyneuron* var. *serratum* (E. S. Miller) BSP., f. *dissectum* Benedict, and f. *multifidum* Tetrick are synonymous with var. *incisum* (Howe) B. L. Robins., f. *hortonae* (Dav.) L. B. Smith, and f. *furcatum* Clute, respectively. Former proliferation of nomenclature within *A. platyneuron* appears due to a lack of descriptions which accurately circumscribe the limits of variability of infraspecific taxa and an apparent lack of familiarity with type or authentic material and existing nomenclature.

(323)

The Effect of Food Availability on the Trap Response of the Cotton Rat, *Sigmodon hispidus*

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Savannah River Ecology Laboratory
and Michigan State University

Four 1 ha trapping grids were established on two young pine plantations near Aiken, South Carolina. The cotton rats and other rodents were live-trapped, measured, marked, and released for three nights each month from April to November, 1975. At weekly intervals beginning in early May, 13.5 kg of mixed oats and sunflower seeds were broadcast over one of the grids on each plantation, thereby continually supplying the rodents with supplemental food. The remaining two grids served as

controls. In October, five nights after the last food application, the four grids were live-trapped for nine consecutive nights. Midway through the trapping period, 13.5 kg of seed were broadcast over the experimental grids. Immediately after the food application the capture rate of *S. hispidus* sharply decreased. The capture rate on the control grids remained unchanged. In addition, the percent of the total known population caught each night throughout the study was significantly lower on the experimental grids than on the control grids. The results of this trapping study and probable causes will be discussed.

(46)

A Comparison of Hindlimb Musculature in Two Salamander Families, the Plethodontidae and the Ambystomidae

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AND JERRY W. NAGEL
East Tennessee State University

Previously, our team reported the study of hindlimb muscles in four species of Plethodontidae. Little interspecific muscular variation was noted. Yet, from the scarce literary accounts, we had a reason to suspect that differences in musculature existed between Plethodontidae and Ambystomidae. Consequently, we enlarged the scope of our investigation to include the family Ambystomatidae. In each species studied, eight major pelvic muscles were dissected, examined and compared with respect to sites of attachment, shape and proportionate size to body area. A comparison was made on muscular similarities and differences within and between families.

(216)

A Survey of the Vertebral Number of the Suborder Percoidei (Class: Osteichthyes, Order: Perciformes)

BRUCE ALAN THOMPSON
Tulane University

The suborder Percoidei is the largest group of perciform fishes. Depending on the source, there are usually 70 to 75 families placed in this suborder. They are an incredibly broad, diversified collection of spiny-rayed fishes. To date approximately one-half of the families have been examined (either by specimen or literature) for vertebral number. The numbers range from a low of 22 (family Priacanthidae) to a high of 50 (family Percidae). Many families of the suborder have a modal count of $10 + 14 = 24$ (total), but whether this can be shown to be the ancestral number remains to be seen. It is interesting to note that two families (Centrarchidae and Percidae) that inhabit freshwaters have more variation than the other 70-some marine families combined.

(346)

Auxin Transport in *Pueraria lobata* (Kudzu)

MICHAEL R. THOMPSON AND ZACHARY S. WOCHOK
University of Alabama

Transport and distribution of auxin has been studied in 6 mm stem sections of *P. lobata*, excised approximately 4 internodes from the vine apex. ^3H -IAA was supplied at $10\ \mu\text{M}$ in donor blocks of agar placed at the morphologically basal or apical end of each section, and a receiver block of 1% agar was placed at the opposite end. Movement of radioactivity was studied in fresh sections both in the presence and absence of 2,4-dinitrophenol (DNP), and in sections which had been frozen and thawed. Transport periods were from 2-10 hours. Stem sections were divided into 3 segments, weighed, and solubilized with 50% chromic acid. Radioactivity was assayed in a Liquifluor-Triton cocktail. After correcting for quenching and counting efficiency final results were expressed as dpm/block or dpm/mg fresh weight. Passive diffusion of IAA accounted for about 25% of the basipetal transport and most of the acropetal transport, as indicated by the effects of DNP or freezing and thawing of the tissue.

(126)

Life History and Habitat of the Blackfin Sucker, *Moxostoma atripinne*, in Tennessee (Osteichthyes: Catostomidae)

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Auburn University
BRUCE H. BAUER
Tennessee Technological University

Moxostoma atripinne Bailey is restricted to the Barren River drainage of Kentucky and Tennessee. Recent samples from northern Tennessee provided material for a contribution on its ecology and life history. Juveniles and adults fed upon the same organisms (primarily chironomid larvae and cladocerans). Most of the older fish were females in their fourth year of life. Adult males were smaller than females of the same year class. *Dactylogyrus* sp. heavily infested the gills of some. The blackfin sucker usually is associated with riffles in small to moderate streams. Young were most common in shallow pools with moderate current, while adults tended to seek cover in deeper water. The species does not appear particularly fastidious in its habitat needs. A large population of young (50-75 mm or 2-3 inches TL) was encountered in a channelized stream, where it apparently was little affected by domestic gravel removal and late August water temperature as high as 29.4°C (85°F).

(271)

Comparison of Fish Populations in Structured and Non-structured Areas of Crow Creek, Franklin County, Tennessee and Jackson County, Alabama

ROBERT M. TODD, JR. AND P. V. WINGER
Tennessee Technological University

The effects of gradient stabilization structures upon fish populations of a channelized stream are currently being studied at Crow Creek, Franklin County, Tennessee and Jackson County, Alabama. The fish populations at eleven stations located on the channelized stream are being compared by abundance, biomass, condition, and age-growth studies. Population estimates are based on the DeLury method and sampled by electrofishing. Sampling of the populations occurred between July 18 and August 8, 1975. Data from the first year's study of the fish populations indicate that populations from non-structured areas are more abundant and possess a greater biomass than those which were found at structured areas. This would indicate that structured areas are less desirable habitats for fish populations than unstructured areas.

(333)

Isolation of Microtubule-Like Structures from Selected Eucaryotic Plant Cells

F. R. TOMAN, M. R. HOUSTON AND E. BENGALI
Western Kentucky University

Widespread detection of microtubules in plant and animal cells has led to the conclusion that they are universal components of eucaryotic cells. In the past few years microtubules have been isolated from a variety of animal cells, but not from plant cells. In this study we attempted to isolate microtubules from *Phycomyces blakesleeanus*, *Saccharomyces cerevisial* and *Allium cepa*. Small numbers of structures resembling microtubules were isolated from all three sources. The lengths of these microtubular-like structures were much shorter than Bovine brain microtubules, which made them appear to be microtubule fragments. Structures with two basic diameters were found. Those with diameters of 215-230 Å and those with diameters of 400-478 Å. The 215-260 Å diameter structures compared favorably to Bovine brain microtubules, while the 400-478 Å diameter structures appeared to be doublet or triplets of the 215-260 Å diameter structures.

(255)

Morphology of the Second Pleopod of *Macrobrachium Rosenbergii* (Crustacea: Decapoda)

AVERETT S. TOMBES AND MARIE W. FOSTER
Clemson University

Early sex determination of this malysian prawn is based on the presence of the appendix masculina adjacent to the appendix externa on the second pleopod of

the male and the presence of only the latter structure on the female. These two structures have their origin on the distal surface of the basipodite and extend distally along the medial aspect of the endopodite. Optical and electron microscopic examinations strongly suggest a sensory function for the appendix externa. Papillae, which increase in number (5 to 30) and size with growth of the juvenile, are present on the distal tenth of the medial surface of the appendix externa. Each papilla is structured as an inveted "J" with the suspected sensory endings on the protected inner surface. Supported in part by funds from the South Carolina Sea Grant Program.

(275)

Some Observations on Feeding and Shallow-Water Behavior of the Bottlenose Dolphin *Tursiops truncatus* in Louisiana Waters (Mammalia: Cetacea)

FRANK M. TRUESDALE
Louisiana State University

Dolphins have been observed and occasionally filmed in very shallow water (Ca 55 cm) of Caminada Bay, Louisiana. Lone dolphins have exhibited a recurrent behavior pattern in shallow water which may represent feeding on bottom organisms. The dolphin rolls on its side until the flipper of the opposite side extends into the air. During this "rolling" the head is underwater and is twisted toward the submerged flipper. Upon resuming normal orientation at the surface, the dolphin may move slowly forward, beak and eyes submerged, blowhole and dorsum exposed, and repeat the "rolling" behavior. Observations have also been made of dolphins feeding behind beach seines and trawls.

(2)

Drift Activity of Macroinvertebrates in a Great Smoky Mountains National Park Stream for the Fall Season

WILLIAM F. TRUMPF, ERIC L. MORGAN
AND PARLEY V. WINGER
Tennessee Technological University

Taywa Creek, a feeder stream of Bradley Fork in the Great Smoky Mountains National Park was sampled for macroinvertebrate drift activity. Three drift samples were taken for a 15 minute period every hour over a 24 hour period. Two separate study periods were assessed, November 10.h and December 10th, 1975. This data is evaluated in terms of fall season drifting activity. Statistical analysis, number and position of peak drift rates, % composition, species diversity, and evenness are discussed. — *This work was supported in part by funds provided by the U.S. Department of the Interior, National Park Service, Southeast Regional Office.*

(178)

Rare and Endangered Vascular Plant Species
of Arkansas

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Arkansas Polytechnic College

A survey of the rare and endangered vascular plant species of Arkansas has been compiled and recently published (*in, Arkansas Natural Area Plan, Arkansas Department of Planning, 1974*). The study indicated the need for continuing field studies, because the distributions of many Arkansas species are still poorly known despite many years of collecting activity. A number of species now considered rare may be of relatively wide occurrence in the state. Better definition of criteria for the designation of rare and endangered species is needed.

(192)

Observation on a Digenetic Trematode
(Trematoda: Plagiorchiida) in the Red
Swamp Crayfish *Procambarus clarkii*
(Crustacea: Decapoda: Astacidae)

HUGH M. TURNER AND KENNETH C. CORKUM
Louisiana State University

Sexually mature, non encysted digenetic trematodes inhabit antennary glands of Red Swamp Crayfish *Procambarus clarkii* in Louisiana. Infected crayfish harbor from one to three worms per gland with 40% incidence during early spring in certain localities. Histological study of infected glands revealed no evident pathology.

(64)

Comparisons of Radiocesium Uptake Among
Herbaceous Species Inhabiting a Contaminated
Floodplain

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Southwestern Oklahoma State University

JOHN E. PINDER, III
Savannah River Ecology Laboratory

Floodplain sediments of Steel Creek, a 20 km stream located on the U.S. Energy Research and Development Administration's Savannah River Plant, were contaminated by low-level releases of radiocesium from the operation of nuclear reactors. Similarities of radiocesium uptake among emergent vascular plant species were investigated by determining leaf radiocesium concentrations in randomly selected individuals of *Sagittaria latifolia* Willd. and nearby individuals of seven other species. Positive correlations between the leaf concentrations of two species indicate similar patterns of radiocesium uptake. *Sagittaria* was used as a reference species because it is a ubiquitous and often dominant member of the swamp flora. The leaf concentrations of *Sagittaria* were positively correlated with the leaf concentrations of the other species, but the correlation coefficients were small ($\bar{r} = 0.29$). Intercorrelations between other species were also near $\bar{r} = 0.29$. The data suggests that factors which increase the uptake of one species also increase the uptake by other members of the plant community.

(157)

Affinities and Status of *Haplopappus linearifolius*
DC (Asteraceae)

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Louisiana State University

Morphological, cytological, biochemical, and ecological evidence suggests that *Haplopappus linearifolius* DC is most closely related to *H. cooperi*. Hall (1928), in that last revisionary account of the genus, treated these species in sections *Senotopsis* and *Ericameria* respectively which he placed in different lines of his phylogenetic scheme. Both species have been problematic to previous investigators having been variously treated as members of different genera but never closely related to one another. These two species do stand apart from other members of the *Astereae* in some respects, but are undoubtedly most closely allied to *Haplopappus* section *Ericameria*. The evidence further argues that section *Ericameria* is discordant in *Haplopappus* and should be given generic status as earlier recognized by Nuttall. It is proposed that *H. linearifolius* and *H. cooperi* comprise a subgenus of *Ericameria*.

(256)

Effects of Photoperiod, Temperature and Pre-
conditioning on the Molt Cycle of Samples
from a Michigan Population of the Crayfish
Orconectes immunis (Hagen)

ROBERT J. VAN HOFF AND RUDOLPH PRINS
Western Kentucky University

Predominantly immature crayfish were obtained from a southern Michigan population. Two sets of three 90-day experiments were conducted over a two-year period. All experiments involved three photoperiods (6L:18D, 15L:9D, 24LL) and three temperatures (14°C, 18°C, 22°C); the first experiment of each set was initiated immediately in August and July, 1973 and 1974, respectively, the other two of each set being initiated at 45-day intervals, after preconditioning the animals at 7°C.

There was a highly significant, positive linear relationship between temperature and molting frequency, substantiating previous information. However, the relationship between photoperiod and molting frequency was not as clear cut. Larger animals (19.0-24.9 mm CT) tended to respond more linearly to photoperiod than smaller animals (13.4-18.9 mm CT), although among the experiments the response to photoperiod was highly significant. No interactions between photoperiod and temperature were shown. The longer the animals were held at 7°C the lower the frequency of molts of these animals once released from these conditions.

(139)

Mixed Mesophytic Communities in Unglaci-ated Southern Indiana: Hemlock (*Tsuga canadensis*)

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University of Louisville

Hemlock is important in discerning the existence and position of Mixed Mesophytic Forest communities in Southern Indiana. Hemlock exists in these communities amidst a high density of woody and herbaceous species many of predominantly southern distribution. *Aesculus octandra* has been found for the first time associated with hemlock in Indiana and joins *Tilia neglecta*, *Aralia spinosa*, *Kalmia latifolia*, *Lycopodium porophyllum*, *Asplenium pinnatifidum*, and *Lorinseria areolata* in association. Hemlock reproduction is vigorous in all these sites which lie dispersed along moist, sheltered escarpments usually composed of sandstone. Two new stations have been discovered in Harrison county. Hemlock-Mixed Mesophytic communities in Southern Indiana may be linked to and derived from Mixed Mesophytic communities in Western Kentucky and the Southern Appalachians.

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Temporal and Spatial Patterns in the Distribution of Radiocesium Contamination of American Coots (Rallidae) of the ERDA Savannah River Plant

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AND I. LEHR BRISBIN, JR.
Savannah River Ecology Laboratory

The Par Pond reactor cooling reservoir system of the ERDA Savannah River Plant serves as a wintering ground for large flocks of migratory waterfowl. Previous studies have shown that American coots (*Fulca americana*) tend to accumulate relatively higher body burdens of radiocesium during their winter stay on the reservoir than other species of waterfowl. These studies compare the radiocesium body burdens of coots collected in different parts of the reservoir system and evaluate differences between contamination levels of 1971-72 and 1975-76. Consideration is given to the possibility that coots might serve as an indicator species for aquatic bird communities.

(21)

Relative Abundance, Biomass, and Diversity of Benthic Macroinvertebrates Encountered in an Estuarine Area Affected by Thermal Effluents from a Fossil Fuel Electrical Generating Plant

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Law Engineering Testing Company

In September, 1975, a survey of estuarine benthic macroinvertebrates was performed as part of an ecological assessment of a thermally affected seagrass bed area in West Bay near Panama City, Florida. Quantitative sampling of benthic macroinvertebrates was performed in order to assess secondary productivity in seagrass

zones within and outside of the thermal effluent area of a fossil fuel electrical generating plant. Species area curves were developed for twenty sampling stations representing seagrass zones along 5 transects. Taxa composition, relative abundance of taxa, biomass (ash-free dry wt in g/m²), and Shannon Diversity (H) were determined for each sample. Variations in taxa composition between seagrass zones was evident. In the near shore seagrass zones, a sharp increase in the number of organisms/m² and biomass suggested increased secondary productivity in the general area affected by thermal effluent as compared to control transects.

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Organic Carbon in the Pamlico River Estuary

THOMAS VICARS, GRAHAM J. DAVIS,
AND MARK M. BRINSON
East Carolina University

An annual organic carbon budget is being developed for the Pamlico River, N.C., estuary as part of a study of factors associated with summer deoxygenation. Since July 1975 dissolved (DOC) and fine particulate organic carbon (FPOC) have been determined fortnightly at 22 locations. Two tributaries are also being monitored at various flow stages. Estuarine DOC averages around 10 mg liter⁻¹ and is less variable than FPOC, which ranges from 0.5-4.0 mg liter⁻¹. DOC concentrations in the tributaries have been as high as 50 mg liter⁻¹ with FPOC levels above 8 mg liter⁻¹. Autochthonous inputs from phytoplankton, filamentous algae and rooted macrophytes are also being studied.—Supported in part by the Water Resources Research Institute of the University of North Carolina and the U.S. Department of Interior.

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Variation of Submerged Plant Bed Patterns in an Estuary

THOMAS VICARS, GRAHAM J. DAVIS,
AND MARK M. BRINSON
East Carolina University

Aerial photography of submerged aquatic macrophytes in the Pamlico River, N.C., estuary during 1974-1975 revealed several forms of plant beds, as well as variation in the pattern of their distribution in the littoral. Two major bed types were distinguished: large continuous stands of up to 40 ha, and smaller circular beds of 5-40 m². The continuous stands were composed of aggregated vegetative clumps in shallow water with randomly distributed stands of *Vallisneria spiralis* Michx. in deeper water. Circular beds were common in deeper water beyond the continuous stands, as well as in regions of intense wave action. These beds were associated in one area with submerged tree stumps bordering a receding marsh shoreline. The effects of currents, depth, wave action and other possible factors controlling the development of these beds will be discussed.—Supported in part by the Water Resources Research Institute of the University of North Carolina and the U.S. Department of Interior.

A Preliminary List of the Bivalves (Unionacea: Unionidae) of the Bayou Teche System in Louisiana

MALCOLM F. VIDRINE AND MARK S. DEROUEN
Gulf South Research Institute

The Bayou Teche drainage system consists of four major bayous: Cocodrie, Boeuf, Wauksha, and Carron. Unionacean faunal elements found in these tributaries include: *Amblema perplicata* (Conrad), *Megaloniaias gigantea* (Barnes), *Fusconaia flava* (Raf.), *F. undata* (Barnes), *Fusconaia sp.* (circular in outline), *Tritogonia verrucosa* (Raf.), *Quadrula nodulata* Raf., *Q. pustulosa* (Lea), *Q. apiculata* (Say), *Uniomereus tetralasmus* (Say), *Plectomerus dombeyana* (Val.), *Anodonta grandis* Say, *A. imbecilis* Say, *Arcidens confragosus* (Say), *Oblivaria reflexa* (Raf.), *Carunculina parva* (Barnes), *Villosa lienosa* (Conrad), *Leptodea fragilis* (Raf.), *Proptera purpurata* (Lamarck), *Lampsilis radiata* (Barnes), *L. hydana* (Lea), *L. teres* (Raf.), *Truncilla truncata* Raf., *T. donaciformis* (Lea), and *Glebulia rodundata* (Lamarck). The lower 50 miles of the Bayou Teche contain only five species: *G. rotundata*, *Q. apiculata*, *U. tetralasmus*, *A. grandis*, and *C. parva*.

Notes on the Bivalves (Sphaeriacea: Corbiculidae and Sphaeriidae and Unionacea: Margaritiferidae) of the Bayou Teche System in Louisiana

MALCOLM F. VIDRINE AND MARK S. DEROUEN
Gulf South Research Institute

Corbicula manilensis (Philippi) (Sphaeriacea: Corbiculidae) inhabits most of the drainages of the Bayou Teche System, including the mainstream of the bayou and the following tributaries: Bayou Cocodrie (below its impoundment), Bayou Wauksha (a dredged bayou) and Bayou Carron. Bayou Boeuf, also a tributary, is currently free of this Asiatic invader. This clam is abundant locally in Bayou Cocodrie and Bayou Wauksha.

Three species of fingernail clams (Sphaeriacea: Sphaeriidae) have been found in the Teche system: *Sphaerium striatinum* (Lamarck) in Spring Creek, a tributary of Bayou Cocodrie; *Musculium securis* (Prime) in Bayou Boeuf; and *Musculium transversum* (Say) in a back-water pond of the southern Bayou Teche.

Margaritifera hembeli (Conrad) (Unionacea: Margaritiferidae) was not found in Spring Creek, although reported from there by Clench and Turner (1956, *Bull. Fla. State Museum*, 1(3):97-239). It was not found in other local creeks parallel to Spring Creek running into Bayou Cocodrie. All these creeks are partially inundated due to backup waters caused by the Bayou Cocodrie impoundment.

New Locality and Host Records for *Najadicola ingens* (Koenike) (Acarina: Unionicolidae)

MALCOLM F. VIDRINE, BLAKE J. VIDRINE,
AND BLAINE J. VIDRINE
Gulf South Research Institute
and Louisiana State University

Najadicola ingens (Koenike) has been found in the gill water tubules of four species of fresh-water clams (Unionacea: Unionidae) in three river drainages in Louisiana. Three new host records for this mite are *Amblema perplicata* (Conrad) and *Carunculina parva* (Barnes) (Calcasieu River, Rapides Parish, Louisiana) and *Fusconaia sp.* (Valentine Creek, Bayou Teche System, Rapides Parish, Louisiana). The latter record was supplied by J. P. E. Morrison (Smithsonian Institute). Members of the *Lampsilis radiata* complex are also parasitized at the Calcasieu River locality and at Little Corney Bayou (Ouachita River, Union Parish, Louisiana). These new locality records for this Nearctic mite extend its southern range more than 1000 miles. The southernmost records published prior to these were in Massachusetts and Rhode Island (Humes and Jamnback, 1950, *Psyche*, 57(3): 77-87) and Michigan (Wolcott, 1899, *Bruz, Trans. Amer. Micros. Soc.*, 20: 193-259).

The Immature Dragonflies and Damselflies (Insecta: Odonata) of a New Reservoir, Lake Anna, Louisa County, Virginia

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AND W. FORD CALHOUN
Virginia Polytechnic Institute and State University

Lake Anna is an impoundment of the North Anna River and four of its tributaries. These tributaries were impounded separately to form lagoons. The immature Odonata have been one of the most interesting groups encountered during 6 years of pre- and post-impoundment study. The odonate fauna of the North Anna River was predominately composed of the dragonflies *Progomphus obscurus* (56%) and *Macromia sp.* (19%). In the tributaries, the most common odonates were the damselflies *Calopteryx sp.* (41%) and *Argia sp.* (37%), and the dragonfly *Aeschna sp.* (10%). In the 3 years following the impoundment of the river and tributaries, the most common dragonflies were *Epicordulia princeps* (1-26%) and *Perithemis tenera* (1-41%). The most common damselflies were *Argia sp.* (0-45%) and *Enallagma sp.* (15-95%). The composition of the odonate fauna in the main reservoir is still changing. *E. princeps* and *Argia sp.* are becoming more common, while *P. tenera* is becoming less common. *Enallagma sp.* continues to occur at the same frequency. The composition of the odonate fauna in the lagoons is reasonably consistent. — This research was supported by the Virginia Electric and Power Company.

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Antennal Amputations in the Springtail,
Sinella curviseta

ELIZABETH S. WALDORF
Louisiana State University

Earlier work demonstrated that males of *Sinella curviseta* (Collembola: Entomobryidae) respond to a female sex pheromone by depositing spermatophores. Antennal amputations were performed to explore the males response and attempt to localize the pheromone receptors. Half and fourth antennal amputees and control males responded similarly to the stimulus of female associates (with an average of 20 spermatophores per 5 min). However antennal amputees exhibited more spermatophore depositions than leg amputees in the absence of females. These "background" depositions tended to increase with larger antennal excisions.

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Population Differences and Site Analysis in
Carpinus caroliniana (Betulaceae) Ranging
from Michigan to Alabama

GORDON I. WARDELL
Western Kentucky University

Specific gravity of secondary wood and fruit weight in 10 populations displayed clines with lowest values (s.g. of 0.532 and fruit wt. of 0.392 g/ 50 dry fruit) being in Alabama. Wide variation in bract length was displayed within populations, however, no variation within individual trees was observed. Recording a total of 500 associated species of *Carpinus* at ten sites in Kentucky coal field and Mississippian plateau habitats revealed the three most common trees to be *Platanus occidentalis*, *Acer saccharum* and *Liquidambar styraciflua*. Relative canopy densities of plant communities containing *Carpinus* will be discussed.

(242)

The Metabolism of Glucose by the Combined
Use of *Gluconobacter suboxydans* and
Pseudomonas fluorescens

K. L. WARE, L. P. ELLIOTT, AND L. B. LOCKWOOD
Western Kentucky University

This investigation sought to characterize the metabolism of glucose by the combined use of *Gluconobacter suboxydans* and *Pseudomonas fluorescens*. The two microbial agents were grown on a 10% glucose medium in presence of calcium carbonate. A pattern between viable cell counts and biochemical activity was established. Various cultural problems were solved, and the role of *Pseudomonas fluorescens* in the production of tartaric acid was considered.

(202)

Investigations of Phytoplankton Communities
in the North Anna Reservoir

KAREN E. WARK, G. B. HALL,
AND GEORGE M. SIMMONS, JR.
Virginia Polytechnic Institute and State University

The North Anna Reservoir, located in Louisa County, Virginia, was created to provide cooling water for a nuclear power station presently under construction by the Virginia Electric and Power Company. Preoperational limnological data has been collected in this reservoir-lagoon complex since March, 1972. Results of this study are based on collections made during 1975. Comparing the upper, middle, and lower regions of the reservoir, properties such as temperature, oxygen, pH, and alkalinity were similar among the three areas. However, there were significant differences in transparency, nutrient levels, chlorophyll concentrations, and phytoplankton communities. Enumeration of phytoplankton density and species composition showed a river/reservoir ecotone of greater diversity. The increased phytoplankton diversity between stations appeared to intensify with thermal stratification. While a large number of species were common to the entire system, the diversity of the phytoplankton community significantly decreased down the reservoir. — *This research was supported by the Virginia Electric and Power Company.*

(1)

Biological Studies of the Spiny Lobster
(*Panulirus argus*: Palinuridae) in South Florida

RICHARD E. WARNER, CHRISTOPHER L. COMBS,
AND DOUGLAS R. GREGORY
Florida Cooperative Extension Service

The spiny lobster (*Panulirus argus*) fishery in Florida is second only to the shrimp fishery in economic importance. Rapidly increasing fishing pressures on *P. argus* and declining catches have in recent years caused significant profit losses to lobster fishermen.

The present study, now in its second year, is designed to examine the biological implications of this apparent overfishing on the population of *P. argus* in the lower Florida Keys. Answers are being sought to such questions as 1) size at first sexual maturity and its relation to the present minimum legal size, 2) the potential effects on the fishery of modification of present legal size limits, and 3) the effects of other modifications of existing management practices on the economics and biology of the resources.

(238)

History of Medical Entomology

A. B. WEATHERSBY
University of Georgia

(No abstract received)

(55)

Models for Estimating Tree Branch
Parameters of Upland Oaks and Hickories

GEORGE T. WEAVER

Southern Illinois University at Carbondale

Several models were compared for estimating biomass of branch foliage, current annual twig growth, bark, and wood of *Quercus alba*, *Q. rubra*, *Q. velutina*, and *Carya* spp. Criteria for selection of models in order of priority were estimates of relative error (calculated on standard error of estimate) and coefficient of correlation.

The most suitable model was $\log_{10}y = A + B(\log_{10}x)$ where y is the dependent variable, x is branch basal diameter, and A and B are constants. Several other independent variables including branch age, height of branch above tree base, and quadratic and interaction terms derived from these were tested in equations of various forms but were inferior to the above model. Data for the *Quercus* spp. could be combined for inter-species regressions for some components but intergeneric *Quercus-Carya* regressions were unsatisfactory.

(82)

Carcinoembryonic Antigen in Human
Sera and Effusions

MARION R. WELLS AND CAROLINE MOHR O'HARA

Middle Tennessee State University

Effusions and matching sera from 61 patients at the Veterans Administration Hospital in Nashville, Tennessee, were assayed for Carcinoembryonic Antigen (CEA). These patients were grouped into four clinical categories: neoplasms, tuberculosis, cirrhosis, and congestive heart failure. Of the serum samples assayed for CEA in neoplasms, 18% had normal values (<5.5 ng/ml), and 100% of the effusions were above normal limits. In the pathological conditions other than neoplasms, 86% of the sera samples were above normal limits, and 86% of the effusions were above normal limits. These data indicate the presence of abnormal amounts of CEA may be detected in pathological conditions other than neoplasms.

(117)

Fecundity, Seasonal Gonad Cycles, Egg Size and
Condition of the Largemouth Bass *Micropterus*
salmoides (Lacepede) in Lake Anna, Virginia

STANFORD R. WELLS, JR. AND JAMES R. REED, JR.

Virginia Commonwealth University

Lake Anna is a newly-constructed 13,000 acre reservoir which will be utilized to provide cooling water for a nuclear powered electrical generating facility. It is divided into a lagoon system which comprises 3,600 acres and a lake system containing 9,400 acres. Fish were collected monthly at selected stations and data taken in the field on weight, total length and gonad weights of male and female bass. Female gonads, collected just prior to the breeding season, were stored in Gilson's fluid so egg size and number data could be re-

corded at a later date. Comparison of several factors including condition, egg size, seasonal gonad cycles and fecundity of the largemouth bass were made for the lagoon and lake systems. — *Funded by Virginia Electric and Power Co., Richmond, Virginia.*

(68)

The Occurrence of *Lygodium palmatum* (Bernh.)
Swartz. (Schizaceae) on Heavy Metal Mines
in the Piedmont of North Carolina

DIANE E. WICKLAND

University of North Carolina at Chapel Hill

During the course of a phytosociological survey of the vegetation around abandoned lead, copper and zinc mines in the piedmont of North Carolina climbing fern, *Lygodium palmatum* (Bernh.) Swartz. (Schizaceae), was constantly found. It was observed with high constancy along streams and ravines in the mine areas. The concentrations of heavy metals in the soils in these areas are known to be excessive. It is suspected therefore that these mine populations of *L. palmatum* show tolerances to heavy metals. The distribution of *L. palmatum* in the piedmont of North Carolina will be compared with the distribution of these abandoned mines. Experiments testing mine populations and other piedmont populations for specific heavy metal tolerances will also be discussed.

(317)

Influence of Temperature on Food Gathering and
Nesting Behavior of the Hispid Cotton Rat,
Sigmodon hispidus, (Rodentia: Cricetidae)
in the Laboratory

WERNER WIELAND AND JOHN F. PAGELS

Virginia Commonwealth University

Cotton rats were maintained in chambers with two compartments separated by plexiglass tubing to determine differences in movement of food and or nesting materials at temperatures of 25, 12 and 2 C. Negligible movements of either bedding or food occurred at 25 C, but at 12 and 2 C greater movement of both was observed. Incidence of movement of food to the nest compartment increased with lower temperature and exceeded movement of bedding material at all temperatures. Further evidence suggesting animals spent less time away from the nest at lower temperatures was demonstrated by an increase in amounts of fecal material deposited in the bedding compartment and the stockpiling of food in this compartment.

(118)

Age and Growth of Lagremouth Bass,
Micropterus salmoides, During the First Three
Years of Impoundment of a Central
Virginia Reservoir

WERNER WIELAND AND JAMES R. REED, JR.
Virginia Commonwealth University

Lake Anna is a 13,000 acre reservoir constructed by Virginia Electric and Power Company (VEPCO) to provide cooling water for four nuclear reactors of a four million kilowatt electrical generating facility presently under construction. The reservoir is divided into a 9,400 acre lake proper and three interconnected cooling lagoons (3,600 acres) by three compacted earth dikes.

Mean values for alkalinity are consistently higher in the lagoons throughout the year. Turbidity was highest in the upstream portion of the lake and lowest in the lagoons. The lower half of the lake is subject to acid and metal mine drainage. Growth of bass appeared to be greater in the lagoon system than in the lake proper. — *Funded by Virginia Electric and Power Co., Richmond, Virginia.*

(108)

Effects of River Impoundment on the Recovery
of Downstream Fish Populations from Acid
Mine Drainage in a Piedmont-Coastal Plain
Stream of Virginia

WERNER WIELAND AND JAMES R. REED, JR.
Virginia Commonwealth University

The lower North Anna and upper Pamunkey Rivers of Virginia were sampled for fishes and selected water quality parameters to evaluate the effects of river impoundment on recovery of fish populations from acid mine drainage downstream. Collections were made at stations established during a pre-impoundment survey in 1971. One of the most obvious differences noted was the increased clarity of the North Anna River at the stations immediately below the dam site. Mean turbidity values at these stations were lower than those of stations sampled further downstream in the Pamunkey River. Impoundment of the North Anna River appears to have reduced siltation in the river below the dam and fish populations appear to be recovering, diversity and numbers of fishes appeared normal for the North Anna River. The downstream stations were not greatly different in terms of fish diversity or numbers than they had been in 1971. The fishes in these areas were not subjected to the extreme stresses of siltation and sedimentation as were those of the upper stations. — *Funded by Virginia Electric and Power Co., Richmond, Virginia.*

(119)

Succession of Fish Populations in the First Three
Years of Impoundment of Lake Anna, A
Newly-Constructed Reservoir in Virginia

WERNER WIELAND AND JAMES R. REED, JR.
Virginia Commonwealth University

Lake Anna is a newly-constructed reservoir that will provide cooling water for a four million kilowatt nuclear powered electric generating facility presently under construction. The reservoir is divided into a lake proper and cooling lagoons. Data on distribution, abundance and diversity of fishes are compared with pre-impoundment studies to determine succession of fish populations and species within the reservoir. After three years of impoundment the typical stream fish populations in this system have been reduced and replaced by lake forms, both by natural growth of existing populations and stocking. The chief predators in Lake Anna are largemouth bass and chain pickerel. There appears to be no difference in the relative abundance of game fish populations in the reservoir and lagoon system but individuals of the same year class are somewhat larger in the lagoon system. Cove rotenone samples taken in late summer 1975 show a mean standing crop of gizzard shad in the reservoir proper of 148.1 lbs. per acre. Data indicate Lake Anna is a young warm water lake and fish populations have not yet stabilized. — *Funded by Virginia Electric and Power Co., Richmond, Virginia.*

(336)

Isolation of Specialized Transducing Phages
Carrying Fragments of the Isoleucine-Valine
(ILV) Operons of *Escherichia coli*

ANN C. WILLIAMS AND ARTHUR L. WILLIAMS
Alabama State University

A strain carrying a deletion for the lambda attachment site (*att λ*) was made use to insert bacteriophage lambda into the *ilv* cluster. Specifically, it was found that bacteriophage lambda was inserted into the *ilvC* gene. Phage lines carrying bacterial DNA from the counter-clockwise side (as the *E. coli* chromosome map is usually drawn) of the insertion could transduce *ilvA*, *ilvD* and *ilvE* mutants, while those carrying DNA from the clockwise side could transduce *ilvC*, *cya* mutants and the one *ilvB* mutant available at this time. The utility of bacteriophage lambda to study the transcription of the *ilv* cluster will be discussed.

(170)

The Endangered Species Act of 1973:
A Review and Explanation

JAMES D. WILLIAMS
Office of Endangered Species,
U.S. Fish and Wildlife Service

The Endangered Species Act of 1973 was passed by the 93rd Congress and signed into law on December 28, 1973. The Act is the strongest legislation ever enacted to protect endangered and threatened plants and animals. The Act gives the Departments of Commerce and the Interior regulatory and statutory authority on endangered and threatened fauna and flora. The 1973 Act provides for two categories of species listing, endangered and threatened, as opposed to one category, endangered, in the 1969 Act. Also new are provisions for State cooperation and participation in the program through cooperative agreements, grants-in-aid funding, and other incentives. The 1973 Act calls for participation where appropriate by all Federal agencies and directs that no Federal funds can be utilized for an activity that would be detrimental to an endangered or threatened species.

All sections of the Act will be discussed. Progress on the part of the U.S. Fish and Wildlife Service towards implementing the provisions of the 1973 Endangered Species Act will be summarized.

(123)

Spawning Behavior of *Etheostoma edwini*
(Pisces: Percidae)

JOHN S. WILLIAMS
University of West Florida

Etheostoma edwini apparently has an extended spawning season, as ripe ova were present from early winter to late summer. Spawning occurred readily in the aquarium, where behavior was observed. A spawning female allows a courting male to mount, then swims from beneath the male and upward, the male following closely. When the female reaches an appropriate substrate for egg deposition, usually a plant, she assumes a vertical, or more often, an inverted position. The male then overtakes the female and mounts her. With both the male and female in this inverted position, a single egg is deposited and fertilized. One spawning pair was seen to repeat the sequence 22 times in succession, but often omitted the initial mounting after spawning began. Males exhibited no territoriality while engaging in spawning, but some large males were intensely agonistic at other times.

(193)

Causes of the 1975 Massive Duckweed Nuisance
in the Black Warrior River, Alabama

LOUIS G. WILLIAMS
University, Alabama

Siphoning of millions of gallons of water from Bayview Lake, a septic lake from domestic and industrial wastes from Birmingham, was responsible for seven months of huge nuisance biomasses of *Spirodela oligorhiza* (Kutz) Hegelm. This recently introduced duckweed from Asia was shown to thrive in natural habitats and laboratory cultures rich in available manganese, iron, boron and zinc, which are also in high concentrations in Bayview Lake.

(86)

Numerical Taxonomy of the *Setaria viridis*
Complex

R. D. WILLIAMS
Southern Weed Science Laboratory

M. M. SCHREIBER
Purdue University

The phenetic relationships of green foxtail [*Setaria viridis* var. *viridis* (L.) Beauv.] and its allies were examined by numerical and morphological methods. Correlation coefficients and taxonomic distances based on quantitative data from 31 characters displayed close phenetic similarities among green foxtail, its varieties and foxtail millet [*S. italica* (L.) Beauv.]. Comparison of 41 morphological features supported the numerical comparisons. By combining all characters examined, the resulting cluster analysis displayed the closest similarity between robust white (*S. viridis* var. *robusta-alba* Schreiber), robust purple (*S. viridis* var. *robusta-purpurea* Schreiber) and giant green foxtail [*S. viridis* var. *major* (Gaudin.) Posp.] indicating that the robust foxtails may be races of giant green foxtail rather than a variety of green foxtail. The numerical and morphological comparisons tended to support the proposed phylogeny of the Old World foxtails.

(115)

Food Habits of the Mosquitofish,
Gambusia affinis (Poeciliidae)

SHERRY E. WILLIAMS AND ROBERT W. MCFARLANE
Savannah River Ecology Laboratory

Gambusia affinis, the mosquitofish, is widespread and abundant on the U.S. Energy Research and Development Administration's Savannah River Plant near Aiken, South Carolina. It has the highest thermal tolerance of the local fish fauna and is the most abundant species in thermal effluent areas, being found at temperatures up to 43°C. The main objective of this study was to examine food habits to determine if the diet had shifted in high temperature areas. Results indicate main dietary items are crustaceans, aquatic insects and larvae, filamentous algae, and plankton. There are seasonal trends reflecting prey availability but there is no significant difference between thermal and non-thermal areas.

(318)

Ecological Strategies of Small Mammal Populations

WILLIAM K. WILLARD¹
Clemson University

A small mammal population was studied in eastern Tennessee to investigate relationships between seasonal movements and/or activity of the mammals and environmental factors such as weather, food and habitat. Small mammal activity was found to be correlated seasonally with food and microhabitat, whereas weather extremes appeared to influence activity on an annual basis. Mammalian activity decreased during the winter months where movements were primarily confined to the lower slopes of the ridges. Temperature inversions occurred frequently during winter and the small mammals utilized burrows on the lower slopes just above bottom elevation. The burrow air temperature was considerably more favorable — never dropping below 5C. During summer months, the greater activity also occurred on the extreme lower slopes and bottoms when cool air drainage predominated. The temperature within the bottom burrows during the summer months never exceeded 22C and represented more moderate conditions than were observed outside the burrows. The data suggest that small mammals are very susceptible to weather extremes, even in temperate climates, and since their physiology cannot fully accommodate, they must therefore employ so-called "strategies" in order to survive.—*This research was sponsored by the Environmental Sciences Division, Oak Ridge National Laboratory (operated by Union Carbide Corporation for the Energy Research and Development Administration), Oak Ridge, TN. 37830.*

¹ Present Address: Tennessee Technological University.

(85)

Pollen Viability in Southeastern Azalea Species and Their Hybrids

FRANK F. WILLINGHAM, JR.
Callaway Gardens

Twelve deciduous species of *Rhododendron* (Ericaceae) and six hybrids, all grown under similar conditions, were surveyed for pollen viability by staining with aniline blue-lactophenol. The plants surveyed included only those species and hybrids judged hardy in middle Georgia by virtue of having been successfully established at least five years prior to the study.

The percent of viable pollen was found to be lower for most species than noted in previous studies. Although flower to flower variation within a single plant remained small for all species and hybrids, the plant to plant variation in several species proved quite large. Hybrid plants, if not totally sterile, exhibited a high percent of viable pollen. No correlation between the variation patterns of the species and their taxonomy or distribution was evident. Seasonal variation in several of the species will also be discussed.

(15)

The Toxicity of Cadmium and Zinc to the Mysid Shrimp, *Neomysis americana* Smith (Crustacea: Mysidacea)

JOHN A. WILLIS
Georgia Southern College

Mysid shrimp, *Neomysis americana* Smith, were subjected to long term exposure of low concentrations of cadmium under dynamic conditions to determine changes in tissue cadmium or zinc concentrations. No appreciable accumulation was detected. Other groups of mysids were exposed to cadmium and zinc under static conditions to evaluate the extent of relative toxicity of each metal. Comparative 24 hour LD₅₀ (dosage lethal to 50% of the population within 24 hours) values derived by multiple regression indicated relative toxicity of cadmium to zinc to be at an approximately 100:1 ratio. The cadmium LD₅₀ line exhibited a greater negative slope than the zinc LD₅₀ line, indicating a greater toxicity of cadmium. The results of the tests indicate that mysids are capable of eliminating cadmium and related heavy metals up to an undetermined point, after which rapid toxicity occurs. However, metal bioassays of both the dynamic and the static types of marine systems may be unsuitable for precise quantitative determinations of LD₅₀ values due, at least in part, to the highly ionic environment.

(53)

The Effects of a Heated Power Plant Discharge on the Stomach Contents of Two Species of Catfish

JAMES H. WILSON AND KENNETH L. DICKSON
Virginia Polytechnic Institute and State University

Young of the year channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictus olivaris*) were collected during the maximum temperature period of the year from reference stations, and at stations below Appalachian Power Company's Glen Lyn power plant on the New River in southwestern Virginia. Examination of stomach contents using an analysis of variance and a diversity index indicate that the channel catfish seemed to be nonselectively utilizing the food substrate present in both the heated discharge (34C) and at the cooler, ambient temperature reference station (26C). The flathead catfish, however, seemed to be either moving out of the heated area to feed, or were selectively feeding on organisms located in the substrate or in the heated area as a result of drift. Both species of catfish showed an increase in the number of chironomid larvae ingested in the heated discharge, compared to the reference stations.

(156)

A Comparison of Two Assay Methods for Glycogen Phosphorylase in the Silkmoth Fat Body

LARRY T. WIMER
University of South Carolina

ROLF ZIEGLER
Freie Universität Berlin

GERALD R. WYATT
Queen's University (Kingston, Ontario)

The activity of glycogen phosphorylase in the silkmoth fat body was compared when the reaction rate was measured in the direction of glycogen synthesis and glycogen degradation. Assays were done on both the active form of the enzyme and total enzyme. Insects were obtained in different physiological conditions to provide for a broad range of enzyme activities. Three comparisons are made of the two different methods, and they are: (1) percent active enzyme; (2) specific activity of active enzyme (micromoles of product formed/mg of protein/hr.); and (3) specific activity of total enzyme. The percent active enzyme was always higher when the reaction was assayed in the direction of glycogen degradation. The specific activity of active phosphorylase measured by the synthesis route was about twice that measured by the degradation route. The specific activity of total phosphorylase was about 2.5-3.0 times higher when assayed by the synthesis route. The two methods show a high degree of correlation; however, the absolute values are different.

(143)

Populational Differences in Fruit Weights of Five Species of Deciduous Trees

JOE E. WINSTEAD AND BURTON J. SMITH
Western Kentucky University

A general pattern of decreasing fruit size (weight) with decrease in latitude of origin in hardwood species was noted in comparing populations of *Acer rubrum*, *Carpinus caroliniana*, *Cornus florida*, *Fraxinus americana* and *Prunus serotina*. Populations tested represented a range from 32 to 47 degrees north latitude. The lightest fruit was found in populations from habitats with growing seasons in excess of 180 days. *Prunus serotina* exhibited the greatest differences in weight with a Quebec, Canada population averaging 15.1 g/100 dry fruit compared with a southern Kentucky population average of 6.2 g/100. Fruit weight patterns tend to show trends of productivity that correlate with other studies indicating differences in ecosystem energetics.

(350)

Effects of Various Phenylpropanoid Compounds (Plant Phenolics) on Lettuce Seed Germination and Growth of *Avena* Coleoptiles

FREDERICK T. WOLF, RONNIE H. TILFORD
AND MITZI MARTINEZ
Vanderbilt University

Effects of several cinnamic acid derivatives upon the germination of light insensitive seeds of lettuce, *var. Black Seeded Simpson*, were studied. Germination percentages were recorded after 2 days. A number of these compounds (including caffeic, chlorogenic and sinapic acids) were completely non-inhibitory at concentrations equivalent to upper limits of their solubility. Others (including *o*-coumaric acid, *p*-coumaric acid, and ferulic acid) resulted in 50% inhibition of germination at concentrations ranging from 0.05 to 0.2%.

Effects of these same compounds upon the elongation of segments of 4-day old dark-grown *Avena* coleoptiles, *var. Clinton*, were studied in the presence of sucrose (2%) and IAA (5×10^{-6}). Some of the compounds proved to be inhibitory to growth at all concentrations tested. Others resulted in enhancement of growth over that resulting in controls. The significance of these results will be discussed.

(26)

Reproduction and Growth of the Snail, *Helisoma trivolvis* (Gastropoda: Planorbidae) in a Reactor Cooling Reservoir

DOUGLAS H. WOOD
Savannah River Ecology Laboratory

Helisoma trivolvis, an aquatic pulmonate snail, was present year-round in the discharge arm of Par Pond on the Savannah River Plant, South Carolina, where it produced three generations during 1975. Growth and spawning of *Helisoma* was synchronous with that of snails of the same species living 4 km. distant, despite a consistent 5°C difference in water temperature between the two locations. Relative growth rate, estimated from size frequency data, varied with temperature, exhibiting a Q_{10} of 2.1, yet growth of snails in the discharge was slower at any given temperature than growth of snails in ambient waters. This shift in the growth-temperature curve was such that growth rates at the two locations were the same at a given time of the year. Adaptation of growth rate to temperature has resulted in synchrony of development and thus, of reproduction between two populations of snails inhabiting thermally different environments.

(69)

Archaic and Recent Vegetative Changes on
McGregor Range, New Mexico

J. T. WYATT

U.S. Army Environmental Hygiene Agency

The great sea of pristine grasses of the 1850's in the lower Tularosa Basin was not exactly one vast unbroken plain. Previously disturbed sands allowed dune intrusion onto Otero Mesa foothills that have supported unique stands of *Juniperus monosperma* for at least the last 300 years. Other evidence of instability before European settlement includes lines of older sand dunes whose tops are often littered with remains of campfire rock, potsherds, flint chips, and other Indian artifacts. However, most of the valley floor grasslands was probably lost between 1880-1920 due to widespread overgrazing. The basin is now "shrub dominant" with many areas being almost devoid of grasses. McGregor's valley floor has now had 20 years protection from livestock grazing, and there has been noticeable restabilization in places. Limited grass regrowth is apparent, and mesquite invasion appears halted. Black grama grass (once dominant) is virtually absent and has been mostly replaced by dropseeds (*Sporobolus* spp.). Complete grassland recovery seems unlikely.

(349)

Effects of Ionizing Radiation Upon Growth and
RNA Synthesis in Lettuce Seedlings

LYNN P. YEALY AND B. P. STONE

Austin Peay State University

The effects of ionizing radiation on hypocotyl and root elongation and the interactions of gibberellic acid, 5-fluorouracil, ethionine, and methionine with ionizing radiation will be discussed. Gamma-irradiation retarded hypocotyl and root elongation. The ionizing radiation effects on growth and RNA synthesis was more severe in the presence of 5-fluorouracil.

(205)

Persistent Soft Water Planktonic Protozoans

WILLIAM H. YONGUE, JR., J. D. MILLER,

AND A. L. BUIKEMA, JR.

Virginia Polytechnic Institute and State University

Ten plankton sample collections were made during the period April through July 1975 from a softwater Appalachian pond. These were subsampled for the presence and relative abundance of protozoan species. Of 59 species observed, 15 (25%) were seen continuously for seven or more of the periods. Nine species (15%) were present in every sample and with the exception of one, a ciliate, they were chromatophore-bearing flagellates. The nine species were: *Dinobryon sertularia*, *Euglena rubra*, *Phacus torta*, *Phacus curvicauda*, *Trachelomonas hispida*, *Trachelomonas volvocina*, *Peridinium tabulatum*, *Peridinium cinctum*, and *Codonella cratera*. Such results provide supporting evidence for the relative stability of freshwater protozoan communities.

(113)

Seasonal Decay Dynamics of *Vallisneria*
americana Michx. in an Estuary

C. D. ZAMUDA, G. J. DAVIS, T. M. VICARS,

AND M. M. BRINSON

East Carolina University

Seasonal rates of inorganic and organic matter losses were determined for *Vallisneria americana* Michx. as part of a continuing study of the role of aquatic macrophytes in the ecology of the Pamlico River, N.C. estuary. Plants were harvested seasonally from two dissimilar locations maintained submerged in nylon bags (mesh = 1mm) with a littoral and midriver decay site at each area.

The upriver harvest area was characterized by dense plant beds and low salinities (0-5 ‰) while at the downriver area plants were less dense and exposed to higher salinities (2-11 ‰). Summer decay was rapid with as much as 70% of organic material lost within the first two weeks.

Newly harvested plants had maximum levels of inorganic nutrients in winter: N, 4.3% (organic dry weight); P, 0.6%; Ca, 0.5%; Mg, 0.4%; K, 3.7%; and Na, 2.3%.

During decay N and P remained essentially constant or gradually increased on the basis of organic dry weight remaining. Na and K levels fluctuated, with concentrations increasing in spring and decreasing throughout the other seasons. Ca levels initially increased and then generally decreased while Mg remained constant except for a summer decline. — *This research was supported in part by a grant from the Water Resources Research Institute of the University of North Carolina.*



Guest Lecturer for the 37th Annual Meeting of the Association of Southeastern Biologists

The guest lecturer for the general session of the 37th Annual Meeting of ASB in New Orleans is Dr. Wes Jackson, Professor of Environmental Studies at California State University. He is presently in his second year of a two year leave of absence taken for the purpose of carrying out a unique experiment which was described in the January issue of the ASB Bulletin.

Dr. Jackson received his AB degree in Biology from Kansas Wesleyan College, his MA degree in Botany from the University of Kansas, and his Ph.D. degree in Genetics from North Carolina State University. He taught at Kansas Wesleyan College before becoming the first chairman of the Environmental Studies Center at California State University. He is the author of a widely adopted text, "Man and the Environment," published by Wm. C. Brown Company (2nd Ed., 1973).

Dr. Jackson has served as a member of a design team and participant in a statewide educational television course on the preparation and evaluation of environmental impact statements to satisfy both the NEPA standards and California law. In addition, he has served as the proposal writer and project director of the Lake Tahoe Environmental Education Project. A consortium of seven institutions are participating in this project. He is presently engaged in obtaining quantitative data on the costs for moving into a subsist-



ence life system and in recording the reactions of his family to the promises and problems of such a life. His forthcoming lecture, "Toward an Ecological Ethic," is derived in part from this project.



Madeline P. Burbank



Joseph C. O'Kelley

ASB Candidates for Office — 1976

The Nominating Committee, composed of Robert B. Short, C. W. Hart and Chairman David Cotter, has selected the following slate of nominees for the various ASB offices that will be vacated this year. Voting will take place at the Business Meeting, Friday, April 23. Additional nominations may be made from the floor.

- President-Elect:* — Madeline P. Burbank, Emory University
Joseph C. O'Kelley, University of Alabama
- Vice-President:* — Edward E. C. Clebsch, University of Tennessee
Franklin F. Flint, Randolph-Macon Woman's College
- Secretary:* — Jerry M. Baskin, University of Kentucky
Gary E. Dillard, Western Kentucky University
- Executive Committee:* — Alan G. Heath, Virginia Polytechnic Institute and State University
J. Frank McCormick, University of Tennessee
Rudolph Prins, Western Kentucky University
Richard Stalter, St. John's University

Biographical sketches of the candidates follow.

Madeline P. Burbanck
(President-Elect)

Dr. Burbanck received the B.A. and M.A. Degrees in Botany from Wellesley College and the Ph.D. from the University of Chicago in 1941. She was a member of the Biology faculty at Drury College from 1944 to 1950, and has held various positions at Emory University since 1956. Her major research interests are in the plant communities of granite outcrops, and in the comparative morphology and cytology of the estuarine isopod *Cyathura*. She has authored a number of papers on each of these subjects.

Dr. Burbanck is a member of the American Association for the Advancement of Science, Ecological Society of America, Sigma Xi (Secretary of the Emory Chapter since 1973), Southern Appalachian Botanical Club (President 1973-74), and the Southeastern Estuarine Research Society. Dr. Burbanck is best known to members of ASB as its first and only Archivist (since 1965) and as Vice-President 1975-76.

Joseph C. O'Kelley
(President-Elect)

Dr. O'Kelley, Professor of Biology at the University of Alabama, received the A.B. and M.A. degrees from The University of North Carolina, and the Ph.D. from Iowa State University. He was an NSF Post-Doctoral Fellow at the University of Wisconsin in 1953 and an NIH Special Fellow at the Johns Hopkins University in 1965. He has been on the Faculty of the University of Alabama since 1951 and served as Biology Department Chairman from 1969-73.

His teaching interests include general biology and cellular biology. His research interests are in the general area of algal physiology.

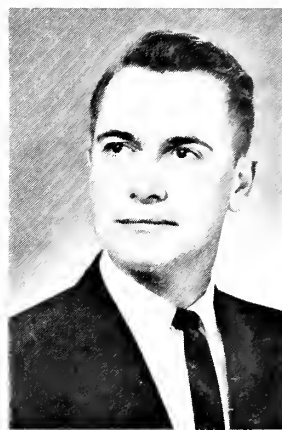
He has served as a member of the ASB Travel Awards Committee (1963-65). In 1970 he was co-recipient of the ASB Meritorious Research Award. Subsequently (1971-73) he served as a member of the Meritorious Research Award Committee of ASB. He is currently a member of the ASB Executive Committee and Chairman of the Place of Meeting Committee.

Edward E. C. Clebsch
(Vice-President)

Dr. Clebsch is Professor of Botany and a member of the Graduate Program in Ecology at the University of Tennessee in Knoxville. He received A.B. and M.S. degrees from that institution and the Ph.D. degree from Duke University. His research interests are in the ecology of the southern Appalachians, Aleutian phytogeography, mineral cycling, and the evolution of disjunct populations. He is a member of several professional organizations, and is a Fellow in the American Association for the Advancement of Science. He was first a member of



Clebsch



Flint



Baskin



Dillard

ASB in 1949, and has served on its Awards, Conservation, and Executive committees.

Franklin Ford Flint
(Vice-President)

Dr. Flint is Charles A. Dana Professor of Biology and Chairman of the Department of Biology at Randolph-Macon Woman's College. He received his B.S. degree from Lynchburg College and his M.S. and Ph.D. degrees from the University of Virginia.

His current research interests are in the ultrastructure of the angiosperm embryo sac. He was a Research Associate with the late Donald A. Johansen of California, with whom he published. He has had research grants from the American Philosophical Society, the American Academy of Arts and Sciences, and the National Science Foundation.

He was a Fulbright-Hayes Senior Research Scholar at Estacao Agronomica Nacional, Oeiras, Portugal, in 1964-65. He was President of the Lynchburg Sigma Xi Club

in 1965-66. He was Staff Biologist to the Commission on Undergraduate Education in the Biological Sciences (CUEBS) in 1968-69. He was also Research Professor of Biology at George Washington University in 1968-69. He was President of the Virginia Academy of Science in 1972-73 and a member of the Council of AAAS in 1972. He serves on the Board of Directors of the Virginia Science Museum Foundation, Inc., and is currently its vice president. He is a member of the Board of Directors of the Virginia Chapter, The Nature Conservancy, the Soil and Water Conservation Districts, and is currently the Director of Area 5, Virginia Association of Conservation Districts. He has been a member of the Education Committee of AIBS since 1973 and was a member of the Botanical Society of America Council in 1974-75. He was secretary of the Teaching Section of the Botanical Society of America in 1974-75 and is currently the vice chairman and program director of that section. He was elected a Fellow of the AAAS in 1972 and of the VAS in 1975.

He has been a member of the ASB since 1952 and served as chairman of its Standards Committee during 1969 to 1972. He was the Association's representative to the Governing Board of AIBS from 1970-73.

Jerry M. Baskin
(Secretary)

Dr. Baskin, Associate Professor of Biological Sciences at the University of Kentucky received his B.S. degree from Union University (Jackson, Tenn.) in 1963 and his Ph.D. degree from Vanderbilt University in 1967. Additional studies were undertaken at the University of Costa Rica (OTS), University of Florida, and Oak Ridge Associated Universities. His major research interest is plant autecology, and he has published a number of papers in this area. He is a member of the Botanical Society of America, the Ecological Society of America, the Torrey Botanical Club, the Southern Appalachian Botanical Club, the Tennessee Academy of Science and Sigma Xi. He recently served the Association of Southeastern Biologists as Chairman of the Travel Awards Committee.

Gary E. Dillard
(Secretary)

Dr. Dillard, Professor of Biology at Western Kentucky University, received B.A. and M.S. degrees in Botany from Southern Illinois University, Carbondale, in 1960 and 1962 and the Ph.D. from North Carolina State University in 1966. He was Assistant Professor of Botany at Clemson University from 1965 until 1968. He has taught at the Tech Aqua Biological Station and served as a Visiting Investigator in Phycology at SIU, Carbondale, and the University of Montana Biological Station. His research interests are freshwater algal systematics and ecology.



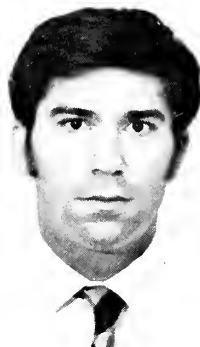
Heath



McCormick



Prins



Stalter

Gary has been a member of ASB since 1965 and was co-chairman of the 1973 meeting in Bowling Green. He is presently serving as a Member-At-Large on the Association's Executive Committee.

Among other professional memberships are the Phycological Society of America, International Phycological Society, American Microscopical Society, Botanical Society of America, Southern Appalachian Botanical Club, Sigma Xi, and Kentucky Academy of Science.

Alan G. Heath
(Executive Committee)

Dr. Heath received the B.A. degree from San Jose State University in 1958 and the M.S. and Ph.D. degrees from Oregon State University in 1961 and 63 respectively. He was an NIH postdoctoral fellow at the Institute of Marine Science, Miami, Florida and then joined the biology department of Virginia Polytechnic Institute and State University in 1964. He is currently associate professor of zoology at VPI&SU. He spent 1970 in England as a USEPA Special Research Fellow at the University of Bristol. Dr. Heath's research interests are environmental physiology of aquatic animals. Currently he is working on the respiratory adaptations of aquatic

salamanders and the physiological responses of fish to water pollutants.

Dr. Heath is a member of the American Society of Zoologists, AIBS, Ecological Society of America, AAAS, Nature Conservancy, Audubon Society, Sigma Xi, and a member of the ASB since 1965. He was chairman of the local arrangements committee for the ASB 1975 Blacksburg meeting.

J. Frank McCormick (Executive Committee)

Dr. McCormick is Director of the Graduate Program in Ecology and is Professor of Botany at The University of Tennessee. He received his B.S. degree from Butler University and his M.S. and Ph.D. degrees from Emory University. Previous positions include Assistant Professor of Biology at Vanderbilt University, Assistant Professor of Zoology at the University of Georgia, and Professor of Botany at The University of North Carolina. He is currently the Secretary of the Ecological Society of America, a member of the Natural Resources Council of America, and a United Nations and World Health Organization consultant to the government of Mexico to assist in environmental planning.

Research interests include the population dynamics and evolution of plant species, physiological ecology and environmental impact assessment. Recent activities include directing courses in the AAAS-NSF Chautauqua Program and serving on National Academy of Sciences Committees which have assessed the ecological impacts of a proposed SST fleet, engineered storage of nuclear wastes, and global effects of nuclear war. He is a member of the ASB Conservation and Research Award Committees.

Rudolph Prins (Executive Committee)

Dr. Prins, Professor of Biology at Western Kentucky University, received his B.A. degree from Calvin College, Grand Rapids, Michigan in 1958, M.A. degree from Western Michigan University in 1962 and, after 3 years experience in high school teaching, returned to graduate school and obtained his doctorate from The University of Louisville in 1965.

He was Assistant Professor of Zoology at Clemson University from 1965-1968 at which time he joined the staff at Western Kentucky University. He has taught several summers at the University of Oklahoma Biological Station and Tech Aqua Biological Station in Tennessee.

Rudy is a member of the American Society of Limnology and Oceanography, International Association of Theoretical and Applied Limnology, The Society of Systematic Zoology, The American Microscopical Society, Sigma Xi, and a Fellow in the AAAS. He has been a member of The ASB since 1963 and has served on the Place of Meeting Committee twice (including currently).

He has been the Secretary of the Kentucky Academy of Science since 1972.

His current research interests are in the area of experimental ecology relating to aquatic invertebrates.

Richard Stalter (Executive Committee)

Dr. Stalter is Associate Professor of Biology and Director of the Environmental Studies Program at St. John's University. He received his B.S. degree from Rutgers University, his Masters Degree in Botany from the University of Rhode Island, and his Ph.D. from the University of South Carolina in Biology in 1968. He has taught at High Point College and Pfeiffer College in North Carolina.

Dr. Stalter is a member of Sigma Xi, Phi Sigma, American Men of Science, Ecological Society of America, Botanical Society of America, Southern Appalachian Botanical Club, South Carolina Academy of Science, the Northeastern Weed Science Society, and a member of the Association of Southeastern Biologists since 1968. He has reviewed articles for four different scientific journals and reviewed a grant proposal for N.S.F.

His research interests include salt marsh ecology, sand dune ecology, the coastal maritime forest in South Carolina, and floristic work on Long Island. He has served as an ecological consultant for various engineering companies and has prepared a dozen ecological impact statements. An author of over fifty articles and abstracts, Dick also finds time to play rugby, has advised five separate clubs at St. John's University, and is active in conservation activities.

Cover Photographs Needed

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 x 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

Emeritus Membership

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg*, Carolina Biological Supply Company, Burlington, N.C. 27215.

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Position vacant

Georgia — Fred K. Parrish, Georgia State University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Maurice Whittinghill, University of North Carolina at Chapel Hill

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

The following grants have been received by members of the Department of Biology, University of Alabama, Birmingham: **Dr. Charles P. Dagg**, "Effects of Chemical Agents on the Development of the Reproductive Tract in Female Mice"; **Dr. Gary R. Poirier**, "Effects of Chemical Agents on the Development and Function of the Male Reproductive Tract"; **Dr. Charles G. Crispens**, "The Role of Corticosteroids in SJL/J Neoplasia."

From the Department of Botany and Microbiology, Auburn University, we have the following news: **Richard L. Garnas** has been appointed as a postdoctoral Research Associate. His Ph.D. is from the University of California-Davis with expertise in agricultural chemistry relevant to the metabolism of xenobiotics in freshwater and marine aquatic ecosystems. He will be headquartered at the Gulf Breeze Environmental Research Laboratory, Sabine Island, Gulf Breeze, Florida and will conduct research studies on the fate and effects of pesticides in salt marsh ecosystems. **Dr. R. Rodriguez-Kabana** was an invitational speaker at an international symposium on bean diseases at the Center for Tropical Agricultural Research at Cali, Colombia, South America, December 1-7, 1975. While there he served also as a representative of the Editorial Committee of the Organization of Tropical American Nematologists and presented a research paper on "Halogen-Silver Staining Techniques for Demonstrating Cuticular Details of Nematodes" at the Caribbean Division of the American Phytopathological Society. Two faculty members have received editorial appointments to international journals: **Dr. Paul A. Backman** as an Associate Editor of the *Plant Disease Reporter* and **Dr. Bryan Truelove** to the editorial committee of the Weed Science Society of America journal, *Weed Science*.

Dr. Kenneth Lewis (Ph.D., University of Ohio) has been appointed Assistant Professor of Biology in the Biology Department of the University of Alabama in Huntsville. His areas of expertise are Plant Ecology and Plant Taxonomy/Biosystematics. **Dr. Samuel Campbell** of the University of Alabama-Huntsville has received an NSF Matching Fund Equipment Grant totalling \$20,000 toward the acquisition of a liquid scintillation

counter, refrigerated work chamber, electrophoresis equipment, respiratory function equipment and a number of accessories.

Grants to the Department of Botany, the University of Georgia are: **Dr. W. Marshall Darley**, \$93,000 from the National Science Foundation for a project entitled "Carbon Flux Through the Benthic Algal Community of a Georgia Salt Marsh"; **Dr. Clanton C. Black**, \$43,300 from National Science Foundation Matching funds toward the purchase of an electron microscope. During the summer of 1975, **Dr. Samuel B. Jones** of the Department of Botany, University of Georgia, conducted research on Compositae: Tribe Vernoniaeae at the Royal Botanic Gardens Herbarium in Kew, England.

Dr. Harvey H. LaFuze will retire in May 1976 following 37 years of service to higher education with 34 years as Chairman of the Department of Biological Sciences, Eastern Kentucky University. He has been instrumental in the designs of two modern science buildings and the organization of many degree programs at Eastern Kentucky University and other universities throughout Kentucky.

Dr. Stephen A. Whipple has been appointed to the newly created position of plant ecologist in the Department of Botany, Louisiana State University, Baton Rouge. **Dr. Whipple**, who completed his Ph.D. at Colorado State University, will be developing a research program entailing the study of vegetation structure and dynamics, plant population dynamics and quantitative techniques of vegetation analysis. **Dr. Whipple** plans to re-vamp the existing plant ecology course, as well as introduce new courses in both plant ecology and allied subjects at the undergraduate and graduate levels. Grants awarded to members of the faculty at Louisiana State University, Baton Rouge are: **Dr. Meredith H. Lieux**, Department of Botany, has been awarded a Department of Health Education Welfare/National Institute of Health grant for continuation of her pollen studies in the southeastern United States and for her project, "A Descriptive Catalog of Modern Pollen of Louisiana Plants Section 1: Trees, Shrubs and Woody Vines"; **Dr. Nikolaus H. Fischer**, Department of Chemistry and **Dr.**

Lowell E. Urbatsch, Department of Botany, a National Institute of Health grant for isolation and characterization of natural plant compounds from crude extractions which have been shown to exhibit antitumor-activity. Presently, **Drs. Fischer** and **Urbatsch** are concerned with compounds from *Melampodium cinereum* but plan to extend their research to *Polymnia*, *Silphium* and related genera.

Dr. James P. McKeown has been appointed chairman of the Department of Biology, Millsaps College, Jackson, Mississippi.

Dr. James Wolf of the Department of Zoology, Mississippi State University, will be returning from a year's sabbatical to Australia.

Dr. Ritchie Bell has announced that the new H. R. Totten Center has been completed at the Botanical Garden in Chapel Hill, North Carolina. This fine 5,000 square foot structure has been made possible by the generous bequest of **Dr. and Mrs. Totten**. It will be formally dedicated on Sunday afternoon, April 11, 1976 at 2:30 p.m. In connection with the dedication of the Roland Totten Center, several visiting scientists will spend from three days to three weeks in Chapel Hill for lectures, seminars and conferences with students. The visitors are **Dr. T. Ledyard Stebbins, Jr.**, University of California at Davis, **Dr. Sherwin Carlquist**, Rancho Santa Ana Botanical Garden and **Dr. William Steere**, Director of the New York Botanical Garden.

A Symposium on Endangered and Threatened Biota of North Carolina was held on November 7-8, 1975 at Meredith College, Raleigh. The meeting was sponsored by the N.C. State Museum of Natural History, and co-sponsored by the Department of Natural and Economic Resources, the Wildlife Resources Commission, and the Academy of Science. The following individuals held positions of responsibility during the symposium: **Dr. John E. Cooper**, Director of Research and Collections at the State Museum was the Coordinator of the Symposium; **Dr. John B. Funderburg**, Director of the N.C. State Museum; **Dr. Thomas L. Quay**, N.C. State University; **Dr. James D. Williams** of the Office of Endangered Species and International Activities, U.S. Fish and Wildlife Service; **Dr. Robert P. Teulings**, Natural Areas Coordinator for the Department of Natural and Economic Resources.

The North Carolina State Museum of Natural History, Raleigh, has appointed two more southeastern biologists to Associate Curatorships in the Research and Collections Division. **Dr. Thomas L. Quay**, N.C. State University, is conducting studies of seaside sparrow populations, and ecological studies at Cape Hatteras. **Mr. John C. Clamp**, NCSU doctoral candidate, is revising the systematics of the family Lagenophryidae (Protozoa; Peritrichida), and assisting in curating the Museum's invertebrate collections. Both researchers have been assigned office and laboratory space at the Museum.

The following news of faculty activities comes from the Department of Biology, Wake Forest University: **Dr.**

Gerald W. Esch was appointed Chairman of the Biology Department effective July 1, 1975. The previous year, he was on leave at the Savannah River Ecology Laboratory in South Carolina. **Drs. Gerald W. Esch and Ronald V. Dimock** have received a one year grant of \$49,500 to conduct studies on diseases affecting freshwater fish in the southeastern U.S. The study, funded by the Energy Research and Development Administration, will be conducted using the facilities of the Savannah River Ecology Laboratory. The primary effort will be given to evaluating the impact of water temperature and other water quality parameters on the ecology of parasitic organisms which produce disease in the centrarchid fish. **Mr. Dwight Kincaid** of the Biology Department has been awarded the first E. C. Cocke Memorial Research Grant. This grant, given annually, was established in memory of the late **Elton C. Cocke**, Professor Emeritus of Biology at Wake Forest and former Chairman of the department. **Mr. Kincaid**, a Ph.D. student, will use the grant to support his studies on theoretical models and adaptive strategies in pollen and leaves of *Ilex* populations in the southeastern United States.

Since the retirement last year of **Dr. A. J. Sharp**, the bryological interests of the Botany Department of the University of Tennessee have been upheld by **Dr. David K. Smith**. **Dr. Smith** teaches bryology and lichenology within the department and has the responsibility for the bryophyte collections, which is now a professional staff position. **Dr. B. Eugene Wofford** has served for the past year and continues to serve as Curator of the Herbarium. **Dr. C. C. Amundsen**, Associate Professor of Botany at the University of Tennessee, Knoxville, and a member of the Graduate Program in Ecology has received a continuation grant for \$22,695 from the Energy Research and Development Administration for "Dynamics of Recovery of Damaged Tundra Vegetation" which has to do with recolonization of disturbed areas in Amchitka Island of the Aleutians. **Dr. R. H. Petersen**, Professor of Botany, has been awarded a \$31,700 National Science Foundation grant to prepare a taxonomic monograph on the "Genus *Phaeoclavulina* in North America."

The following changes have been made in the Department of Biology, Virginia Commonwealth University: **Dr. Lewis C. Goldstein** has returned to the Biology Department from Associate Dean of the School of Arts and Sciences; **Mr. J. Miles Sharpley** is on a leave of absence; **Dr. Dave Cundall**, **Dr. John J. Ruffolo, Jr.** and **Mr. Edward B. Waldrip** have left the department for other positions. **Dr. Joseph P. Chinnici** has received a grant from the American Cancer Society to study the "Genetics and Biochemistry of Aflatoxin B₁ Resistance in *Drosophila* and Mammals." **Dr. Robert W. Fisher** has received an American Cancer Society grant to study "Control Mechanisms in Cell Division, Differentiation, and Cell-Cell Interaction." **Dr. Fisher** also received a Grant in Aid from Virginia Commonwealth University for \$3091 to study the "Induction of Differentiation in Blue-Green Algae — A Model System."

About Institutions

The **Tech Aqua Biological Field Station** has announced the courses to be offered during two five-week summer terms (June 6—July 10; July 14—August 18) in 1976. Courses include Local Flora, Freshwater Algae, Freshwater Invertebrates, Ornithology and Mycology for the first term. The second term courses are Ecosystem Analysis, Ichthyology, Limnology, Aquatic Microbiology and Biology of the Chironomids. The Tech Aqua program is conducted by a consortium composed of **Tennessee Tech, Middle Tennessee, Belmont, Tennessee State, Trevecca, Sewanee, University of Tennessee-Martin, Vanderbilt and Western Kentucky University**. The field station, a modern campus of 18 air-conditioned buildings, is located on Center Hill Reservoir approximately 60 miles east of Nashville, Tennessee. For information contact **Dr. Robert Martin**, Department of Biology, **Tennessee Tech**, Cookeville, Tennessee 38501.

A new master's program has been initiated at the **University of Alabama-Huntsville**, as a cooperative degree program with **Alabama A & M University**. The student may major in Microbiology, Physiology, Entomology, Molecular Biology, Ecology and Systematics. Also, a new Environmental Sciences wing is almost completed at the **University of Alabama-Huntsville**. It will have an electron microscopy complex, a microbiology teach-

ing laboratory and research area, a mycology research laboratory, plant ecology research complex and organic and environmental research laboratories.

The **Gulf Coast Research Laboratory** at Ocean Springs, Mississippi has announced new courses for the summer of 1976. They are: Salt Marsh Ecology, Marine Ecology and Introduction to the Behavior and Neurobiology of Marine Animals. Many other courses will also be offered including Marine Botany, Marine Chemistry, Physical and Chemical Marine Geology, Marine Invertebrate Zoology and Fisheries Management, Parasites of Marine Animals, Marine Microbiology, Marine Vertebrate Zoology and Aquaculture. Information for the summer terms (June 14—July 9; July 12—August 20) may be obtained from the Director, **Gulf Coast Research Laboratory**, P.O. Drawer AG, Ocean Springs, Mississippi 39564.

Delta State University is in the process of constructing a 50,000 sq. ft. addition to the existing Departments of Mathematics and Physical Science building.

In early September, 1975, the **Biology Department** at **Middle Tennessee State University** reoccupied a portion of the Old Science Building. The building was renovated over the last two years. Accompanying the renovation was the installation of a Zeiss Transmission Electron Microscope, which will be used for teaching and research purposes.

Second Mineral Cycling Symposium Scheduled

The second in a series of Mineral Cycling Symposia sponsored by the Savannah River Ecology Laboratory of the University of Georgia is scheduled for April 28-30, 1976. The Symposium will attempt to assess certain aspects of the "state of the art" in environmental research related to energy production. Emphasis will be on the chemistry and cycling of pollutants from nuclear fuel cycles and non-nuclear energy production. Papers dealing with other aspects of basic cycling processes will also be included. Plans call for six one-half-day sessions. The proceedings will be published. For further information, contact *Dr. D. C. Adriano* or *Dr. I. L. Brisbin*, *Co-Chairmen, Symposium Program and Publication Committees, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina 29801*, or phone 803-824-6331, Extension 2752.

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Time and Place of Future Meetings

1976 April 21-23 Braniff Place (formerly the Jung Hotel), New Orleans
1977 April 14-15 North Carolina State University, Raleigh
1978 April 13-15 University of Alabama, University, Alabama
1979 University of Tennessee, Chattanooga

Change of Address

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail. Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.*

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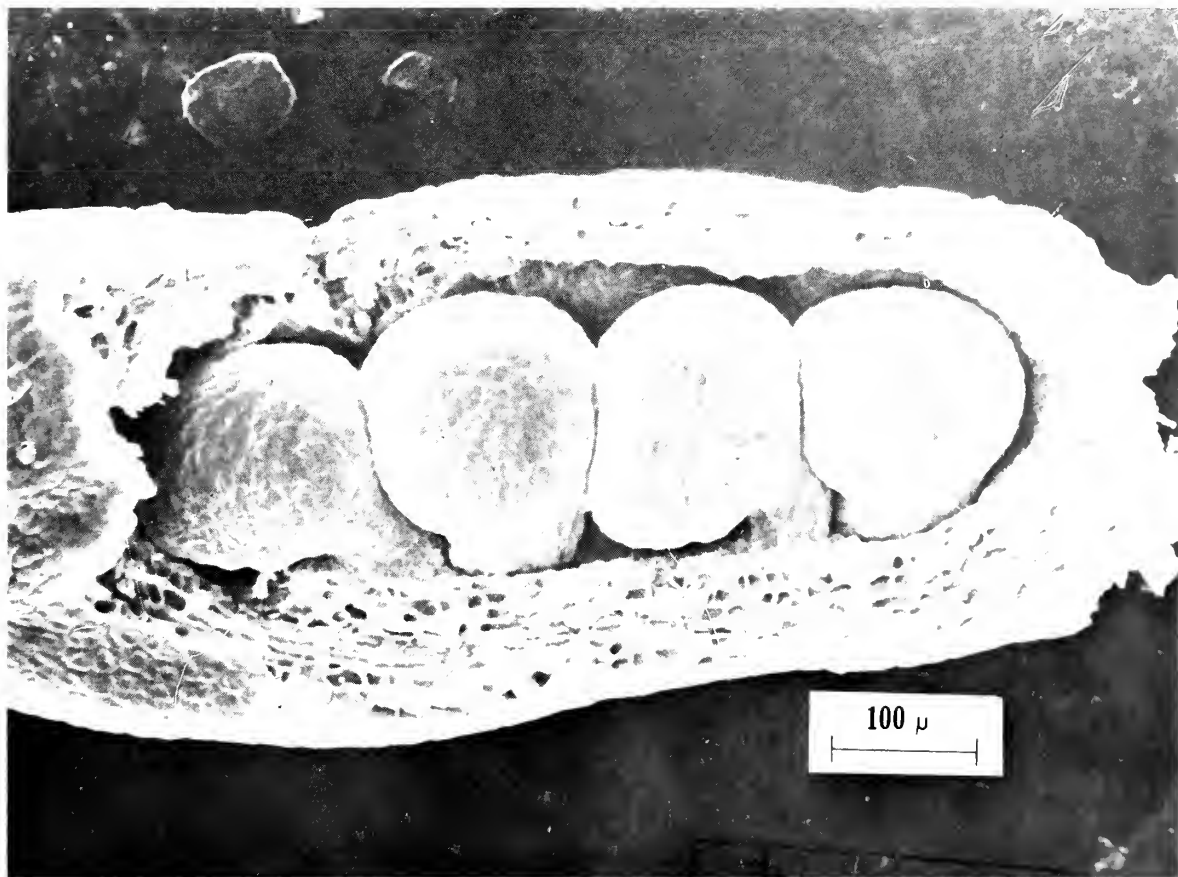


The ASB

BULLETIN

Volume 23, No. 3

July 1976



White Clover Ovules

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

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J. Frank McCormick (1979), University of Tennessee
Rudolph Prins (1979), Western Kentucky University

AAAS Representative, Section C - Franklin F. Flint (1977)

AIBS Representative - John M. Herr, Jr. (1978)

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COVER

Scanning electron microscope photograph of white clover ovules (*Trifolium repens* L.) within the carpel. These ovules have four-nucleate megagametophytes inside. Courtesy of David H. Rembert, Jr., University of South Carolina.

Deadline for October Issue: September 1

Deadline for January Issue: November 1



Toward an Ecological Ethic

WES JACKSON

Director, The Land Institute, Salina, Kansas 67401

Those of us who think about the need for an ecological or environmental ethic should take seriously the wise words of Aldo Leopold who said, ". . . nothing so important as an ethic is ever 'written.' Only the most superficial student of history supposes that Moses 'wrote' the Decalogue; it evolved in the minds of a thinking community, and Moses wrote a tentative summary of it for a 'seminar.'" ¹

No ethic written this evening or tomorrow concerning the environment will be widely accepted. Rather it is for us as colleagues in the "thinking community" Leopold mentioned to do lots of hard thinking about that ethic.

Sizing up the Problem

I will avoid a re-statement of the problems of the environment in checklist fashion. I will also refrain from presenting an extensive literature review of opinion on the causes. Nevertheless, there are a few rather widespread notions of where to lay the blame that we might consider for a moment.

Most of you are familiar with the now-classical paper by the historian Lynn White, "The Historical Roots of Our Ecological Crisis." White takes the philosophical position that "Human Ecology is deeply conditioned by beliefs about our nature and destiny — that is by religion." Christianity doesn't come out so well in that paper for, according to White, we must "reject the Christian axiom that nature has no reason for existence save to serve man." ²

A more thorough-going treatment of the subject was attempted by Theodore Roszak who posited tandem culprits: Christianity *and* Science. Christianity is blamed because of its insistence that all other myths be excluded in favor of one great myth. Science is criticized because it ex-

plains objects in the environment as "nothing but." The mystical essence of objects was removed as Nature was turned over and over in the palm of the hand, in the test tube and on the lab bench. Once the mystical essence had been destroyed or reduced, our old animistic faith with the environment had been broken. The pursuit of reason and objectivity granted mankind power over Nature. ³

The following poem by Galen Rowell is about a bristle cone pine. Named "WPN-114" by a scientist, it illustrates the attitude of which Roszak writes. The pine began life in 2880 B.C. and ceased to exist as a tree on 1964 A.D. — a span of 4844 years.

The ex-Oldest Living
Thing on Earth —
Was ancient when Cortez
Conquered Mexico,
Was bent with years when
Caesar entered Gaul,
Was old beyond memory
when Moses delivered
the Law,
Was Time's patient watch-
man when Cheops built
his pyramid,
Was sliced by a chainsaw
to see how old it was.

Requiescat in Pacem ⁴

It is the pursuit of reason and objectivity which made this tree just an object, in Roszak's analysis. It is a small wonder that an alien and distanced relationship with our environment has developed.

Science is only one culprit. Christianity helped by placing emphasis on the "word," making the "word" central. The altar was symbolically pushed to the side and replaced by the pulpit. The scientific revolution was thus inevitable. In the wake of this revolution, Roszak contends, we find humans stripped of their "sacramental awareness" of nature and their "energies of transcendence" gone. Reason now rules. Reason dictates

* Prepared for the general session at the meeting of the Association of Southeastern Biologists, Braniff Place, New Orleans, La., April 22, 1976.

our politics and economics. The whole man is destroyed and the man of "single vision" reigns.⁵ The reward for the destroyed communion with nature has been power, both power over nature and power over other humans. So goes the Roszak thesis.

Thomas J. Lyon has suggested that the root of our crisis may be a psychic split, actually a problem of brain anatomy.⁵ His touchstone is the somewhat popular book, *The Psychology of Consciousness* by Robert Ornstein, who, in summarizing much research, describes the bilateral specialization of the cerebral cortex.⁶ The left hemisphere of the brain processes information in orderly sequence. Language and logic are at home here. So are our sense of time, our ability to plan, to write, to verify, to reason and to read. On the right side we find specialization for our intuitive sense and altogether non-linear understanding. Our sense of place, ability to see, sing and dream are associated with this right side.

We recognize right away that Western civilization has placed a premium on the things which the left side does well and has diminished the importance of the intuitive and space senses of the right half. Perhaps in our hunting-gathering days, there was more balance in our psychic activity in order to survive in such an environment. But when we began to manage ecosystems through agriculture, more time during the day had to be devoted to the rational, logical side. Lyon suggests that this psychic split and over-emphasis of one side may be construed as responsible for the human condition of alienation from the environment.

These are but three accounts of the many efforts to size up the problem. Personally, I would be somewhat reluctant to blame either the Judaeo-Christian ethic or Science for the demise of the planet. The Genesis statement on dominion does appear early in the *Holy Bible* and therefore likely was read more often than statements which spoke to alternative relationships to nature. To be sure, scientists have treated objects in the environment as "nothing but," taking a very mechanistic view of nature, but destruction was underway before either the Judaeo-Christian influence or science as we know it came on the scene. After all, Plato lamented the sorry con-

dition of the mountains of Attica, a once prosperous region only "fit for bees" by his time.⁷ Finally, to explain the whole of the human condition as the consequence of a fragile connection between the brain hemispheres seems a bit much.

A Look to Some Eastern Religions for Help

Whatever the cause of our growing alienation from nature, many in our society are responding by developing an interest in some of the religions of the East, religions which we faintly recall have a strong dose of nature worship and are therefore worthy of examination. To be sure, the Shinto religion of the Japanese was originally a form of nature worship. But Buddhism is especially attractive to many environmentalists, particularly those who see consumerism as the heart of the ecological problem. Buddhists believe we are sad because we thirst for things, and when we have accumulated things we become their slaves. So long as we desire possessions, we are prevented from attaining knowledge and insight. (For a splendid treatment of Buddhist economics, see the now popular book, *Small is Beautiful, Economics as if People Mattered*, by the British economist, E. F. Schumacher.)⁸

The religion of the East of which we seem to hear more and more in our search is Taoism, one of the three great religions of China. Tao rules heaven, heaven rules earth, and earth rules man. All are designed to move in harmony, except that man has upset this harmony by substituting his own designs. Tao is "the way" which man can only know if he returns to a life of humility and simplicity. He can find peace and harmony only by returning to nature.

So it would seem that we could take our pick of the ethical systems already instituted long ago by the religions of the East. Perhaps there is no need for a "thinking community" to evolve an ecological ethic. Like most solutions, however, there is at least one major flaw. For in spite of the fact that Eastern cultures often did practice their beliefs, and that officials did encourage harmony with nature, they did so when in Tuan's words, "it did not conflict with the urgent needs of the moment."⁹ Rene Dubos goes so far as to say that the "Chinese attitude of respect for nature probably arose, in fact, as a response to the

damage done in antiquity.”¹⁰ The British scientist and historian, Joseph Needham, has shown how the Chinese used technology destructively long before the West had equaled China in scientific and technological development, which wasn't until the 17th century.¹¹ Even the Buddhists contributed to deforestation to build their temples. In some places they used more than half the available timber.¹² Finally, the classic nature poets of China, writing as though they had achieved identification with the cosmos, were, it turns out, retired bureaucrats living on estates in which gardeners trimmed and managed local nature.¹⁰

Since these religions arose after much destruction, their relative ineffectiveness when “urgent needs were upon the people,” causes one to wonder how much they have to contribute to our “thinking community,” only lately worrying about similar problems in the West. I believe we *cannot* turn exclusively to the religions of the East for profound guidance; we must do some creative thinking on our own.

The Fall of Man Revisited

To begin this creative process, I suggest a revisit of the “fall of man.” The Genesis account, you will recall, is one in which an explicit commandment was given by God. The first humans disobeyed, and, according to some, for that error we still pay. Much of the human condition is the consequence of this act.

There is another “fall of man” story — a modern one — relevant to our situation. A few years ago on the last page of *Life Magazine*, I saw a memorable photograph of a near-naked and well-muscled tribesman of Indonesian New Guinea, staring at a parked airplane in a jungle clearing. The caption read something to the effect that the Indonesian government was attempting to bring these savages into the money economy. They had set up a stand on the edge of the jungle and reportedly were doing a brisk business in beer, soda pop and tennis shoes.

We can imagine what must have followed, what the wages of their sin, *their* fall, must have been — decaying teeth, anxiety in a money system, destruction of their social structure. If they were

like what we know of most so-called primitive peoples, in spite of a hierarchial structure, they had a much more egalitarian society than industrialized people today.¹³

The New Guinea tribesmen did not receive an explicit commandment to avoid the “goodies of civilization,” unlike Eve, and later Adam, who partook of the tree of knowledge (something for us academics to ponder). They were simply *unwittingly accessible* to the worldly items of beer, soda pop and tennis shoes.¹⁴ In the Genesis version, the sin involves disobedience, an exercise of free will. In the latter, the “original sin” is our very nature, our unwitting accessibility to the material things of the world.

And now, for a third rendition of the fall of man. This is another modern story, perhaps a parable for our time. Several years ago, I saw a newspaper account of the recent life of Edwin “Buzz” Aldrin, Jr., an astronaut who walked on the moon. After his adventures, he told of the pressure to accomplish and excel in the space program. He discussed the anxieties, the rivalry, the internal politics, all the common human problems which became exacerbated among those attempting the greatest technological adventure of all time. “Our profession requires constant study and work. It was too competitive to get behind,” Aldrin said. Some time after his return and the around-the-world public relations trip, Aldrin recognized that his mental health was in jeopardy and spent a month in a hospital undergoing psychiatric treatment. But there is a stunning end to the story. In spite of the terrific psychological turmoil, he has said that he would do it all over again.

In the Genesis account, Eve and Adam and all of humanity to follow had no choice as to their way of life after the forbidden fruit was taken. The New Guinea tribesmen, unwittingly accessible and lacking much of an overall perspective, doubtlessly became technological junkies with all the attendant problems. They likely stayed hooked. Is the story of Buzz Aldrin the analog for modern humanity? We know we have broken from an intimate association with nature. As a people we associate less with trees, grass, pure water, things warm and human, and more and more with cars, TV sets and chemical feasts. We

make the comparison, acknowledge the psychological turmoil of the modern way and say it is too bad. But the TV set gets a higher rating than a sunset and all that remains healthy is the GNP.

What Kind of a Creature is This?

When we think about our problem with ourselves and with nature, we become perplexed and ask, "What kind of a creature is this?", almost within a mood that suggests we aren't talking about humans, but about some other species. And of course, as soon as we ask that question, we have asked the oldest religious question, "What is man?"

There are lots of answers to this question, and they have to do with where we begin in time, and what dimension of humanity we speak about. If we go way back into our origins, we can picture ourselves as beautiful children of the universe along with all other living things. Here is how Nobel laureate and biologist George Wald describes us:

We living things are a late outgrowth of the metabolism of our Galaxy. The carbon that enters so importantly into our composition was cooked in the remote past in a dying star. From it at lower temperatures nitrogen and oxygen were formed. These, our indispensable elements were spewed out into space in the exhalations of red giants and such stellar catastrophes as supernovae, there to be mixed with hydrogen, to form eventually the substance of the sun and the planets, and ourselves. The waters of the ancient seas set the pattern of ions in our blood. The ancient atmosphere molded our metabolism.¹⁵

Beautiful! What a beginning!

We don't fare so badly either when we describe ourselves as higher primates, having been around some 2 to 3 million years or so. We have had this large brain for some 200,000 years. Continuing forward, Cro-magnon was here by 30,000 years ago. Indeed, we were hunters and gatherers until some 8 to 10 thousand years ago. Think of it: for some 95% of our total evolutionary history with the big brain, we gathered and hunted and fished in what we would recognize today as mature ecosystems. Aside from causing the extinction of some significant megafauna,¹⁶ we were a species pretty well-integrated with our surrounding environment. To this point we still might

regard ourselves as that innocent child of the universe.

Our age of innocence ended with the advent of agriculture, that period 8 to 10 thousand years ago when the greatest set of revolutionaries the earth has known began to change the face of the earth. The revolutionaries gave us essentially all of our crops and domesticated animals. Since then, very few ones have been added. With that revolution came the large immature ecosystems, the monoculture, and maybe for the first time, the epidemic. Because immature ecosystems have an excess of potential energy, that revolution eventually gave us civilizations which ran along on what Georgescu-Roegen¹⁷ calls our "terrestrial dowery," usually with a decline in that dowery.

However it began, it seems likely that the agricultural enterprise began unwittingly with no explicit warning that some agriculture promotes more agriculture in the same way that some consumer items such as beer, soda pop and tennis shoes promotes the need for more beer, soda pop and tennis shoes. Eventually man took over much of the role of nature and now a new thing had appeared on the earth, at least in a magnitude unknown till now: the substitution of enterprise for patience. Man began to reward enterprise as nature continued to reward patience. Innocence now began to fade. From agriculture on, the slide toward mine dependence was simply a matter of enterprising man using his clever brain — usually with more cleverness than wisdom.

I think it is important for us to remember that it all began in innocence rather than sin. If modern day tribesmen were accessible to the beer, soda pop and tennis shoes, even while they were living within the context of the system which had shaped both their bodies and their psyches, why should it be at all surprising that "out-of-context" hunters and gatherers with backs bent by agriculture would be accessible to the promises of coal, oil and natural gas?

And now I must pause, for if the description of what we are stops here, *Homo sapiens* is only half-described. The other half, of course, is that we are a species capable of creating and manipulating symbols, a creature who, William Blake insisted, "must and will have some religion."¹⁸

We are a species whose existence seems to be as dependent upon the opportunity to rise to creative and religious heights as it is dependent upon the opportunity to breathe good air and drink good water. And then there is the most sobering thought of all; we seem to be matter's way of having gained self-recognition, at least for this solar system. If we fashion a do-it-yourself extinction, it will be a long time before matter can recognize itself again, at least in this part of the universe.

What kind of creature are we? Hunters and gatherers out of context. Enterprising! (Perhaps enterprising because we are out of context.) What is man? A creature born more in innocence than in sin. Accessible to the products of the earth that our clever minds can fashion. A symbol-maker and manipulator of symbols. A creature who "must and will have some religion."

Four Proposals

All of these considerations must be background for a "thinking community" out of which an ecological ethic can evolve. No modern day or future Moses, conducting a seminar in which our ethic becomes summarized, dares ignore this totality.

I have four proposals to contribute to this segment of the "thinking community" — proposals which I think can help us toward the evolution of an ecological ethic. These four proposals very much involve us both as individuals and as biologists. I have stressed that our fall with agriculture and our continued tumble into the making of civilizations and the exploitative industrial state happened innocently. *I have not done this for the purpose of suggesting that we return to hunting and gathering.* Far too much has gone through the turbines for that to happen.

In spite of my contention that we were born in innocence, we need to remember that there comes a time in the life of an innocent child when innocence leads to disruption or destruction in the home that parents will not tolerate. Eventually, the child must develop the point of view of the parents.

The age of innocence for humanity is over. It is time to ask, almost prayerfully, "What would the system have us do in order to preserve and

maintain the long-term ability of the system to support a variety of life and culture and maximize options for future generations?" So my first proposal is that we begin to develop the point of view of the life support system.

I first began to think about this in earnest after reading Aldo Leopold's essay on "Thinking like a mountain."¹

"A deep chesty bawl echoes from rimrock to rimrock, rolls down the mountain, and fades into the far blackness of the night. It is an outburst of wild defiant sorrow, and of contempt for all the adversities of the world.

"Every living thing (and perhaps many a dead one as well) pays heed to that call. To the deer it is a reminder of the way of all flesh, to the pine a forecast of midnight scuffles and of blood upon the snow, to the coyote a promise of gleanings to come, to the cowman a threat of red ink at the bank, to the hunter a challenge of fang against bullet. Yet behind these obvious and immediate hopes and fears there lies a deeper meaning, known only to the mountain itself. Only the mountain has lived long enough to listen objectively to the howl of a wolf.

"Those unable to decipher the hidden meaning know nevertheless that it is there, for it is felt in all wolf country, and distinguishes that country from all other land. It tingles in the spine of all who hear wolves by night, or who scan their tracks by day. Even without sight or sound of wolf, it is implicit in a hundred small events: the midnight whinny of a pack horse, the rattle of rolling rocks, the bound of a fleeing deer, the way shadows lie under the spruces. Only the ineducable tyro can fail to sense the presence or absence of wolves, or the fact that mountains have a secret opinion about them.

"My own conviction on this score dates from the day I saw a wolf die. We were eating lunch on a high rimrock, at the foot of which a turbulent river elbowed its way. We saw what we thought was a doe fording the torrent, her breast awash in white water. When she climbed the bank toward us and shook out her tail, we realized our error: it was a wolf. A half-dozen others, evidently grown pups, sprang from the willows and all joined in a welcoming mêlée of wagging tails and playful maulings. What was literally a pile of wolves writhed and tumbled in the center of an open flat at the foot of our rimrock.

"In those days we had never heard of passing up a chance to kill a wolf. In a second we were pumping lead into the pack, but with more excitement than accuracy: how to aim a steep downhill shot is always confusing. When our rifles were empty, the old wolf was down, and a pup was dragging a leg into impassable slide rocks.

"We reached the old wolf in time to watch a fierce green fire dying in her eyes. I realized then, and have known ever since, that there was something new to me in those eyes — something known only to her and to the mountain. I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view."

Mountains can relate part of the opinion of the life support system. So can rivers in their angry, muddy, churning every spring when they raise their backs, and within widening and caving banks carry a rich plasma, the ecological capital, the terrestrial dowery, all the way from my area in Kansas to New Orleans and the Gulf. With the prairie sponge nearly gone, thousands of tons of this ecological capital disappear into the Gulf in a year.

The air of our Earth Mother testifies about the earth's condition to the passengers of a jet who look out the window and to the inhabitants of our large industrial cities whose eyes begin to water when they walk out the doors of their homes. The Mother seems to say, "This air sink is too full." And, as if this message is not direct enough, our very cells, having had no evolutionary experience with large numbers of various man-made chemicals, often go wild when Mississippi water is consumed in New Orleans.

We can even say that Mother Earth is telling us through species extinctions and declining populations. These species are like mine canaries to us, as Roger Tory Peterson has said. This is so, of course, because the redwood and the whale, the sunflower and the osprey, and essentially all the rest of the living creation possess the same blueprint approach through the DNA's and the RNA's in assembling the same 20 amino acids. In mechanistic language, the canary is sent into the mine as a highly sensitive instrument. Its similarity to us is what makes it reliable as an instrument, not its difference. Any atmosphere, sufficiently noxious to be wrong for the canary is eventually wrong for us. Through our awareness of this similarity of life forms, Mother Earth effectively says that whatever it is that threatens other species with extinction or serious population decline is also a threat to humans. It is the role of biologists to make this clear to all our students

and to a listening public. I happen to agree with Schumacher that the primary purpose of education is for the transmission of values.⁸

Unwittingly and innocently accessible to our clever devices we have been, and now the message comes back in a thousand ways; however beautiful we children of the earth are, we products of the simian line, however tender a carnivore we claim to be, the Earth Mother simply will not stand much more in the way of extensive species truncation and extinctions for the sake of further increasing the amount of human biomass and wasteful livelihood.

The beautiful child of the home has learned that it is tenderness and not greed which enhances her stature in the family. The beautiful child has learned that it is service to others within the family which generates stability, not exploitative demands. All humans must eventually learn, that this is also the proper relationship with our Earth Mother.

We *can* learn from the earth. So in developing an ecological ethic, we should first develop the point of view of the life-support system. Any standards of conduct which are set by an ecological ethic must be with this point of view in mind.

My second proposal may be highly controversial because of the current disagreement about the value of Sociobiology between Harvard colleagues E. O. Wilson and Richard Lewontin. Nevertheless, I propose that we learn as much as we can about human activity in the environment which shaped us. We spend most of our time peeking into our past through written history, mainly because the history of agricultural man, civilized man, is easily available. But if we take the 5 to 6 thousand years of recorded history and compare it to the 200,000 years that man has existed with the big brain, we are talking about some 2 to 3 percent of the total. I jokingly remind my historian friends that written history is an account of humans during the most abnormal years of the species. If one is interested in abnormal social psychology, he or she studies history.

I think we can learn much about our current and otherwise unexplainable behavior by studying our paleolithic rootedness, the pattern of events in the day and the year in the life of those intelligent hunters and gatherers. Please understand,

this is not for the purpose of discovering a primitive "Be Kind to Nature" ethical system. In fact, I sometimes wonder how important an ecological ethic was for our ancestors, or for that matter how important it is for the few tribes left.

The Kalihari Bushmen are hunters and gatherers, and we can learn about ourselves by observing their lives. Bushmen of the Kalihari like to eat a rather large nocturnal mammal called the springhaas.¹⁹ Capturing and killing this animal causes a complete destruction of the immediate area. When two hunters discover a burrow, they position themselves at opposite ends and begin to dig furiously with long sticks, throwing dirt in every direction. They have only one thing in mind, to capture and kill this animal.

How about an environmental impact analysis with a paragraph or two on impact mitigation for this area? It isn't necessary, of course, for nature does have redemptive powers, and for that area, redemption is carried out by the reproductive pressure of the springhaas population and ecological succession of the vegetation. By the time these or other tribesmen come that way again, the local area likely will have healed. And here is the point: they can afford to take without thought for the morrow, because the long-term ability of the system to support a variety of life and their culture has not been destroyed. The local terrestrial dowery is still there. Even the nutrients tied up in the springhaas will be returned to the general area for recycling. No ecological ethic is necessary so long as the energy input into an area is spent through the arms and legs of the people of the area.

Why should we be so surprised then that the environment takes such a beating? We simply take, as we always have, from the environment, usually without thought. This pattern of behavior is likely deep within our psychological meat and will not be mitigated without internalized pressure from an ethic. Before the fall, when our numbers were few and our tools simple, like the Bushmen, such an ethic was not necessary.

But to return to the main point of this second proposal. Is it not likely that there are some paleolithic urges which need to be satiated, played out, bled off — *now that we are out of context* —

and others which need to be amplified? The total ensemble of our daily activities, I would think, could be enhanced by a discovery of their analogs in the past.

Is it possible that we will one day see our drive to attain status in a hierarchy in order to obtain big cars, big houses, and multitudes of consumer goods as ways of playing out the urges which were needed for survival in our paleolithic past? And isn't it possible that we might invent games or activities to satiate those urges and thereby make the big car and the heavy consumption unnecessary? But I realize that I am treading on dangerous ground. Yet, as the debate about Sociobiology continues, I shall maintain this second proposal: to learn as much as possible about life in the environment which shaped us.

My third proposal involves the heart of the ethic. This proposal is to place ourselves in positions to maximize our sense of organic inter-relatedness both among members of our own species and other species so that we can know and feel our rootedness in the land.

Guilt and fear may be good motivators for initiating action, but in the midst of seeming plenty they do a poor job at sustaining that action. Shortly before and after Earth Day, 1970, we saw a flourish of eco-activity throughout the "respectable" society that, at best, bordered on tokenism. Housewives changed their soaps, hauled their cans and papers to the re-cycling center, turned the thermostats down a little in winter and up a bit in summer. Here and there, a few car pools were tried. School kids pulled old tires out of streams and vowed to have "no more than two." Finally, it mostly died down. Guilt had been satiated, and fear turned to fatalism. Those with "mature judgement" in the society dismissed the whole thing as a fad and let it go at that. It was "business as usual," even in the midst of it all.

During that period, almost every environmental speech ended with "what the individual can do," partly because the guilty and fearful wanted to know. Most of those speeches contained a statement to the effect that the quality of life can improve with a decrease in the consumption of material goods. However, this was such a new idea that it was not really understood or seriously tried

by many. Now we have citizens who are beginning to understand the need for the U.S. to conserve resources but are not personally motivated to decrease their consumption of material goods. And so we are at a new point of departure. From now on, any suggestion as to what the individual can do must have an appeal more like the proverbial carrot before the donkey, rather than the switch behind his rump. We have had, almost exclusively, the negative motivations of fear and guilt before us, but with little success. Maybe it is because the guilty and fearful have caught on that their resource savings will simply get blotted up by the non-guilty and non-fearful.

If we are to try the "carrot" approach, the heaviest burden is on the environmentalist who must suggest alternatives which favorably compete with the large single-unit campers, high-powered motorboats, entire evenings of TV with its advertisements that whet and give license to consumptive appetites, the shopping trips to huge discount shopping centers to "buy a few items" as a way of dealing with off-hour boredom, and all the forms of recreation which are resource-expensive.

This third proposal focuses on off-work hours for a very good reason. Very few of us will be able to make even minor changes on the job. Activity on that job is keyed to accommodating the system which is inherently exploitative to some degree of both people and resources. Because the individual must sell his or her body to the job for the purpose of keeping the kids in food and clothing and paying the mortgage, any boat-rocking on the job can place individuals in a vulnerable position. Any time that belongs to the individual is during off hours, though even then some time has to be set aside to "putting things in order."

But we still face a practical problem. When I say that we seek a sense of inter-relatedness and rootedness in the land, I seem to be describing lofty and vague goals. As we begin to think how this is to be translated into action during our daily lives, I know that we need something to maximize that sense of inter-relatedness and to know that rootedness. That "something" must not be a cheap gimmick, but must be a "to-the-marrow"

recognition of a personal need or purpose. We need a religious purpose to sustain our action. I think that purpose simply involves a decision *to take more control over our own lives*, with the added spinoff being a reduction of our vulnerability and a higher expression of our innate potentialities.

How can a person, who wants to take more control over his own life, especially in off-work hours, position himself to maximize his sense of inter-relatedness with members of his own species and other species and feel his rootedness in the land? The suggestions I will make to answer this question will be directed to those people in suburbia, where 55% of the American population lives. Here reside the so-called affluent, middle-class Americans, from blue to white collar workers, who are the largest consumers.

My first suggestion for the suburbanite is for him to try to grow most of his own vegetables. Two practical reasons for growing vegetables are to save money and to eat safer, more healthful food. However, the monetary savings is not great, especially at first. Compared to most countries, food is a relatively inexpensive item in the household budget for Americans. But there is also the possibility that the overall health and longevity of the family could improve. We don't really know the effects of all the pesticide residues, preservatives and other chemical additives in our commercially-produced food, but we have good reason to be uneasy about them. But let us discount health as a significant factor, just as we discounted the monetary saving. What is left?

What is left is a symbolic gesture with a purpose. Symbolic gestures which are meaningful must ultimately be associated with the physical world. Sometimes the chain between the symbol and the physical world is so long that it takes a philosopher to explain the relationship. But this is not so with food production. The garden is a statement that the individual is seizing more control over his or her own life, is taking a step away from such complete vulnerability, is getting more in touch with the earth.

After people in the suburbs have begun to overcome the spiritual danger of believing that food comes from a grocery store, they can then strive to overcome the second spiritual danger de-

scribed by Aldo Leopold, the belief that heat comes from a stove.¹ This can be accomplished relatively inexpensively by those who build solar collectors for space heating and water heating. The Association of Home Appliance Manufacturers has estimated that some 60% of home energy is consumed for space heating and 15% for water heating. The family that installs solar collectors to provide 75% of their home energy needs would be taking a significant step towards gaining even more control over their own lives.

Solar heating systems can now be purchased from many companies. However, individuals can build their own. Literature on solar energy systems is available at the elementary level, and the technology is not complicated.

Materials that go into the collector can be purchased or scavenged and the collectors can be assembled slowly. Collectors can be mounted on roofs, integrated as patio covers, or simply positioned in yards if space is available and safety is taken into consideration. This activity, which is bound to attract the attention of the neighborhood, is a very significant statement. It shows further progress toward gaining control over one's own life. Like the garden, the solar collector can help us get in touch with the world.

Several of my California students have reminded me about the Mormon practice of storing up a two-year supply of food, pointing out how the Mormons will be in great shape in the event of food scarcity. My reply has always been that if I am hungry, I am liable to "hunt me up a Mormon." All the old visions of defending the bomb shelter with a machine gun come to mind. As a boy I wondered how Noah managed to keep the unbelievers off the ark in the last moments of rising water. That's more of a miracle than the flood itself. My point is that our salvation lies in being one of the community, not in being the only one with foresight to develop alternate food and energy sources. Why would anyone want to be an isolated "have" in the midst of "have-nots"?

Although a person may have placed himself in a position where he can feel his rootedness in the land and can take more control over his own life, he is still a part of a community. A healthy in-

terdependence is possible if others in the community also adopt the religious purpose of taking more control over their own lives. This could result in a charming variety within the suburbs. Homesites might be surrounded with gardens, greenhouses and possibly small livestock. Solar collectors, windmills, and methane generators would be part of the scene. Some homes could be turned into small shops. With necessities closer to home, fewer automobiles would be needed, and this would surely change the face of the community for the better. Such changes are difficult to imagine for the Rosemonts, Winding Hills, Oak Acres and Ridgewoods. But most important changes are difficult to imagine.

My fourth proposal is that we begin to assemble and cannonize an ecological Bible, a mutable *Whole Earth Book*. The *Whole Earth Book*, not to be confused with the *Whole Earth Catalogue*, would have a symbolic acronym, WEB. Our WEB might contain Wald's version of the genesis of the earth. There might be a Book of Proverbs, a Book of Songs. Parts would be light and joyful; parts would be solemn. The WEB would celebrate the earth and life on the earth through song, poetry and prose, painting and photography. The WEB would help Americans begin to establish a common covenant with nature.

There could be many potential contributors, such as Loren Eiseley, Roger Tory Peterson, John Muir, George Perkins Marsh, John Burroughs, Sigurd Olsen and the Odum Brothers. But there is one contributor to the environmental movement who stands above everyone else, and without whose writing no *Whole Earth Book* would be complete. That man is Aldo Leopold. On the need for a land ethic, Leopold seems to have said it all, and well. Perhaps our WEB should have a Book of Leopold. But we must be careful, for it is not in the nature of an ecological ethic to make room for sainthood. Nature is mutable and knows few if any absolutes. Besides, Leopold himself would have resisted any attempt to make him a patron saint. Our best tribute to Leopold would not be to sanctify him in a *Whole Earth Book*, but to include him as one of the people in the "thinking community" who contributes toward the evolution of an ecological ethic.

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10. RENÉ DUBOS, "Franciscan Conservation versus Benedictine Stewardship," in *A God Within*, Charles Scribner's Sons, 1972.
11. JOSEPH NEEDHAM, *Science and Civilisation in China*, 4 vols., Cambridge: University Press, 1954-62.
12. YI-FU TUAN, "Our Treatment of the Environment in Ideal and Actuality," *American Scientist*, 58, p. 248, 1970.
13. JAMES V. NEEL, "Lessons from a 'Primitive' People," *Science* 170: 815-821, 20 November 1970.
14. This expression "unwittingly accessible" appears in *Tales of Power* by CARLOS CASTANEDA, Simon and Schuster, New York, 1974.
15. Quoted in article by S. I. RASOOL, "Evolution of the Earth's Atmosphere," *Science* 157: 1466-1467, September, 1967.
16. See JOHN D. BUFFINGTON, "Predation, Competition, and Pleistocene Megafauna Extinction," *BioScience*, 21: 167-170. Also, DANIEL A. GUTHRIE, "Primitive Man's Relationship to Nature," *BioScience*, 21: 721-723, 1971.
17. NICHOLAS GEORGESCU-ROEGEN, "Entropy the Measure of Economic Man" in *Science* 190: 447-450.
18. *Blake: Complete Writings*, edited by GEOFFREY KEYNES, Oxford University Press, 1969.
19. The Time-Life Book on *Early Man*, 1965 by F. CLARK HOWELL contains some superb sequence photographs of Bushmen digging for and capturing the springhaas on pages 186-187.

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Position vacant

Georgia — Fred K. Parrish, Georgia State University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Maurice Whittinghill, University of North Carolina at Chapel Hill

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Dr. Ronald Lindahl has joined the Department of Biology of the University of Alabama, Tuscaloosa, as an Assistant Professor. **Dr. Lindahl**, a biochemical geneticist, came to the department from Argonne National Laboratory's Division of Biological and Medical Research, where he did his Post-Doctoral research. **Dr. Lindahl's** primary research interests are concerned with the mechanisms that cause, and the significance of, biochemical changes in mammalian liver during chemically-induced hepatocarcinogenesis.

Members of the University of Alabama, Department of Biology, were saddened by the death of **Dr. Everett Bishop** on March 25, 1976. **Dr. Bishop** had been an active member of the department since 1946. **Dr. Bishop** obtained his doctorate from the University of Iowa, and was the author of numerous papers in the field of protozoology and a member of several professional societies.

The following grants have been received by members of the Biology Faculty at the University of Alabama: **Drs. John K. Hardman** and **Charles O'Kelley** — \$44,000 from the National Science Foundation to study "The Control of Cell Division by Light"; **Dr. Ronald Hood** — \$1,200 from the National Institute of Health for a Biomedical Sciences Support Grant; **Dr. Ronald Lindahl** — \$2,400 from the University's Research Grants Committee to study "Biochemical and Genetic Properties of Aldehyde Dehydrogenase in Chemically-Induced Tumors"; and **Dr. John L. Mego** — \$72,418 from NIH to study "Protein Catabolism in Subcellular Organelles". **Dr. Zachary S. Wochok** also received a \$28,000 grant from the Gulf States Paper Corporation to study induction of reproductive cones by gibberellic acid, to develop a culture system for growth of Southern Pine seedlings, and to study methods of reclaiming strip mine lands using flyash. **Dr. Wochok** was also the recipient of a University Research Grants Committee award of \$2500 to develop a tissue culture system for *Camellia japonica*.

The following news comes from the Department of Botany and Microbiology of Auburn University. **Tim A. McArdle** has been appointed as a Research Associate

to conduct research on implementing arginine maturity index method of predicting peanut harvesting dates. **Dr. John D. Weete** was appointed to the Water Resources Research Institute Council as a faculty member representative for a three-year term through 31 December 1978. **Dr. Donald E. Davis** was an invited participant in an in-depth review of resident instruction, research, and extension on an integrated basis for the Institute of Food and Agricultural Sciences at the University of Florida in January 1976. **Dr. Bryan Truelove** was appointed by the Executive Committee of the Southern Weed Science Society to edit a 2nd edition of "Research Methods in Weed Science". **Dr. Donald E. Davis** was awarded the first Distinguished Service Award by the Southern Weed Science Society in Dallas, Texas. **Dr. Walter D. Kelley**, who was awarded the Ph.D. in forest pathology from North Carolina State University, was elected to full membership in the chapter of the Society of Sigma Xi. **Dr. Robert G. Gudauskas** reviewed competitive research grant proposals as a member of a peer panel at Phoenix, Arizona, for the Cooperative State Research Service of the U.S. Department of Agriculture. Fourteen research papers were presented by faculty and graduate students at the 1976 meeting of the Alabama Academy of Sciences at Mobile in April. In addition, **Drs. Elroy A. Curl** is a member of the Board of Trustees and **Urban L. Diener** is the new President of the Academy for 1976-77. **Dr. Gerald A. Sansing**, research microbiologist with Commercial Solvents Corporation, presented a seminar address to the faculty and graduate students at Auburn University on "Secondary Microbial Metabolism as Related to Industrial Microbiology". **Dr. Sansing** received his Ph.D. in 1972 from Auburn University in the area of mycotoxicology.

Activities from the Florida State Museum, University of Florida, include the appointment of **Ms. June Gabalden** as Editorial Assistant to replace the retiring **Mrs. Florence Pettis** as assistant to **Dr. Oliver Austin**, editor of the *Auk* and Curator Emeritus of Ornithology. **Dr. Austin** begins his 9th year as editor of *Auk*. **Dr. Fred Thompson**, Curator in Malacology, has received a grant of \$3000 from the National Geographic Society for work on systematics and distribution of Snails in the Domini-

can Republic, beginning in January 1976. **Dr. J. W. Hardy**, Chairman and Curator in Ornithology and **Dr. Ralph J. Raitt**, New Mexico State University, are the recipients of a \$45,000 2-year grant to continue studies in western Mexico of the behavioral ecology of certain social jays (*Cisilopha*). The work resumes in the summer of 1976 near Mazatlan and Acapulco, involving the investigators and from 8 to 10 students. The vertebrate fossil collections of the Florida Geological Survey, Tallahassee, Florida, have been transferred to the Florida State Museum and \$25,000 in National Science Foundation funds have been received for their curation over the next two years, under the supervision of **Drs. Patton and Webb**, curators in vertebrate paleontology.

Thomas C. Emmel, Chairman of the Department of Zoology, The University of Florida, was appointed to this position effective September 1975. Other appointments are: **Stephen A. Bloom** (Ph.D. University of Washington, 1974), **Martha L. Crump** (Ph.D., University of Kansas, 1974), **H. Jane Brockmann** (Ph.D., University of Wisconsin, 1976), **Peter Feinsinger** (Ph.D., Cornell University, 1974) and **Michael C. LaBarbera** (Ph.D., Duke University). All of the above faculty are new Assistant Professors of Zoology effective September 1976.

Dr. Thomas Peter Bennett, Chairman of the Department of Biological Science, Florida State University, was appointed Temporary Special Assistant to **Stanley Marshall**, President of Florida State University, for a three month period in the Fall of 1975. The following grants have been awarded to members of the Department of Biological Science: **Dr. L. M. Beidler**, Public Health Service, "Sensory Physiology"; **Dr. Kurt G. Hofer**, Public Health Service, "Cell Population Kinetics as Factor in Tumor Therapy"; **Dr. J. Herbert Taylor**, National Foundation March of Dimes, "Chromosome Structure: Units of Replication and Genetic Function"; **Dr. Don Tucker**, Public Health Service, "Relation of Neural Responses to Odor Properties".

Dr. G. E. Taylor, Jr., has been appointed as Instructor of Biology at Agnes Scott College, Georgia. **Dr. Taylor** received his Ph.D. from Emory University.

Dr. David Cotter of the Department of Biological and Environmental Science, Georgia College, has received a National Science Foundation grant of \$11,030 for 6 undergraduate research participants. Georgia College was awarded a multi-year commitment by N.S.F. and will have N.S.F. support for 3 summers.

The following news has been received from the Department of Botany, University of Georgia. **Dr. Michael T. Clegg**, presently at Brown University, will be joining the Department in September 1976 as an Associate Professor. **Dr. Samuel B. Jones** was recently promoted to the rank of Professor. **Dr. Jonathan J. Westfall**, Professor, will retire in June 1976. **Dr. Westfall** recently received the Meritorious Teaching Award from the Association of Southeastern Biologists in recognition of his more than 40 years of outstanding teaching. **Mr. Frank**

V. Palfrey, a Texas rancher who graduated from the University of Georgia in 1921, died last year and willed the university a gift valued at \$909,004. **Mr. Palfrey** stipulated that his gift be used "for the benefit" of the University's Department of Botany. The Botany Department has received a \$6,000 educational grant from E. I. DuPont De Nemours and Company. The purpose of this grant is to help universities maintain or enhance the strength of their instruction in science and engineering. **Dr. Donald Fisher** has received a one-year N.S.F. grant renewal of \$45,000 for his study entitled "Intercellular Transport of Organic Compounds in Plants". **Dr. Joe L. Key** has received a one year E.R.D.A. grant renewal of \$23,000 for his study entitled "RNA Metabolism in the Regulation of Protein Synthesis in Plants".

Dr. Shirley Tucker of the Department of Botany, Louisiana State University at Baton Rouge, has received a renewal of her National Science Foundation grant for the next two years to investigate the "Systematic significance of ontogenetic features in the Piperaceae and Aristolochiaceae". **Dr. Tucker** is interested in hearing from anyone who can supply living or preserved material (young floral buds) of taxa in these families.

Dr. Richard Lumsden, Professor of Biology, Tulane University, has been appointed Dean of the Tulane University Graduate School. **Dr. Lumsden** is a well-known authority on the tapeworm integument.

Dr. J. Frank McCormick, Director of the Graduate Program in Ecology at the University of Tennessee, Knoxville, was the recent guest speaker in the Department of Biological Sciences, Mississippi University for Women. **Dr. McCormick's** visit was arranged through the Visiting Scientists Program of A.I.B.S.

Two new members have recently joined the Biology Department of Alcorn State University, Mississippi. They are **Dr. Nusrat Z. Naqvi**, Assistant Professor of Biology and **Mr. Leroy Johnson**, Instructor of Biology. **Dr. Verna R. Lawson** of Alcorn State has received a National Science Foundation grant to study the "Effect of Metal Ions Associated with Automobile Exhausts on the Growth of Sorghum Seedlings". N.S.F. has also awarded **Dr. Alice M. Russell** of Alcorn State, a grant to study the "Effect of Macrophage Lysozyme Enzyme Processes on the Antigenicity of Human Serum Albumin in an *In Vitro* Culture System". **Dr. Zamin Syed Naqvi** will be investigating "Toxicity and Ecological Effects of Selected Insecticides and Herbicides" with grant funds received from the United States Department of Agriculture.

Gulf Coast Research Laboratory of Ocean Springs, Mississippi has completed a contract with the National Park Service to do two years of research on two offshore islands that belong to the Gulf Islands National Seashore. The work will be conducted by the Botany Section personnel with **Dr. Lionel N. Eleuterius** as the principal investigator. The contract is entitled "A phytosociological study of Horn and Petit Bois Islands, Mississippi." It provides funds in the amount of \$30,481 for

the first year of the study and an additional payment of \$30,133 for the second year. **Dr. Robin Overstreet** has returned to his duties as head parasitologist at Gulf Coast Research Laboratory, after spending five weeks in Israel, studying parasites found in mullets from the Mediterranean and Red Seas. The mullet is very important to the Israeli economy. It is one of four fishes commonly raised in large ponds on kibbutzim (communal settlements) to help supply the food market. In addition to establishing what parasites are found in mullet, **Dr. Overstreet** also helped determine the possible dangers that exist when mullet are stocked in ponds or eaten incompletely cooked. This year's work on parasites concludes a two-year study, both of which included trips to Israel. The project was sponsored by the United States-Binational Science Foundation. **Dr. Overstreet** worked with an Israeli counterpart, **Dr. Ilan Paperna**, who is director of the Heinz Steinitz Marine Biology Laboratory in Elat. The laboratory is a branch of the Hebrew University of Jerusalem. **Dr. William W. Walker**, of the Gulf Coast Research Laboratory is the principal investigator of a second year grant entitled, "Insecticide persistence in natural seawater as affected by salinity, light, temperature, and sterility". The project cost for the second year is \$29,265, with the Environmental Protection Agency paying \$20,000 and the Laboratory paying the remainder. This research was designed to provide data on the persistence of organophosphorus, and chlorinated hydrocarbon insecticides in seawater.

Dr. A. W. Cooper has resigned from the Department of Botany, North Carolina State University, and will join the School of Forest Resources to work in a program of resource management and land use planning. **Dr. Cooper** has been on leave from NCSU to serve as Assistant Director of the North Carolina Department of Natural and Economic Resources. **Dr. T. R. Wentworth** joined the Department of Botany January 1, 1976 as an Assistant Professor of Botany. He is a graduate of Cornell University and will teach in the ecology program.

Dr. David E. Davis retired as the Head of the Zoology Department, North Carolina State University on December 1975. **Dr. Reinard Harkema** was named Acting Head. **Dr. Herbert A. Underwood**, Assistant Professor of Zoology, NCSU, has received a \$40,000 two-year grant from the National Science Foundation to study "Circadian Physiology and Photo-reception in lizards: the role of the eyes and pineal system."

Dr. Anthony Huang, Assistant Professor of Biology at the University of South Carolina, has received a \$25,000 grant from the National Science Foundation to study plant and animal microbodies.

Paul L. Fisher retired on June 1, 1976 as Professor of Biology, Furman University. He has been a member of the faculty since 1945. He expects to maintain his residence in Greenville, S.C. and to continue his research on

the relationship of Multiple Sclerosis and Muscular Dystrophy.

Mr. William G. Eickmeier (Ph.D. candidate, University of Wisconsin-Madison) will join the faculty of the Department of General Biology at Vanderbilt University, in September 1976, as an assistant professor. **Mr. Eickmeier's** field is plant ecology. **Dr. Elsie Quarterman**, Professor of Biology at Vanderbilt, retired at the end of the spring semester after 33 years of service. **Dr. Quarterman** was granted the title "Professor of Biology, Emerita" upon her retirement by **Chancellor Alexander Heard** at the 1976 Commencement exercises. **Dr. Clint E. Carter**, Assistant Professor of Biology, Vanderbilt, has been awarded a grant in the amount of \$75,000 from the National Institutes of Health for 3 years to isolate and purify the soluble egg antigen from *Schistosoma mansoni*. **Dr. Lee H. Pratt**, Associate Professor of Biology, has been awarded a grant in the amount of \$42,000 from the National Science Foundation for a research project concerned with the molecular mode of action of phytochrome.

Dr. Elizabeth B. Jackson has retired from Longwood College, Virginia, after 38 years of science teaching. She was named Board of Visitors Distinguished Professor of Natural Sciences by **Mr. William E. Daniel**, rector of the Board of Visitors. **Dr. David A. Breil** has been promoted from Associate Professor to Professor of Biology. **Dr. Thomas Ely** will leave Longwood College to accept a teaching and research position at North Alabama University.

Dr. Horton Hobbs has left Christopher Newport College of William and Mary for a position at George Mason University. **Mr. Roy Hyle**, of Christopher Newport college has moved to Thomas Nelson Community College. **Dr. Harold Cones** and **Dr. Ronald Mollick** have returned to Christopher Newport College of William and Mary.

Dr. Eric L. Bradley, Department of Biology, College of William and Mary, is the principal investigator and **Dr. C. Richard Terman** co-investigator on a 3 year National Institutes of Health grant entitled "Hormonal bases of reproductive inhibition in deer mice" to be conducted at the College Laboratory of Endocrinology and Population Ecology. **Charlotte P. Mangum** is the recipient of a National Science Foundation grant entitled "Influence of Environmental Salinity on Oxygen Transport Systems". **Henry Aceto**, **Robert Black** and **Eric Bradley** are recipients of an \$18,000 NSF Instructional Scientific Equipment Program grant to establish an undergraduate course in Radioisotope Methodology.

Professor B. F. D. Runk, Department of Biology, University of Virginia, Charlottesville, retired on May 31, 1976.

Dr. L. Michael Hill, Associate Professor of Biology, Bridgewater College, Virginia, has received grants from Sigma Xi and the Virginia Academy of Science to conduct research into the causes of variation in *Aster acuminatus* Michx.

The following grants have been received from faculty of the Department of Zoology, The University of Tennessee, Knoxville. **Dr. Jeffrey A. MacCabe** was awarded a 3 year grant for \$148,616 to study "Mechanism in limb morphogenesis" from the National Institutes of Health. **Dr. Joseph C. Daniel, Jr.** received a 3rd year renewal of NIH Ro1 HD06226-04 "Uterine proteins in mammalian embryogenesis" of \$41,490. **Dr. Arthur M. Jungreis** received a 2 year, \$58,000 National Science Foundation Grant to study "Physiology of molting fluid formation and resorption in insects". **Dr. Gerald L. Vaughan** will be studying the "Biological impact of contour strip mining in small watersheds" under a grant of \$71,000 (2 years) from the Energy Research and Development Administration. The National Science Foundation has awarded a 2 year grant to **Dr. Susan E. Reichert** for \$45,000 to study "Self population regulation in spiders". She also received a NSF (\$37,000) equipment grant for developing a program in behavioral ecology.

About Institutions

The Department of Biology at the University of Alabama, Tuscaloosa, has recently purchased an ETEC Scanning Electron Microscope complete with a Wavelength Dispersive X-Ray Spectrometer. The department

has also occupied a new Animal Facility completely equipped to house and care for a variety of laboratory species.

The name of the **Biology Department** at **Georgia College** has been changed to the **Department of Biological and Environmental Science**, in recognition of the new B.S. degree program in environmental science.

Tulane University was the host to the 1976 American Institute of Biological Sciences Annual Meeting on May 30 through June 4 with approximately 3,000 in attendance.

Three new programs have been initiated by the **Biology Department of Alcorn State University**. They are (1) a Master of Science in Education degree with endorsement in biology, (2) an Allied Health Program and (3) a Science Lecture Series.

Biology faculty and students have moved into a new **Biological Sciences Center** at the **University of South Carolina**. The new center is eight-stories tall and was built at a total project cost of \$5.2 million. The 97,000 square foot building contains space for research and instructional laboratories, classrooms and office space.

The **Biology Department of Christopher Newport College of William and Mary** has begun a new program in ornamental horticulture.

Time and Place of Future Meetings

- | | | |
|------|-------------|---|
| 1977 | April 14-15 | North Carolina State University,
Raleigh |
| 1978 | April 13-15 | University of Alabama, University,
Alabama |
| 1979 | | University of Tennessee, Chattanooga |

Cover Photographs Needed

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 x 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

Change of Address

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail. Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.*

Please PRINT new address below:

Name:

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City: State: Zip code:

Emeritus Membership

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg*, Carolina Biological Supply Company, Burlington, N.C. 27215.

Symposium on Rare, Endangered and Threatened Biota of the Southeast

April 22, 1976

New Orleans, Louisiana

**Cosponsored by the Association of Southeastern Biologists
and Ecological Society of America**

C. E. Styron and J. Frank McCormick, Chairmen

**Edited by
C. E. Styron**

Division of Mathematical, Natural and Health Sciences

**St. Andrews Presbyterian College
Laurinburg, North Carolina 28352**

During the past two years the Conservation Committee of the Association of Southeastern Biologists has canvassed the membership of the ASB to identify biologists working in the area of rare, endangered and threatened biota (RE&T Biota). The sheer mass of information received and the interest evinced by our inquiries suggested the need for a symposium. To this end, several biologists were invited to present papers at the annual meeting of the ASB, reviewing progress in their areas of special concern. Following the session for invited speakers, a number of other biologists presented contributing papers. The seven papers which follow are proceedings of the session of invited papers.

The Conservation Committee of ASB expresses their sincere appreciation to the authors for their efforts in assuring success of the symposium.

A Review of the Endangered Species Act of 1973

JAMES D. WILLIAMS

*Office of Endangered Species
U.S. Fish and Wildlife Service*

This presentation is based on a review of the Endangered Species Act prepared by staff biologists in the Office. The Endangered Species Act of 1973 (hereinafter referred to as the Act) was passed by the 93rd Congress and signed into law by the President of the United States on December 28, 1973. The Act is the strongest legislation ever enacted to preserve and protect endangered and threatened animals and plants. It expands upon previous acts on endangered species, the most recent being the Endangered Species Act of 1969. The 1973 Act gives the Departments of Commerce and Interior regulatory and statutory authority over endangered and threatened fauna and flora which was not included in the previous acts. It provides for two categories of species determination, "endangered" and "threatened," as opposed to one previous category, "endangered," in the 1969 Act. It allows for determination on a population basis for animals of any group. Also new are provisions for State cooperation and participation in the program through cooperative agreements, grants-in-aid funding, and other incentives. The new Act calls for participation where appropriate by all federal agencies and directs that no federal funds can be utilized for an activity that would be detrimental to an endangered or threatened species.

The Endangered Species Act of 1973 is a very complex piece of legislation and has frequently led to confusion and various erroneous interpretations. The following is a brief review of the Act section by section to point out some of the more important features of the Act. Baker and MacBryde (1976) explain provisions of the Act for plants in the next paper.

Section 2. Findings, Purposes, and Policy

Section 2 presents the reasons for the Act. Because of man's activities, species of wildlife have become extinct and other species are presently faced with the threat of extinction. Recognized are the educational, scientific, recreational, historical, and esthetic values of endangered and threatened species. The need for protection of endangered species and threatened species is a world-wide problem and has been recognized by international treaties and conventions. The Act provides a tool to implement international commitments. The states and other interested parties are an integral part of the program to meet both national and international need for protection of wildlife. Through federal financial assistance and other incentives state participation is to be encouraged.

The purposes of the Act are to conserve the ecosystems upon which endangered and threatened species depend and to provide a program for the conservation of such species. The Act also insures that the United States lives up to the international treaties and conventions on conservation to which it is a party. Finally, Congress declared it their policy that all federal departments and agencies should seek to conserve endangered and threatened species and should utilize their authorities in furtherance of the purposes of the Act.

Section 3. Definitions

There are 16 terms which are defined for the purposes of the Act. Selected definitions of terms whose meanings are important keys to interpretation of certain sections of the Act are as follows:

- (2) The terms "conserve," "conserving" and "conservation" mean to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary. Such methods

and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping and transplantation and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking. To most wildlife managers the term conserve as used in the Act means management.

- (4) The term "endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present overwhelming and overriding risk to man.
- (5) The terms "fish and wildlife" means any member of the animal kingdom, including without limitation any mammal, fish, bird (including any migratory, non-migratory or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, arthropod or other invertebrate and includes any part, product, egg or offspring thereof or the dead body or parts thereof.
- (9) The term "plant" means any member of the plant kingdom, including seeds, roots and other parts thereof.
- (11) The term "species" includes any subspecies of fish or wildlife or plants and any other group of fish or wildlife of the same species or smaller taxa in common spatial arrangement that interbreed when mature.
- (14) The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in any such conduct.
- (15) The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Section 4. Determination of Endangered and Threatened Species

Section 4 provides for the determination of endangered and threatened species. The determination of a species as "endangered" or "threatened" is based upon one or more of the following factors:

- (1) The present or threatened destruction, modification or curtailment of its habitat or range;
- (2) Overutilization for commercial, sporting, scientific or educational purposes;
- (3) Disease or predation;

- (4) The inadequacy of existing regulatory mechanisms; or
- (5) Other natural or man-made factors affecting its continued existence.

The Secretary of Commerce bears the prime responsibility for determination of marine species. The Secretary of the Interior has the responsibility for all other species.

When species are determined as threatened, regulations that are necessary for protection and management may be issued by the Secretary. However, it may not be necessary to issue any regulations for some species. The Secretary can issue regulations that prohibit any act that is promulgated under Section 9 of the Act. An exception to this is when a state has entered into a cooperative agreement; then only those regulations which have been adopted by the state for *taking* threatened resident species of wildlife shall apply.

When a species is similar in appearance to an endangered or threatened species, regulations can be issued for this species to insure protection of the endangered or threatened species. The reasons for this are to avoid difficulties of identification by law enforcement personnel, avoid additional threats to endangered or threatened species and further the intent of the Act.

All regulations proposed by the Secretary will be published in the *Federal Register* after consultation with appropriate state and federal agencies and interested persons and organizations.

At the present time (April, 1976), the official list contains a total of 427 endangered species and 11 threatened species both foreign and domestic. Of the 427 species, 147 are endangered or threatened species found in the United States and its territories. The present United States lists, endangered and threatened, include 33 mammals, 66 birds, 8 reptiles, 4 amphibians, 34 fishes, and 2 insects. The list *does not* include all of the species found in the United States Fish and Wildlife 1973 Red Book. It is anticipated that the restructuring of the list should occur within the next year. There are no plants on the list at the present time.

Section 5. Land Acquisition

This section authorizes acquisition of land and water habitat for endangered and threatened species using Land and Water Conservation funds. This provision was also present in the 1966 and 1969 Acts. To date more than 40,000 acres of habitat for 11 endangered species has been acquired at a cost of approximately 13 million dollars.

Section 6. Cooperation with States

This section of the Act recognizes the need for close cooperation with the states and provides for management agreements and cooperative agreements to assist the states with their programs. Management agreements between states and the Fish and Wildlife Service provide for administration and management of areas for the conservation of endangered species or threatened species. In cases where conflicts arise between state and federal laws or regulations, the more restrictive laws or regulations shall apply.

Cooperative agreements, among other things, provide for federal assistance to the states for implementation of state endangered species' and threatened species' programs. For a state to be eligible for a cooperative agreement with the Fish and Wildlife Service, the state agency must have:

- (1) Authority to conserve species that have been determined by the state or the Fish and Wildlife Service to be endangered or threatened. This authority should be broad enough to cover additional species that may be listed in the future.
- (2) Acceptable conservation programs for all resident fish or wildlife species in the state that are deemed endangered or threatened by the Fish and Wildlife Service.
- (3) Authority to conduct investigations.
- (4) Authority to acquire land or aquatic habitats for conservation of resident endangered species and threatened species.
- (5) Provisions for public participation in designating resident endangered species or threatened species of fish and wildlife.

Cooperative agreements provide for the actions that are to be taken by the Secretary and the states, the benefits that are expected to be derived by the cooperative program, the estimated cost of the actions and the share of the costs by the federal government and the states. The federal share shall not exceed two-thirds of the estimated program costs; however, this share can be increased to 75% for species shared by two or more states. Review of the state's programs must be made at least annually to assure that their programs are effective and that legal authorities are still appropriate.

Section 7. Interagency Cooperation

Section 7 charges the Secretary to review all Department of Interior programs and to use these programs for furtherance of the Act. All other federal agencies in consultation with the Secretary and with his assistance are to utilize their authorities in furtherance of the Act by carrying out pro-

grams for conservation of endangered and threatened species. These agencies are also to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of these species or result in the destruction or adverse modification of habitat that is determined to be critical by the Secretary after consultation with the affected states.

Section 8. International Cooperation

This section provides for international programs for endangered animal and plant species. Among other items, this section provides the mechanics for financial assistance, encouragement of foreign programs, personnel, investigations and implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Section 9. Prohibited Acts

Two important prohibitions under the Act make it unlawful for any person subject to the jurisdiction of the United States to *take* any endangered fish or wildlife species within the United States or the United States Territorial Sea (*take* means harass, harm, pursue, hunt, shoot, kill, trap, capture, or collect, or attempt to engage in any such activity), and to violate any of the regulations that may be promulgated by the United States Fish and Wildlife Service for threatened fish or wildlife species. It is also unlawful for any person to violate regulations promulgated by the Secretary on threatened plant species. The Act does not prohibit the "taking" of endangered plant species.

Section 9 also deals with endangered and/or threatened species held in captivity, with violations of the Convention and with import/export only via official ports designated.

Section 10. Permits

Permits may be issued by the Fish and Wildlife Service that would allow certain actions that are prohibited under the Act (e.g., taking of endangered and threatened species of fish and wildlife). These permits are issued for scientific purposes or for propagation or survival programs that would enhance the species. An application for a permit must be filed with the United States Fish and Wildlife Service which then reviews and publishes the application in the *Federal Register* for a 30-day period. If no valid, adverse biological comments are received, the permit is then issued to the individual that will be conducting the programs or activities.

Section 11. Penalties and Enforcement

Section 11 expresses the civil penalties that can be assessed by the Secretary on persons who violate the Act. It also covers criminal violations, rewards, district court jurisdiction, and enforcement. It also provides for citizen suits that can enjoin any person, including governmental agencies or instrumentality who is alleged to be in violation of the Act.

Section 12. Smithsonian Institution

Through this section, the Secretary of the Smithsonian Institution, in conjunction with affected agencies, was directed to review plant species and develop a recommended list and recommendations for conservation of endangered and threatened plant species within one year. This information was presented in a report to the Congress in December 1974.

Section 13. Conforming Amendments

This section amends other acts to be consistent with the Endangered Species Act of 1973.

Section 14 repeals the Endangered Species Conservation Act of 1969.

Section 15 authorizes funding for the Departments of Interior and Commerce to carry out their responsibilities under the Act.

Section 16 provides for the effective date of the Act — December 28, 1974.

Section 17 states that except as otherwise provided for in the Act, no provision of the Act will take precedence over any more restrictive, conflicting provisions of the Marine Mammal Protection Act of 1973.

This has been a very brief review of the Endangered Species Act of 1973. For additional information, a copy of the Act, various *Federal Register* documents listing species and critical habitat, and general information on endangered and threatened species, please contact the Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C. 20240.

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The Endangered and Threatened Plant Program of the U.S. Fish and Wildlife Service

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In the previous paper Williams (1976) discusses the Endangered Species Act of 1973 (Public Law 93-205) in general terms; this paper explains the provisions of this Act for plants.

Previous endangered species legislation (1966 and 1969) did not include plants. In Section 3 of the 1973 Act the term "plants" is defined as "any member of the plant kingdom, including seeds, roots and other parts thereof." Section 2(a)(4) of this Act specifies that the United States has pledged itself to conserve the 20,000

plants now listed in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Section 12 of the 1973 Act directs the Smithsonian Institution to review species of plants which are or may become endangered or threatened and to report to Congress within one year.

There are several major differences in how plants and animals are dealt with in the Endangered Species Act of 1973.

In Section 3, the term "species" is defined as

including "any subspecies of fish or wildlife or plants, and any other group of fish or wildlife of the same species or smaller taxa in common-spatial arrangement that interbreed when mature." Hence, population segments of animals are included in the Act, whereas population segments of plants are considered to not be included.

Section 5 states that land can be purchased for the conservation of endangered and threatened wildlife, fish or plants with funds made available pursuant to the amended Land and Water Conservation Fund Act of 1965. For plants there is the added restriction that they must be included in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora. This international convention has been ratified by the United States and over twenty other countries and came into force on July 1, 1975.

The purpose of the Convention is to reduce the impact of international trade on plants and animals for which this activity is or may become a threat to their survival. These organisms are listed, depending on the degree of endangerment, on the three appendices of the Convention. Appendix I, the most seriously jeopardized group of animals and plants, includes only foreign plant taxa, but Appendix II includes the entire orchid and cactus families, both of which have many rare taxa in the United States. Appendix II also includes ginseng (*Panax quiquefolius*), which is native to North America. Appendix III of the Convention includes no plants as yet, but the United States, as a party to the Convention, can unilaterally add plant species to this Appendix to prevent commercial exploitation.

Section 6 deals with cooperative agreements with states and provisions for financial aid from the federal government to carry out these cooperative programs. Before a state can enter into a cooperative agreement, it must show that a state agency exists which has the authority to establish programs, including the acquisition of land, for the conservation of resident endangered and threatened species. There is some question as to whether Section 6 applies to plants. The Fish and Wildlife Service is seeking authority to permit states to enter into cooperative agreements for whatever endangered and threatened species

they have authority to conserve. A decision on this matter will be reached shortly.

Section 7 deals with interagency cooperation, and directs all federal agencies to maintain programs for the conservation of endangered and threatened species. It also directs them to insure that actions authorized, funded or carried out by them do not jeopardize the existence of such species or modify critical habitat of such species. Section 7 is a major strength of the Act with respect to plants.

Perhaps the most important difference between plants and animals in the Act is that the "taking" of endangered animals is prohibited, whereas the taking of endangered plants is not. Section 9 spells out the prohibitions for plants. It will be unlawful to:

- (1) import or export such plants to or from the United States;
- (2) transport such plants in interstate or foreign commerce; and
- (3) sell such plants in interstate or foreign commerce.

Section 9 does not prohibit or regulate:

- (1) the intrastate sale of such a plant; and
- (2) interstate movement of such plants unless it involves commercial activities which include a change in ownership.

Section 10 provides for exceptions to these prohibitions. Permits will be issued by the United States Fish and Wildlife Service, as they are for endangered and threatened animals, to carry out prohibited acts for scientific purposes or to enhance the propagation or survival of the affected species.

Section 12, as mentioned earlier, directed the Secretary of the Smithsonian Institution to conduct the initial review of possible endangered and threatened plants, and to recommend methods of adequately conserving such species. The Smithsonian Institution was given one year to complete this task, and their "Report on Endangered and Threatened Plant Species of the United States" (House Document 94-51) was presented to Congress on January 9, 1975. This report contains the names of over 3000 plant taxa which are perhaps extinct, or possibly endangered or threatened. Over 1000 of these are endemic to Hawaii. Other states with very large numbers of plants in-

cluded in the report are California, Texas, and Florida.

The Endangered Flora Project within the Department of Botany at the Smithsonian Institution was responsible for preparing the report. Their lists were prepared by reviewing floras, taxonomic monographs and revisions. Also, taxonomic specialists were consulted and some collections were checked in herbaria. State lists of rare and endangered plants were also used as reference material. (The report is not a compilation of state lists, however, since a plant may be extirpated, rare or endangered in one state, but very common in another.) In September, 1974, a workshop was held under the joint sponsorship of the Smithsonian Institution and the Office of Endangered Species and International Activities of the United States Fish and Wildlife Service. The participants included botanists from federal agencies, universities and botanical gardens. They reviewed the plants on a preliminary list and refined it; much unpublished data and new distributional information were used during the workshop. Since the Smithsonian Institution report lists plants found basically in the 50 states, species occurring outside the United States as well were not included unless their exact endangerment status outside the country was known. Only vascular plants were included in the report, although non-vascular plants are covered by the Act. (DeFilippis (1976) presented a history of the compilation of the report.)

The Endangered Flora Project at the Smithsonian Institution has continued its work. The lists of plants in the original report have been revised on the basis of comments received both by the Smithsonian and the Fish and Wildlife Service. The revised lists will be published later this year. In addition, the Endangered Flora Project personnel are preparing computerized distribution maps of the localities of the exploited plants listed in the report, and computerized information sheets for the plants included in their revised lists. They are also preparing a series of Red Data Book entries of United States plants for the I.U.C.N. Red Data Book on Angiosperms. The series includes representatives of different geographical regions, diverse plant families and various kinds of threats.

The United States Fish and Wildlife Service regards the Smithsonian Institution's report to be a "petition" as provided for in Section 4(c)(2) of the Act. On July 1, 1975, the Smithsonian Institution's list (plus a few additions and corrections) was published as a "Notice of Review" in the *Federal Register*. By publication of this list the Service formally initiated a review of the status of these plants pursuant to the Endangered Species Act of 1973.

Previously, on April 21, 1975, a "Notice of Review" for four plants was published in response to a petition from a group of Wisconsin citizens. Subsequent to the publication of both notices, the governors of all states and United States Territories involved were informed and their comments were solicited. Copies of the July 1 notice were also sent to many other United States government agencies and botanists throughout the country. The 45 foreign plant taxa on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora were published in the *Federal Register* as a proposed rulemaking on September 26, 1975.

As of April, 1976, therefore, over 3200 plants are in the process of being considered for determination as endangered or threatened. In the near future, the Fish and Wildlife Service is planning to propose:

- (1) regulations that would implement the Act with regard to plants¹ and
- (2) a determination that about 1700 plants from the Smithsonian revised report are endangered pursuant to the Endangered Species Act of 1973.²

Both the proposed regulations and the proposed list of endangered plants will probably be published in the *Federal Register* by the summer of 1976. A minimum 60-day comment period will follow both proposed rulemakings.

Also, a final rulemaking that determines which of those plants on Appendix I of the Convention are to be classified as endangered will probably be published in the summer of 1976.

Obviously, the Endangered Species Act of 1973 offers many possibilities for plant conservation. The help of professionals, such as members of the Association of Southeastern Biologists, is essential for responding wisely and effectively to the Act. Any data on plants will be welcomed by

the Office of Endangered Species. Details on distribution, threats to survival, propagation techniques and recent taxonomic studies are some of the kinds of information which can help the United States Fish and Wildlife Service implement the Endangered Species Act of 1973 on behalf of our plant heritage.

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¹ The proposed regulations were published in the June 7, 1976 *Federal Register* (Vol. 41, p. 22916-22922).

² The list of 1700 proposed Endangered plants was published in the June 16, 1976 *Federal Register* (Vol. 41, p. 24523-24572).

Computerized Information Systems for Threatened and Endangered Species

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Since the enactment of federal, state, and local environmental laws protecting endangered and threatened animal and plant species, the United States Army Corps of Engineers division, district and facilities engineers have had to evaluate design, construction, operation and maintenance activities in terms of their effects on endangered species and their habitats.

These federal and state laws, along with increasing attention within the Office of the President, the Department of Defense (DOD) and the Department of the Army, have resulted in the development of a series of executive orders, DOD instructions, directives and memoranda and Army regulations regarding the role of federal agencies and departments in wildlife conservation. A series of Corps of Engineers regulations have also been prepared as aids in implementing the higher-level promulgated laws and regulations. At last count there were 86 documents, including the public laws, that regulate and guide project planners and designers within the Corps of Engineers on environmental quality management, of which endangered species protection is a part. A list of those documents has recently been published (Rekas *et al.*, 1975).

Examples of Responses to Legislation

By 1971 it was clear that the Corps badly needed a catalog of threatened and endangered species, so that at least those provisions of the laws that are concerned with the protection of bird and mammal species could be met with confidence. The Waterways Experiment Station (WES) was successful in convincing the Military Construction Directorate of the Office of the Chief of Engineers of that need, and it authorized WES to develop an information system containing data on the habitat requirements of protected species of mammals and birds. A three-volume technical report entitled *A User-Accessed Computer Information System for Environmentally Sensitive Wildlife* documents the result of the WES effort (Addor and LaGarde, 1974).

In December 1973 Congress enacted the Endangered Species Act of 1973. Section 7 of that act states that all Federal agencies shall

“. . . utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to Section 4 of this Act and by taking such action necessary to insure that actions authorized, funded, or carried out by them do not

jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with the affected States, to be critical."

One result of Section 7 of the 1973 act was a Department of Defense memorandum issued in June 1974 outlining an endangered species protection program to be initiated and carried out at all military installations and activities. The principal elements of the memorandum are given below.

- (1) Familiarization with the current listing of species that are threatened or endangered.
- (2) Coordination with the regional office of the U.S. Department of the Interior and the appropriate state agency having cognizance over this program.
- (3) Inventorying threatened wildlife species indigenous to or dependent upon the habitat of the installation.
- (4) Identification and protection of the wildlife habitat on the installation.
- (5) Development of positive programs for the avoidance of any interference by military activities with "on-base" endangered or threatened species habitat.
- (6) Avoidance of any interference of military activities with off-installation habitat, including low flight over habitat or nesting areas by military aircraft.
- (7) Support of state legislation necessary to implement the federal act when deemed appropriate.

Similar requirements are in effect for Corps of Engineers divisions and districts.

As a partial response to the DOD memorandum, the Office, Chief of Engineers, asked WES to compile a selected list of legally protected fish and wildlife for the 163 United States Army installations and major activities in the continental United States. A two-volume report entitled *Selected Legally Protected Animals* was prepared. Report 1 contains the names of protected animals, vertebrates and invertebrates, that range on or in the vicinity of the 163 United States Army installations and major activities in the continental United States (LaGarde *et al.*, 1975). Report 2 contains a list of federally protected naturally occurring wild species and species introduced and established in the wild, and lists of state-protected animals on a state-by-state basis (Rekas *et al.*, 1975).

In May 1975 WES personnel met with several federal agency representatives who were interested in the development of a sensitive wildlife information system for interagency use for many different purposes. The purposes include a means of supplying the latest up-to-date information to field personnel, a general information source for designers, planners and land managers for preparation of Environmental Impact Statements (EIS's) and a research source for scientists. At the request of the agencies, WES prepared a plan to modify and expand the user-accessed computer information system for environmentally sensitive wildlife (Addor and LaGarde, 1974). That plan was accepted and system development was started in January 1976, supported by United States Fish and Wildlife Service, United States Forest Service, Soil Conservation Service, Bureau of Land Management, Federal Highway Administration, United States Army Training and Doctrine Command, and the Corps of Engineers. The National Park Service and the Energy Resources and Development Agency are considering joining the other federal agencies in supporting the system.

Several factors influence the design of computer information systems for threatened and endangered species. These factors include the intended uses of the system, the data categories required by the users, the amount of data to be stored, the format required in the system output, i.e. narrative or graphic, the cost of developing, maintaining and operating the system and the location and type of computer. These factors will be discussed with respect to the design of the two information systems mentioned above.

User-Accessed Computer Information System for Environmentally Sensitive Wildlife

The user-accessed computer information system for environmentally sensitive wildlife (ISESW) was developed to aid the engineer and land manager in the planning and design of resources development projects and EIS. The basic premise is that if the land manager or project design engineer is alerted to the possible presence of valued wildlife populations on the land area of a proposed project and if he understands the relation between habitat structure and population densi-

ties, he can assess the possible effects of proposed alterations of the project land area on the suitability of that area as habitat for those populations. He can, therefore, consider the safety and well-being of those populations as an integral part of the project design or land-use plan.

The computer information system contains two basic subsystems: the information files and an information retrieval program. The information file contents are accessible through the user-operated computer retrieval program, which is readily available for use by anyone with access to a teletype with audio-coupler anywhere in the United States. The retrieval program is written in a conversational mode so that only a modest acquaintance with computers is required for its operation.

The system provides information in two forms: a narrative summary of the known habits and ecological requirements of the selected mammal and bird species and a computer-plotted map of the known geographic range of the species. Narrative information categories (Table 1) were selected by WES ecologists, biologists, and zoologists. The geographic ranges of selected mammal and bird species were obtained from Hall and Kelson (1959) and Wetmore (1957) and other available technical literature. The number of mammals and birds considered was limited to those species listed as "threatened" in "Threatened Wildlife of the United States" (U.S. Department of Interior, 1973).

The system was designed for use on the WES GE 635 series computer in the time-sharing mode, but was developed so as to be compatible with many other computer systems. The program language is a basic form of FORTRAN IV. No operational statements appear in the program that are not acceptable to FORTRAN compilers on other computers. For the program to be used on other computers, some input-output disc control must be changed, but no changes are anticipated that would require restructuring of the program logic or other extensive effort. The retrieval program was designed to fit and operate within a computer memory size of 16 K words. The data files, however, require substantial disc space: approximately 6.5 M words at present. All graphics requested by the program operator are output

TABLE 1.—Narrative information categories used in the User-accessed Computer Information System for Environmentally Sensitive Wildlife (from Addor and LaGarde, 1974).

State	Nesting or Bedding
Class	a. Site Preferences
Species	b. Materials
Status	Rituals
Description	a. Site Preferences
Range	b. Materials
Habitat	Population Structure and Trends
Range/Habitat Map	Reproduction and Survival
Food Habits	Commentary
Shelter Requirements	Bibliography
a. Site Preferences	
b. Materials	

off-line to a CALCOMP 28-in. drum plotter. Any plotter of sufficient size that recognizes the CALCOMP functions PLOT, SYMBOL and NUMBER generated output is acceptable for use with this program. All output other than graphic is obtained on the teletype used to control the program. A simple data retrieval operation costs less than three dollars.

Sensitive Wildlife Information System

The work that WES is currently doing on the sensitive wildlife information system involves a modification and expansion of the original ISESW.

- (1) Animal information categories have been expanded to permit the storage of more detailed information (Table 2).
- (2) Plant information categories have been developed in anticipation of federal protection for endangered plants (Table 3).
- (3) A steering committee consisting of representatives from all participating federal agencies is being set up to recommend species for inclusion in the data files and to edit the files.
- (4) Species data will be supplied by the participating federal agencies and WES, and the final committee-approved narrative information for a species will represent, by inter-agency agreement, the most authoritative data that can be obtained at the time of narrative preparation.
- (5) The retrieval program is being changed to permit a search for species names by occurrence within a state or county within a state and also by legal status (federal or state). Narratives for individual species will continue to be obtained over the teletype.

TABLE 2. — Animal Data Information Categories with Examples of Category Contents Used in the Sensitive Wildlife Information System.

Kingdom	Range
Class	Locations or regions
Family	Counties
Scientific name	Ownership responsibility
Common name	Habitat
Species	Plant-animal community relation
Scientific name(s)	Critical habitats
Common name(s)	Range/Habitat Map
Date	Food
Entered into system	Shelter Requirements
Last update	Site preferences
Legal Status	Materials
Not yet nominated	Nesting or Bedding
Nominated, rejected	Site preferences
Candidate, undetermined	Materials
Recommended	Ritual Requirements
Beneficiary	Site preferences
Extirpated	Materials
Information not available	Population Structure and Trends
Reasons for Current Status	Reproduction
Habitat modification	Phenology
Commercial, sport, scientific or education overutilization	Mating habits
Disease	Family structure
Predation	Longevity
Inadequate regulatory mechanisms	Survival rates
Other natural or man-induced factors	Responses to Management
Value Potential, Positive or Negative	Conservation and Recovery
Recreational	Depositories
Commercial	Documents
Scientific	Captive representatives
Aesthetic	Type specimens
Ecological	Gatekeeper organization
Legal protection	Bibliography
Description	
Documents with illustrations	
Physical appearance	
Field Marks or distinguishing characteristics	
Critical taxonomic criteria	

Major results that the participating agencies expect from the coordinated effort are: a reduction in duplication of effort, a pooling of information on species, the resolution of some environmental problems and disagreements among agencies and the provision of the best possible information to all the participating agencies.

A Research Need

Efforts to provide comprehensive data on the habits and habitats of threatened and endangered species have been thwarted by a disturbing lack of published data on most of these species. For

example, many of the information system narrative summaries do not contain data on species' specific habitat requirements and responses to habitat alterations. A land manager or project design engineer is unable to determine what impact his activities will have on populations of threatened or endangered species without this information. The Office of Endangered Species and International Activities, Fish and Wildlife Service, has recognized the need for more detailed data and has organized "recovery teams" to study specific endangered species and recommend a plan ". . . which will secure or restore an en-

TABLE 3.— Plant Data Information Categories with Examples of Category Contents Used in the Sensitive Wildlife Information System.

Kingdom	Range
Class	Locations or regions
Order	Counties
Scientific name	Ownership responsibility
Common name	Habitat
Family	Community relations
Scientific name	Critical habitats
Common name	Range/Habitat Map
Species	Site Quality Limitations
Scientific name(s)	Climatic
Common name(s)	Topographic
Date	Edaphic
Entered into system	Water content
Last update	Nutrient
Legal Status	Tidal
Not yet nominated	Responses to Sporadic Extremes
Nominated, rejected	Flood
Candidate, undetermined	Drought
Recommended	Frost or freeze
Beneficiary	Sun exposure
Extirpated	Toxicities
Information not available	Burning
Reasons for Current Status	Biotic Relations
Habitat modification	Dominance potential
Commercial, sport, scientific or education overutilization	Supporting roles
Disease	Disease organisms
Consumption	Consuming organisms
Inadequate regulatory mechanisms	Community Associations
Other natural or man-induced factors	Growth Rate and Longevity
Value Potential, Positive or Negative	Reproduction
Recreational	Phenology
Commercial	Sexual
Scientific	Vegetative
Aesthetic	Responses to Management
Ecological	Fertilization
Legal protection	Burning
Description	Herbicides
Documents with illustrations	Mechanical clearing
Physical appearance	Tilling
Distinguishing characteristics	Conservation and Recovery
Critical taxonomic criteria	Depositories
	Documents
	Cultivated representatives
	Type specimens
	Gatekeeper organization
	Bibliography

dangered or threatened species as a viable self-sustaining member of its ecosystem” (Office of Endangered Species and International Activities, 1974). Individual and society-sponsored research can contribute to this effort. Any such data should be transmitted to the Office of En-

dangered Species and International Activities, Fish and Wildlife Service, Washington, D.C. Those data will be incorporated into the narrative summaries in the expanded computerized information system.

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Biogeographic Information System for Animal Species in the Southeastern United States¹

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Rapid land-use changes constantly threaten to selectively eliminate or alter the abundance of animal species at both the local and regional geographic scales. Unfortunately, pest species often increase in abundance with urbanization and land development, while desirable songbirds and small mammals are reduced or eliminated. Groups responsible for land-use planning rarely have sufficient information to adequately address these problems. It is becoming increasingly important for planners to predict the consequences of their actions and to have alternatives available to minimize the adverse ecological effects of land

development. One of the long-term goals of the Regional Assessment and Evaluation program at Oak Ridge National Laboratory (ORNL) is to understand and describe the regional ecological processes that determine how the occurrence and abundance of animal populations respond to environmental changes within a region. To fulfill this goal we are gathering information on the structure of avian and mammalian communities in the southeastern United States and relating this information to vegetation structure. The resulting data base can be used for predicting the effects of habitat alterations. This paper discusses the philosophy of the project, computer system capabilities, contents of the data base and an example of species-habitat relationships developed for the four southernmost counties and the Key Largo area of southern Florida.

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Data Base Systems

Figure 1 illustrates the design and components of our data base. Counties are convenient and consistent spatial units in the 15 southeast and southcentral states, and the programs STORER and RANGER (Schreiber, *et al.*, 1974; Stephenson, *et al.*, 1976) are used to store and manipulate species distribution data.

Spatial distributions of bird and mammal species in the Southeast, including common species as well as those deemed threatened or endangered, are catalogued from species range maps or descriptions. The computer program STORER converts these diverse sources of information to a common, computer-readable form. The digitization procedure consists of recording county codes in which species occur, and several shortcuts have now been incorporated into the sequence. Eight character mnemonic names are utilized as codes for the Latin names. Counties are numbered to reflect their geographic contiguity. Options are also available to indicate that a species occurs in every county in a state or, conversely, to indicate that it occurs in every county except the listed counties. The program (Stephenson, *et al.*, 1976) also aids in checking and editing the digitized data. Once the data are stored, they can be retrieved in any of the following modes:

- (1) list of counties in which a species occurs,
- (2) list of species that occur within a county,
- (3) list of species that occur within a region of several counties,
- (4) map of counties in which a species occurs (Fig. 2), or
- (5) data file to be utilized by other analysis programs.

Abundance relationships with habitat variables and other quantitative information are being entered into the GEOECOLOGY system (Schreiber, *et al.*, 1974). This system is being developed at ORNL to provide a comprehensive regional data base of selected environmental parameters germane to the assessment of impacts related to energy technology. The spatial data base currently contains county level data on land use, agriculture, forest resources, population, terrain, climate, wildlife and water resources. The GEOECOLOGY system utilizes the Statistical Analysis Sys-

tem (SAS) (Barr and Goodnight, 1974) for subsetting, merging and analyzing county level data. Data from the system can be input to both cartographic display programs and simulation models.

Habitat Descriptors

Our philosophy behind building this data base capability is enmeshed in fundamental niche theory. The identification of appropriate habitat descriptors involves the determination of parameters related to the niche pattern descriptions of species. Most animal population studies which use this approach, particularly those involving avian species, have generally examined interactions of individual populations within specific vegetation types. This approach concentrates on development of specific habitat variables which correlate with specific species occurrence (e.g., Shugart and Patten, 1972; Anderson and Shugart, 1974). The following simulation study demonstrates a multivariate statistical analysis that determines those habitat variables which influence the distribution and abundance of animal populations.

Multivariate Analysis of Habitat Parameters

Ten rare and endangered bird species (Table 1) found in southeastern Florida were used to demonstrate the use of multivariate analysis to correlate habitat structure with species occurrence and abundance. The birds selected for the analysis are generally found in Broward, Dade, Monroe and Collier Counties. A total of 25 0.08-ha sample plots were selected in these four counties. Twenty simulated bird observations were made on each of the plots and vegetation structure data were simulated for each of the plots, using the methods of Anderson and Shugart (1974).

Based on previous studies (Anderson and Shugart, 1974) 22 habitat variables (Table 2) were selected. A multivariate analysis was used to eliminate the confounding effect of intercorrelations among the habitat variables. The discriminant function analysis was used as a final summarization. For each species, a discriminant function (in theory, the best, single, linear combination of all of the variables which distinguish between categories) separates plots into categories in which that species is absent, present or present

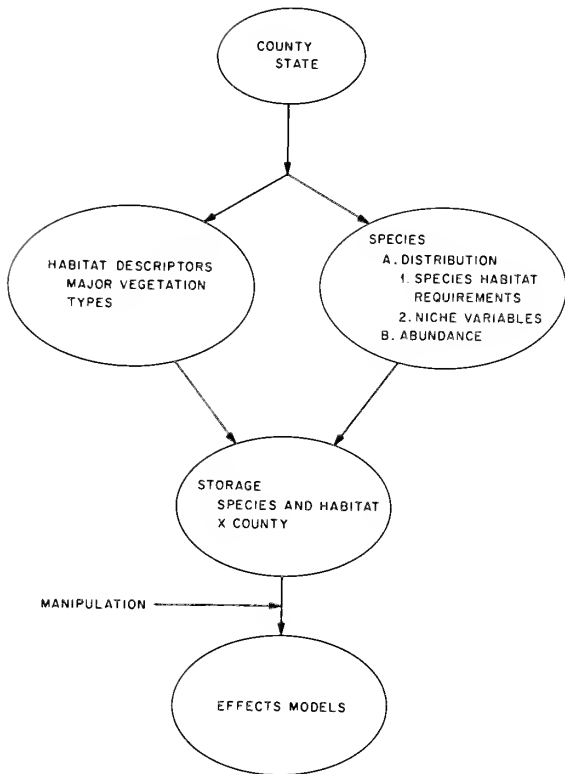


FIG. 1.—Conceptualized design of Geocology Data Base illustrating means of data storage, retrieval and manipulation.

in numbers greater than 1 is calculated. This discriminant function is then correlated with each of the variables to provide an ordering of the habitat variables according to their ability to classify sites where a particular species is absent, present or abundant. A tabulation of these correlations (Table 1) permits comparison of different habitat selection strategies for different species. In this study, the analysis identifies the most reliable variables which distinguish the 0.08-ha study plots in which a species is present from those in which it is absent. In all cases reported, the discriminant function is significant at least at $\alpha \leq 0.5$.

A number of the species show strong correlation of the discriminant function with the simulated habitat variables (Table 1). A change in one of these variables would most likely influence the numbers of individuals of that species present. The high correlation with some of the habitat variables may indicate a particular habitat struc-

ture that is indicative of that particular variable. For example, a high correlation with the number of trees greater than 22.8 centimeters DBH may mean that the bird species prefers open areas underneath larger canopy trees and requires such areas for foraging.

Species such as the Brown Pelican and Great-white Heron are correlated with just a few of the simulated habitat variables. The Brown Pelican shows a high correlation with the foliage biomass of the average tree (AFO-2, Table 1) and the branch biomass of the average trees (ABR-2) in the 10.4 to 22.8 centimeters DBH, as well as a high correlation with the branch biomass of trees greater than 22.8 centimeters DBH (BRA-3, Table 1). It also correlated with the proportion of biomass below 1.8 meters (LB-10), which may indicate dense thickets along shorelines where the birds might be found. The Great-white Heron also correlates with AFO-2 and ABR-2, indicating its presence in areas with relatively uniform tree size.

The Sandhill Crane shows a high correlation with a large number of variables (Table 1). However, the highest correlations, i.e., above 0.9, are shown with the number of trees 1.2 to 10.3 centimeters DBH and with the number of trees above 27 meters. The high correlation with a large number of variables indicates that this spe-



FIG. 2.—Computer generated distribution map of Wood ibis (MYCAME), Indiana bat (MYOS01), Ipswich sparrow (PASPRI), and Burrowing owl (SPFCUN), used to demonstrate the cartographic capabilities on the GEOECOLOGY data bank.

TABLE 1.— Simple correlation coefficients for habitat variables and discriminant function value.

	Brown Pelican	Rosette Spoonbill	White Ibis	Great White Heron	Sand Hill Crane	Bald Eagle	Caracara	Mongrove Cuckoo	Cape Sable Sparrow	Black-whiskered Vireo
TRE-1		0.373	0.782		0.931		0.931	0.661	0.721	0.718
TRE-2			0.621	0.421	0.831	0.634	0.643		0.682	0.421
TRE-3			0.771		0.722	0.541	0.732	0.571	0.665	0.522
FOL-1			0.601		0.631		0.937	0.731	0.781	0.744
FOL-2			0.691		0.875	0.731	0.621	0.631	0.842	0.633
FOL-3			0.321		0.673	0.422	0.541			
AFO-1					0.342		0.443			
AFO-2	0.699	0.934		0.734	0.221			0.321		0.622
AFO-3			0.797		0.234	0.437	0.922	0.401		0.521
BRA-1			0.748		0.794	0.521	0.881	0.762		0.830
BRA-2			0.872		0.673	0.641	0.772	0.511	0.722	0.721
BRA-3	0.892	0.871	0.201	0.321	0.321		0.342		0.842	
ABR-1					0.311		0.471			
ABR-2	0.701	0.931		0.731	0.121			0.502		0.641
ABR-3			0.103		0.185	0.521		0.611		0.722
FH-20								0.680		0.774
IH-20		0.574			0.574	0.320	0.632	0.721		0.784
SH-20		0.401	0.114		0.341	0.741				
TTRE			0.799		0.921	0.652	0.742	0.422	0.911	0.321
LB-10	0.503		0.842		0.874	0.220	0.911	0.321	0.632	0.322
OPEN			0.672		0.766	0.112	0.711		0.481	
SAPS										

cies is found throughout the area and that further analysis would be necessary to identify restrictive variables associated with its distribution.

Application of Niche Quantification

As an example of the application of the relationship of species and habitat we simulated the structure of five small mammal populations on a section of Key Largo in the Florida Keys. Initially, multivariate analysis was performed on a set of habitat parameters, similar to those used in the previous bird analysis, to group variables which were important in describing the habitat strategies of the mammal populations. We then used discriminant function analysis to construct an n-dimensional hyper-volume of niche overlap and abundance (Table 3). The species used in this analysis were: Key Largo woodrat (Group 1), Key Largo cotton mouse (Group 2), Key Largo gray squirrel (Group 3), Norway rat (Group 4), and shorttail shrew (Group 5). Information on the habitat of the first three species was taken from Brown (1970). Information on the shrew and Norway rat was taken from Hall and Kelson (1959).

The position of each species "niche" in this hypervolume can be measured directly in terms of inter-niche distance in the hyperspace. Many comparisons can be made using this statistic. Viewing the total habitat of each species as a hypervolume of habitat variables, one can compare the distance between the different species' population centers (Table 3). Using the Key Largo wood rat as an example, it is seen that the habitat hypervolume is 3.16 units. The smaller the number is when the species is compared within itself, the larger is the abundance of the species in its particular habitat. Other populations with similar values when compared to the woodrat select habitat hypervolumes similar to that of the woodrat population. The Key Largo cotton mouse (Group 2) is 3.54 units away; the Key Largo gray squirrel (Group 3) 3.30 units; however, the shrew (Group 5) was 6.03 units away and the Norway rat (Group 4) even more distant, 12.63, indicating a wide separation in the habitat needs of the first three species when compared with the latter two species.

The habitat discrimination function also can be reclassified to determine the number of individuals

TABLE 2. — List of twenty-two values used to characterize the habitats of ten rare and endangered bird species found in south Florida.

TRE-1:	No. of Trees 1.2-10.3 cm DBH
TRE-2:	No. of Trees 10.4-22.8 cm DBH
TRE-3:	No. of Trees >22.8 cm DBH
FOL-1:	Foliage Biomass of Trees 1.2-10.3 cm DBH
FOL-2:	Foliage Biomass of Trees 10.4-22.8 cm DBH
FOL-3:	Foliage Biomass of Trees >22.8 cm DBH
AFO-1:	Foliage Biomass of Average Tree 1.2-10.3 cm DBH
AFO-2:	Foliage Biomass of Average Tree 10.4-22.8 cm DBH
AFO-3:	Foliage Biomass of Average Tree >22.8 cm DBH
BRA-1:	Branch Biomass of Trees 1.2-10.3 cm DBH
BRA-2:	Branch Biomass of Trees 10.4-22.8 cm DBH

TABLE 2. — (Continued).

BRA-3:	Branch Biomass of Trees >22.8 cm DBH
ABR-1:	Branch Biomass of Average Tree 1.2-10.3 cm DBH
ABR-2:	Branch Biomass of Average Tree 10.4-22.8 cm DBH
ABR-3:	Branch Biomass of Average Tree >22.8 cm DBH
FH-20:	Distance to Flowing Fresh Water
IH-20:	Distance to Impounded Fresh Water
SH-20:	Distance to Salt Water
TTRE:	No. of Trees Above 27 m
LB-10:	Proportion of Biomass Below 1.8 cm
OPEN:	Proportion of Open Prairie
SAPS:	No. of Saplings

TABLE 3. — Niche hypervolume and classification of five mammal species found on Key Largo, Florida.

DISCRIMINANT ANALYSIS PAIRWISE SQUARED GENERALIZED DISTANCES BETWEEN GROUPS

$$\text{WHERE: } D^2(I|J) = (\bar{X}_I - \bar{X}_J)' \text{COV}^{-1} (\bar{X}_I - \bar{X}_J) - 2 \text{LN PRIOR}_J$$

GENERALIZED SQUARED DISTANCE TO GROUP

FROM GROUP	1	2	3	4	5
1	3.15795741	3.54131215	3.30095368	12.62585354	6.02752653
2	4.25466204	3.87130730	4.10278257	14.86500182	7.59402811
3	2.85466657	2.94314558	2.71167031	12.02225461	5.29944663
4	12.95089139	14.47668980	12.79357957	3.48299527	6.53733517
5	5.92994620	6.78309789	5.64815341	6.11471698	3.06037708

DISCRIMINANT ANALYSIS SUMMARY OF CLASSIFICATION PERFORMANCE USING GENERALIZED SQUARED DISTANCE

$$\text{WHERE: } D^2(x) = (x - \bar{X}_J)' \text{COV}^{-1} (x - \bar{X}_J) - 2 \text{LN PRIOR}_J$$

NUMBER OF OBSERVATIONS CLASSIFIED INTO GROUP

FROM GROUP	1	2	3	4	5
1	7	3	6	0	4
2	4	3	6	0	1
3	7	3	11	0	4
4	0	0	1	12	4
5	1	0	7	5	8

of a certain species that would be placed in the habitat hypervolume of the other different species. The lower portion of Table 3 summarizes these results. The conversion of mature hammock for subdivision development (represented by the hab-

itat of the Key Largo woodrat) virtually eliminates the occurrence of the other three species, since no member of the woodrat, cotton mouse and gray squirrel were placed in this type.

Conclusion

Information stored in our data bank can be used in identifying characteristics of the habitat which, if altered, might affect rare and endangered species. This analysis provides information about specific variables that are important to the abundance and distribution of rare and endangered species. Presumably changes in these selected habitat variables, which include types of vegetation, openness, and distances to water, would alter the species composition in this area. With this habitat information and related population data we feel it will be possible to predict changes in the populations of animal species prior to landscape alteration over large regional areas. The type of data analysis we have demonstrated can have far-reaching effects in conservation of not only existing rare or endangered species but also of those species which may become endangered by unknowing destruction of critical elements of their habitat.

Acknowledgments

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The Tennessee Heritage Program: An Applied Data Management System for Endangered and Threatened Species Information

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The Tennessee Heritage Program is an applied data management system which has been designed to assist planners, scientists, resource managers, and other concerned individuals and organizations in protecting critical habitats. Information on plant communities, critical habitats, special species, geological features, aquatic types, and other natural and cultural features is collected and stored for application by legitimate users.

The Tennessee Heritage Program was initiated in April, 1975, by The Nature Conservancy, Tennessee Department of Conservation, and Bureau of Outdoor Recreation. The initial purpose of the Heritage Program was to assist the Tennessee Department of Conservation with the implementation of the Natural Areas Act of 1971 by providing a systematic process for identification and classification of outstanding natural features, including endangered and threatened species. The Heritage Program's development and installation were to be completed within one year, but the completion date has been extended to 1 July 1976 for fiscal planning purposes. The ultimate disposition of the Tennessee Heritage Program, as is the concept for similar programs in Mississippi, South Carolina, West Virginia, Ohio, Oregon, North Carolina, and New Mexico, is for the contracting state agency to assume control and continuation of the data management system.

Only portions of Heritage Program development and implementation pertinent to discussing special species will be herein presented.

Classification System

Definitions

The Heritage Program classification documents list and comment on those Tennessee species, communities, habitats, and unusual features, called ELEMENTS, identified by reliable sources as being of special interest to Program personnel and users. The class entitled Special Species includes endangered, threatened, special concern, rare, and peripheral plant and animal species. The listed species and habitats, or elements, have been identified by competent professionals as needing expert protection and management designed to insure their perpetuation as components of a viable natural system.

Definitions of plant and animal species/sub-species categories in the Special Species class are as follows:

- | | |
|-------------------------|---|
| <i>Endangered:</i> | In danger of extinction throughout all or a significant portion of its range. |
| <i>Threatened:</i> | Likely to become endangered within the foreseeable future throughout all or a significant portion of its range. |
| <i>Special Concern:</i> | Falls into one or more of the following:
<ol style="list-style-type: none">(1) An animal included on the Tennessee Wildlife Resources Agency's list of "Species Deemed in Need of Management."(2) A plant or animal population requiring monitoring or obser- |

vation due to the absence of information on which to base any other disposition or assignment.

- (3) An animal or plant likely to become threatened in the foreseeable future.

Rare: Has populations which are small or severely limited within its existing or original range.

Peripheral: Has populations which occur in Tennessee on the outer fringe of its center of distribution.

Authorities

Endangered and threatened animals incorporated in the classification system appear on federal and/or Tennessee state lists. The enabling federal and state authorities are the "Endangered Species Act of 1973" (PL93-205) and the "Tennessee Nongame and Endangered or Threatened Wildlife Species Act of 1974 (Public Chapter 769).

The Smithsonian Institution (1974) is used as the official reference for the designation of endangered or threatened status to critical plants. At the time this manuscript was prepared, no federal or state law has been passed to officially list and protect plants. The authors sincerely hope that federal action is soon taken, and we have initiated activity at the state level that, hopefully, will result in the establishment of enabling legislation during the next legislative session.

With respect for certain animals appearing in the Special Concern category, the "Tennessee Nongame and Endangered or Threatened Wildlife Species Act of 1974 (Public Chapter 769) provides protection for nongame species/subspecies. This list is called "Species Deemed in Need of Management."

Special Concern plants, and both plant and animal species/subspecies incorporated as rare and peripheral, are listed on the basis of consultations with knowledgeable scientists.

It is important to note that competent scientists are the only source of credible information at both the national and state levels on species/subspecies to be included on valid lists. In the preparation of the Tennessee Heritage Program's data management and classification systems, every

effort has been made to seek the recommendations of recognized, competent scientists. Each element occurrence references the source of information, thereby crediting the sources for their contributions and enabling users to contact the primary sources for additional information or comment.

Contents

The classification system is dynamic; additions and deletions are made as justifiably necessitated. At the time of this writing, the following total number of plants and animal elements, respectively, exist: Endangered (25, 36); Threatened (31, 34); Special Concern (1, 117); Rare (84, 0); and Peripheral (1, 0).

Data Management System

The data management system includes data gathering, storage, retrieval, display, and application. The process is cyclic and continuous.

Data Gathering

The primary sources for information are knowledgeable experts, publications, and unpublished materials. Thus far, the most important data sources have been professional scientists, many of whom are attending this conference.

The necessity for providing information which (1) acknowledges the presence of a species or population and (2) specifies the location of that element is very important and worth emphasizing. For illustrative purposes, suppose a highway is proposed between points A and B in Coffee County. A scientist knows that a population of rare orchids exists in the right-of-way, but due to the fear that his colleagues will collect samples, the botanist acknowledges only that the population exists within that county. The offered data is then not applicable for the planners, and the botanist has effectively prevented his contemporaries from collecting the orchids, but at what consequence to the population concerned?

Scientists who intentionally conceal locational information from persons capable of planning for the protection of a species have no basis for complaints if the species/population is inadvertently destroyed. If specific locational information is provided when alternatives are most easily de-

veloped, which is during the initial planning phases, then conservationists have a much greater chance for successfully protecting the habitat.

Data Storage and Retrieval

Information concerning Special Species is stored in three separate, but cross-referenced files: Manual, Map and Computer. These files are a repository for all known data concerning Special Species.

The Manual Files contain all applicable printed information on a species, population and habitat.

The Map Files are predominantly 7.5' quadrangle topographic sheets that have the specific location of the species/population marked.

The Computer File is used as a quick-reference index to the other files. A minimum amount of information is stored, inexpensively, and may be retrieved and displayed on printouts or computer-generated maps. Security modes have been installed to prevent unauthorized entry into the data bank. Also, suppression of critical information is possible on printouts and is employed when specific information is not needed by a user, thus minimizing the chance of inadvertently disseminating sensitive data.

Data Application

Data incorporated into the Heritage Program's file system is treated as sensitive information and not indiscriminately entrusted to the general public. However, the information has been collected for use by bona fide scientists, planners, resource managers, and related professionals as a tool for sound research, planning and management efforts.

Results

The Tennessee Heritage Program has accomplished several significant achievements in the areas of ecology, applied data management systems, critical species/habitat protection, and rudimentary organization of working scientific committees. As the Program matures and the data base is enriched, the applications of information to environmental planning and management decisions will increase.

From an ecological perspective, the documentation and description of the 130 plant community types in Tennessee is a first and highly important

step toward measuring the remaining natural diversity of the state. The development of lists containing the name and locations of critical habitats and endangered, threatened, special concern, rare, and peripheral plant and animal species is also a valuable tool which scientists can begin to use for complete ecosystem analysis.

The data management capability intrinsic to the Heritage Program is a major innovation for the natural sciences. The consolidated, centralized data base is a tremendously powerful research and management tool. The capability to query for the majority of specific information on a particular subject is an effective, efficient and economically feasible procedure.

As the data base increases, habitats can be identified and assigned priorities according to criticality and need for protection. Furthermore, comments from experts may be solicited and incorporated into planning and management decisions at the initiation of environmental assessments, thereby increasing the possibilities for utilizing this critical data at the most ecologically opportune and effective time.

Information accumulated by the Tennessee Heritage Program staff has been used for planning and review purposes by the Corps of Engineers, Tennessee Valley Authority, Bureau of Outdoor Recreation, Soil Conservation Service, Tennessee Department of Conservation, Tennessee Wildlife Resources Agency, Tennessee State Planning Office, and Tennessee Department of Transportation. Information exchange and related cooperative efforts have been conducted between the Program and Oak Ridge National Laboratory, Appalachian Trails Committee, Nuclear Regulatory Commission, National Park Service, academic institutions, private citizens, consulting engineering firms and other conservation organizations.

An itemization of specific Heritage Program applications and a complete list of plant and animal species included in the class Special Species are available upon request to the senior author.

Conclusions and Recommendations

Habitat Preservation

A viable program of species/population pro-

tection generally should address the problems of habitat preservation. The preservation of habitat includes three basic steps: identification of critical habitat, acquisition of property rights and implementation of a realistic management plan.

The scientific community is almost solely responsible for accomplishing steps 1 and 3. The professional scientist, who is interested in protecting an endangered or threatened species, can focus attention on the habitat and provide invaluable assistance in drafting, implementing, and monitoring a management operation.

The acquisition of property rights, which includes donation, partial gift, easement, lease, registry, or fee-simple purchase, can be accomplished through appropriate governmental organizations or private groups such as The Nature Conservancy.

The Heritage Program's approach is an effective avenue for habitat protection, as demonstrated by accrued applications of Program products.

Habitat Destruction

The modification of habitats will continue to occur, and at an increasing rate. As the human population and concomitant resource consumption increase, as the national economy improves and as certain philosophies are perpetuated, man and his coinhabitants of this ecosphere will feel the impacts.

The knowledge that development is occurring

and will continue to occur mandates that conservationists begin to work more closely with resource planners and managers, developers, other scientists and related professionals. The inclusion of sound environmental data during the initial planning phases increases the possibilities for successfully protecting habitats.

Recommendations

Experience gained in the Tennessee Heritage Program and similar endeavors indicates that the protection of habitat is a cooperative effort. Scientists have expertise in natural area inventory and assessment. The information should be efficiently and effectively conveyed to those planners and managers who are in positions to apply environmental data in order to avoid or lessen adverse ecosystem impacts.

Without intending to be presumptuous or to exploit the scientific community, scientists are the indispensable sources of basic ecological information. Increased support from the scientific realm is necessary lest the battles against unregulated, poorly planned development continue unchecked. Professionals concerned with the conservation of critical elements should work cooperatively with The Nature Conservancy's Heritage Programs by providing relevant information, investigating further the concepts and applications of natural area programs and the role of the private sector in protecting natural diversity.

Report on the Work of the Florida Committee on Rare and Endangered Plants and Animals

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The Florida Committee on Rare and Endangered Plants and Animals (FCREPA) is a rather loosely knit group of scientists who are donating their expertise and time to increase knowledge of the threatened biota of Florida and to aid in its preservation. It is jointly sponsored by two of Florida's most active environmental organizations — Florida Audubon Society and Florida Defenders of the Environment. Reubin O'D. Askew, Governor of Florida, and Nathaniel P. Reed, Assistant Secretary of the U.S. Department of the Interior, serve as Honorary Co-Chairmen. The major objectives of the Committee are to 1) prepare a comprehensive inventory of the rare and endangered flora and fauna of Florida, 2) encourage further research on rare and endangered species in Florida as a basis for more effective action to aid their survival, 3) formulate guidelines and recommendations for the preservation and enhancement of threatened plant and animal populations in the state and 4) promote greater public understanding of the significance of rare and endangered species and the importance of preserving them.

The Committee was formed in 1973. The objectives and general organization were outlined at a meeting in September of that year arranged by the Conservation Research Committee of the Florida Audubon Society under the chairmanship of Dr. William B. Robertson, Jr. The Committee was formally established and began active work at a two-day conference in December.

The professional affiliations of the 64 current members of the Committee include ten colleges and universities, five research foundations, one environmental consulting firm, three state or na-

tional environmental organizations, four state agencies, and four federal agencies. Thirty-six members (56%) are associated with academic institutions, nine (14%) with research foundations or consulting groups, four (6%) with environmental organizations, ten (16%) with state agencies, and five (8%) with federal agencies. In addition to the regular members, 25 scientists from within and outside Florida have worked with the Committee as consultants.

The internal structure of the Committee consists of a Coordinating Committee of 15 persons and eight Special Committees with from five to 13 members and varying numbers of consultants. The Coordinating Committee, which is responsible for the over-all direction of the FCREPA program, includes the chairmen of the special committees and representatives of the Florida Audubon Society, Florida Defenders of the Environment, Florida Department of Natural Resources, and Florida Game and Fresh Water Fish Commission. The author serves as the current chairman of the Coordinating Committee.

Seven of the Special Committees consist of experts on different major groups of organisms. The groups covered and chairmen of the respective committees are as follows: Plants (Dr. Daniel B. Ward, Herbarium, Agricultural Experiment Station, University of Florida); Freshwater and Marine Aquatic Invertebrates (Dr. Joseph L. Simon, Department of Biology, University of South Florida); Insects and Other Terrestrial Invertebrates (Dr. Howard V. Weems, Bureau of Entomology, Division of Plant Industry, Florida Department of Agriculture and Consumer Services); Fishes (Dr. Carter R. Gilbert, Florida State

Museum, University of Florida); Amphibians and Reptiles (Dr. Roy W. McDiarmid, Department of Biology, University of Florida); Birds (Dr. Herbert W. Kale, II, Florida Audubon Society); and Mammals (Dr. James N. Layne, Archbold Biological Station, American Museum of Natural History). The remaining special committee is concerned with development of recommendations on research, management, and other matters relating to rare and endangered species at the state or national level and facilitating interaction between FCREPA and various governmental agencies and other groups concerned with threatened wildlife. Its present chairman is Mr. Lovett E. Williams, Florida Game and Fresh Water Fish Commission.

Summary of Activities

The main emphasis in the work of the Florida Committee thus far has been the preparation of as complete an inventory of rare and endangered plants and animals in Florida as present knowledge will permit.

For purposes of the Florida inventory, we have adopted the same definition of "species" as employed in the Endangered Species Act of 1973. That is, the term is used in a general sense to denote either 1) a full taxonomic species, 2) a subspecies or variety (in plants), or 3) particular populations of a species or subspecies which deserve recognition because of their biogeographic, ecological, or evolutionary significance or other reasons.

Categories used to designate the status of extant species of plants and animals on our list include: Endangered, Threatened, Rare, Species of Special Concern, and Status Undetermined. Our Endangered and Threatened categories are defined as in the Endangered Species Act of 1973, and our Rare and Status Undetermined categories correspond respectively to the Rare and Indeterminate categories of the IUCN Red Data Books. Species of Special Concern is a new category created by the Florida Committee for certain species that do not clearly fit the definition of Endangered, Threatened, or Rare yet warrant special attention. Included in this status category are 1) species that, although perhaps presently comparatively abundant and widespread in the state,

are especially vulnerable to certain types of exploitation or environmental changes and have experienced a longterm population decline or 2) species whose status in Florida has a potential effect on endangered or threatened populations of the same or related species elsewhere in the United States or other parts of the world. Certain species of wading birds whose populations in Florida are steadily dropping as the result of loss of wetlands and the red and black mangroves are examples of the first type of Species of Special Concern. The American Alligator, which can probably no longer be considered Endangered or Threatened in Florida by strict definition but which should nevertheless be protected in such a way as to prevent any kind of commercial exploitation of its hides that would result in further deleterious pressures on truly endangered crocodilians elsewhere in the world, exemplifies the second type.

Species on the Florida list are assigned to a given category on the basis of the status of their populations in the state. Thus, a plant or animal whose range barely reaches Florida, i.e. a peripheral species, may be classified as Endangered, Threatened, or Rare as a member of the Florida biota and still be generally common elsewhere in its range.

In addition to extant rare and endangered species, the Florida inventory also includes species that have disappeared from the state through extirpation or extinction since about 1600.

The current FCREPA list is the culmination of about 2½ years' work. At our conference in December 1973, each Special Committee drew up a provisional list based upon the best information available. Following this meeting, the Special Committees continued to refine their provisional lists and prepare accounts for each species on the list. In August 1973, the Committee sponsored a public conference on rare and endangered species at the University of South Florida to present the revised lists and summarize the information compiled for each group of organisms. This meeting also gave a further opportunity for state and federal agencies, conservation and sportsman organizations, and other interested parties and individuals to comment on the lists. Since that date, the lists for each group have remained fairly static,

TABLE 1. — Number of Florida plant and animal species listed under various status categories.

Group	Status Category							
	End.	Threat.	Rare	Sp. Spec. Concern	Status Undet.	Total *	Rec. Extirp.	Rec. Extinct
PLANTS	41	30	76	2	—	149	11	—
Pteridophytes	8	—	7	—	—	15	2	—
Gymnosperms	1	1	1	—	—	3	—	—
Angiosperms	32	29	68	2	—	131	9	—
FRESHWATER INVERTEBRATES	2	14	6	5	2	29	—	—
Mollusks	1	9	—	3	—	13	—	—
Crustaceans	1	5	6	2	2	16	—	—
MARINE INVERTEBRATES	14	2	1	—	1	18	—	—
Corals	14	—	—	—	—	14	—	—
Mollusks	—	—	1	—	—	1	—	—
Crustaceans	—	2	—	—	1	3	—	—
TERRESTRIAL INVERTEBRATES	13	21	—	4	59	97	—	—
Mollusks	—	1	—	—	—	1	—	—
Arachnids	1	1	—	4	—	6	—	—
Crustaceans	1	—	—	—	—	1	—	—
Insects	11	19	—	—	59	89	—	—
FISHES	2	24	14	2	—	42	—	1
AMPHIBIANS	1	1	7	—	1	10	—	—
REPTILES	6	12	12	2	3	35	—	—
BIRDS	11	13	11	26	6	67	3	2
MAMMALS	10	9	11	1	5	36	2	2
Total	100	126	138	42	77	483	16	5

* Of extant listed species.

although they have been revised as necessary to reflect new data or as the result of reevaluation of previous information. As expected, because of the number of species involved, taxonomic difficulties, and generally fragmentary information on populations, the plant and invertebrate lists have required the most frequent revision.

The present FCREPA lists contain 483 extant species plus 21 recently extirpated or extinct species. Species listed as Endangered, Threatened, Rare, Species of Special Concern, or Status Undetermined include 149 plants, 29 fresh water invertebrates, 18 marine invertebrates, 97 terrestrial invertebrates, 42 fishes, 10 amphibians, 35 reptiles, 67 birds, and 36 mammals (not including marine species). Of these, 100 (21%) are considered Endangered, 126 (26%) Threatened, 138 (29%) Rare, 42 (9%) Species of Special Concern, and 77 (16%) Status Undetermined. Seventy-four percent of the forms included on the lists are full taxonomic species; 20 percent, recognized subspecies, 1 percent, local populations; and 4 percent, undescribed species or subspecies. A

breakdown of the listed species by status category and major taxonomic groups is given in Table 1.

Accounts of each species included on the lists have been or are being prepared by an authority on that species or general group. The accounts of extant species include common and scientific names; description of distribution in Florida and also total range if the species occurs outside the state; habitat requirements; a summary of ecology and life history with special emphasis on those aspects that may be relevant to understanding habitat relationships, population status and distribution; description of any specialized or unique characteristics; summary of evidence upon which the status classification is based; recommendations for research, management, or other actions that will aid the species; and selected references. The average length of the write-ups is about four double-spaced pages; and a detailed Florida range map and general range map, where applicable, are included. In addition to summarizing previously published information on the species, many of the accounts contain a substantial amount of

original data from the author's own research. Accounts of recently extirpated or extinct species are less detailed and mainly cover the former range and habitat relationships of the species in Florida and the history and cause of its decline.

Species accounts for all the vertebrate groups, the marine and freshwater invertebrates, and the endangered plants have now been completed and those for the remaining listed species are expected to be finished in the near future. Present plans for publication call for a preliminary microfiche edition, which should be available within the next few months. This will be followed later by a printed edition issued as separate volumes for each of the six major groups covered by the inventory. We are hopeful that the first of these may be out within the year. The microfiche edition, which is being arranged by Florida Audubon Society, is being used to get the information assembled to date into the hands of agencies and organizations anxious to make use of it for such purposes as land-use planning, evaluation of environmental impact statements, environmental education programs and so forth. It will contain only the species accounts and accompanying range maps. The final printed edition which will be published under the auspices of the Florida Game and Fresh Water Fish Commission will include in addition to species accounts a general description of major Florida habitat types, an analysis of the data in the individual species write-ups to identify those habitat types and geographic regions of the state that are most critical with regard to the rare and endangered species in the particular group and over-all recommendations on research, land acquisition, management, or other action required to alleviate the threats to that group of organisms.

Even prior to actual publication, the lists and background information prepared by the Florida Committee have received wide circulation and have been utilized extensively by state and federal agencies, regional planning councils, state and national conservation organizations, private consulting firms and the news media. One of the major uses of the lists have been in the preparation or review of Environmental Impact Statements and Development of Regional Impact pro-

posals required by the state for certain types of development projects. The list has also been included in the state's Comprehensive Environmentally Endangered Lands Plan which sets forth criteria for evaluating lands considered for acquisition by the state in order to protect their environmental values. The Committee has also provided information to environmental groups for their use in developing rare and endangered species education programs. Many newspaper and magazine articles, which have contributed greatly to increasing the public's concern for rare and endangered species, have also drawn heavily on material made available by the Committee.

The Committee has also had significant input into the development of the state's endangered species program in which the Florida Game and Fresh Water Fish Commission is the lead agency. The current state list, which covers only Endangered and Threatened fishes, amphibians, reptiles, birds, and mammals, was adopted largely from the FCREPA lists. In addition, although given no legal status, those vertebrate species on the Committee list in the categories of Rare, Species of Special Concern, and Status Undetermined have been endorsed for further studies and management by a formal resolution of the Commission. The Committee has also proposed the species of plants, invertebrates, and various marine vertebrates on its lists for inclusion on the official state list. However, action on this proposal has been delayed until questions concerning the legal authority of the Florida Game and Fresh Water Fish Commission to list species in these groups have been resolved.

This report on the work of the Florida Committee on Rare and Endangered Plants and Animals would not be complete without a final word of acknowledgment and sincere thanks to the members of the committee and consultants who have given so generously of their time and knowledge and to Florida Audubon Society, Florida Defenders of the Environment, the Florida Game and Fresh Water Fish Commission, Florida Department of Natural Resources, and other governmental agencies, conservation organizations and individuals who have encouraged our efforts.



The Red River Gorge showing meander pattern of the River. This point on Chimney Top Rock would also have provided a view of the proposed Red River Lake. Photograph by William H. Martin, January 10, 1976.

The Red River Gorge Controversy in Kentucky: A Case Study in Preserving a Natural Area

WILLIAM H. MARTIN
Eastern Kentucky University

The preservation of unique and unusual habitats and remnants of once wide-spread natural ecosystems also favors the survival of rare, endemic, threatened and endangered species. It is widely recognized that loss of habitat is the single most important factor that "breaks the web," lowers habitat and species diversity and leads to lengthening of the rare, endangered and extinct species lists.

The struggle to preserve such habitats has in-

tensified in recent years as environmental awareness in the United States population has run headlong into developers, resources industries and governmental agencies. Dam construction and the development of other "water resource" projects by the United States Army Corps of Engineers (COE), Tennessee Valley Authority (TVA), Bureau of Reclamation and private industry has been, and will continue to be, an area of controversy as the dams increase and natural areas are

inundated. Recent citizen efforts, assisted by NEPA, have helped to bring a halt to some of those projects widely defined as environmentally unsound.

The COE project for the North Fork of the Red River in Kentucky was the construction of a dam that would have created a small lake (ca. 620 ha in area) for flood control, recreation, and water supply. This project and the controversy surrounding it represent an example of successful efforts to prevent elimination of unique and important representatives of aquatic and terrestrial Kentucky ecosystems and further reduction of restricted habitats of rare, endemic and unusual plant and animal populations.

The objectives of this paper are to (1) assess the ecological value of the Red River Gorge, (2) outline the controversy surrounding the area, and (3) consider the organization of successful opposition to the project. Some of the points considered in this discussion should be of value to other biologists in the southeastern United States as we all become involved in insuring the protection, preservation and perpetuation of irreplaceable, essential biotic resources.

The Red River Gorge

The Red River Gorge in Kentucky is located on the western flank of the Cumberland Plateau. In the southern Appalachians, this edge of the plateau is often dissected into extensive gorges, gulfs, or deep ravines with topographic, edaphic, geologic and microclimatic features that provide entirely different physical environments in comparison with other parts of the plateau and landscapes to the east and west.

Located in Powell, Menifee and Wolfe counties, the Gorge is a large representative of these ecosystems. Rock strata of Pennsylvanian and Mississippian ages provide the parent material for the complex of soils of the ridge crests, slopes, coves and flood plains. Regional climate is temperate continental, but the local climate is undoubtedly modified by the sharply dissected topography. The Red River drains into the Kentucky River, master drainage system of east-central Kentucky. The area discussed here refers to the North Fork of the Red River, with the public land presently administered by the United States

Forest Service as a Geologic Area of the Daniel Boone National Forest.

Braun (1950) places the Gorge in the Cliff Section of the Cumberland Plateau, the western part of the Mixed Mesophytic Forest Association. Special mention is given to the Red River Gorge area (pp. 98, 109-110) regarding geologic and vegetational features. Throughout the gorge areas of Kentucky, Tennessee and Alabama she recognized the habitat diversity, floristic richness and diversity of forest communities associated with the many habitats of this sharply dissected topography. The unusual habitats created here provide sites that allow survival of relic and disjunct populations, permit the extension of species' ranges beyond "normal" geographic boundaries and promote the evolution of endemics and ecotypes (subspecies). The arrival of Europeans signaled the beginning of widespread forest habitat change and manipulation. In the 19th and 20th centuries, these forests provided a major source of fuel for heavy industry as well as a local source of fuel, food and fiber. By the end of World War II, practically all of the forests of the Cumberlands were secondary growth with a few scattered remnants of old-growth or virgin forest remaining because the trees were "overmature," "cull" or "inaccessible."

Relatively few ecological studies have been conducted in Cumberland Plateau gorges, beyond Braun's reconnaissance of the Cumberlands in the 1930's and 40's. Scattered vegetation studies in the Cliff Section since that time have concentrated in Tennessee (Caplenor, 1965; Safley, 1970; Quarterman, *et al.*, 1972). Herman and See (1973) have conducted one of the few studies in the Red River drainage, a remnant hemlock-tulip poplar forest in "Tight Hollow."

Branson and Batch (1974) have surveyed the fish fauna of the Red River drainage and report over 70 species of stream fishes as representatives of five main zoogeographic elements. Many of the species are indicators of the oxygenated, relatively clear, unpolluted stream water; for example, 13 darter species, a unique assemblage for one stream, include two Kentucky endemics, bluestripe darter (*Percina cymatogenia*) and emerald darter (undescribed *Etheostoma* sp.).

Fortunately, a major floristic study on the

North Fork of the Red River has been conducted by Higgins (1970). He reported 555 vascular species (and varieties), and with unpublished additions to the list by Mr. Johnnie Varner of Cynthiana, Kentucky, the number of known taxa now stands at over 720 vascular species. This list exceeds those reported from the gorges of Tennessee (Caplenor, 1955; personal communication with Dr. Ross Clark, Erskine College) and the Blue Ridge escarpment (Cooper and Hardin, 1970; Racine and Hardin, 1975), and provides an excellent example of the direct relationship between environmental and biotic diversities. The rich flora has several northern and southeastern representatives in addition to Southern Appalachian taxa. Eight vascular species are known to Kentucky only from the Gorge, and 10 others are known from but one or two other locales. The only known endemic to the Red River drainage is *Solidago albopilosa*, which was discovered, named and described by Braun (1942). Restricted to the base of sandstone cliffs and rockhouses (Andreasen and Eshbaugh, 1973), it is one of seven plant species listed as endangered in Kentucky (Smithsonian Institution, 1975).

Floristic richness of the Red River ecosystem is accompanied by a vegetational complexity that includes cane, sycamore, beech-sycamore and river birch communities on the flood plain; diverse tulip poplar, oak, beech, white pine, hemlock and mixed mesophytic communities on the terraces, slopes, leads, draws and in the coves; pine, pine-oak and oak-pine communities prevail on the plateau surface and on the drier sites throughout the Gorge.

Excerpts from a statement made by the late Dr. Braun in 1970 attest to the scientific and educational value of the Red River Gorge:

“. . . The Red River country in Kentucky (North Fork Red River in Powell, Wolfe, and Menifee Counties) is, from an ecological standpoint, one of the finest areas in eastern United States . . . It is the most representative area remaining in the whole of the Cliff section of the Mixed Mesophytic Forest Region.

“Here, in this one spot in the Red River valley, the entire ecosystem can be studied. Flooding by the construction of a dam . . . will destroy this remaining example of this type of forest-community distribution . . .

“Much of the area is as yet scientifically unknown.

It would take years of intensive study to unravel the problems presented here . . .

“Any water level about 700 feet should be condemned because of the destruction that would result — the disruption of entire ecosystems, the backing of water into the lower reaches of tributary creeks and hence the destruction of ravine ecosystems.”

Genetic or Water Reservoir?

Plans to build a dam on the North Fork of the Red River go back to 1962 when a project designed only for flood control was approved by Congress. In 1967 plans to build the dam began to solidify, but the growth of widespread opposition delayed the project; and in 1971 under pressure from Sierra Club and others, the Corps proposed to move the dam 8 km downstream.

Meanwhile, the National Environmental Policy Act (NEPA) became law, and in compliance with the act, the Corps submitted a draft environmental impact statement in 1973. The project now had grown from an \$8 million flood control dam in 1962 to a “multi-purpose,” \$31.8 million flood control, recreation, water supply dam.

In 1973 and 1974 the Red River controversy was kept hot by politicians, arguments between the dam proponents in the nearby towns that wanted to develop the flood plain and future lake-front property, and the conservationists-preservationists that were mostly “outsiders.” However, the 55 families that would be moved from the project area joined with the outsiders, and this combined opposition formed a most active, vocal and effective coalition.

Prior to the publication of the Final EIS, this opposition formed the Red River Gorge Legal Defense Fund, Inc. in anticipation of lawsuits that could be filed (under NEPA). In July, 1974, the Final EIS, with the decision to continue the project, was published and in August a suit was filed in United States District Court asking that the project be halted. Extensive affidavits were prepared and letters that provided the documentation against the project were written to the Council on Environmental Quality (CEQ). The long list of critical analyses of statements in the EIS revolved around the inadequate treatment of environmental impact, displacement of families, economic considerations and the veracity of the

magic number — the benefit/cost ratio. For example:

- (1) The compilation of a list of plant and animal species was considered "too expensive" and "time consuming," although five of the eight plant species known only to Kentucky from the Gorge would be eliminated by the lake along with at least ten species with limited distribution in the region;
- (2) one paragraph was set aside to discuss the "displacement" of 55 families and loss of agricultural land was not considered;
- (3) among a long list of weaknesses, the benefit/cost ratio used 3½% discount rate and attributed 44% of the flood control benefits to reducing the flood level on the Ohio River by less than one inch!

In short, the EIS exposed the degree of attention given the impact of this project. Simply put, the Corps chose to deal in generalities rather than facts, produced arguments without research and supplied opinions (theirs) instead of data as documentation.

On two separate occasions CEQ asked the Corps for responses to criticisms to the scientific-conservationist community. The data provided did not deny the criticisms, but confirmed the Defense Fund's position. Finally, CEQ recommended termination of the project. With this mass of negative data and a critical GAO report, Governor Julian Carroll announced his opposition to the project in September, 1975. With this opposition by the governor, the Corps "suspended" the Red River Lake project.

The suspension by the Corps does not mean that Red River Lake is a dead issue. Congress has to "deauthorize" the project to really end the dispute and save the Red River Gorge. At this time we simply cannot predict the position of the next governor and the same success and public support the next time.

Organizing Effective Opposition

Some of the features that seem to be important aspects of this struggle to preserve a natural area may be useful to other areas in the Southeast where "progress" and "development" mean loss of habitat and possible loss of rare, endangered or threatened biota. Here are some suggestions from this experience in Kentucky:

- (1) Organize EARLY. Everyone recognizes that or-

ganization is essential, but one key to success in the Red River case was early organization of conservationists, biologists, economists, agronomists, sociologists, attorneys and local citizens into one group along with an executive committee empowered with authority to make decisions and locate those individuals who have the expertise required to evaluate segments of a project.

- (2) Obtain CENTRAL office space and hire a FULL-TIME staff to coordinate all of the activity, including prepared reports, establishing deadlines, and a telephone network for fast communication.
- (3) Develop a favorable relationship with the press. Do NOT use a press release but establish direct contact with the media. Provide current material, do not overstate a given situation, avoid personality conflicts and do not provide speculative material.
- (4) Maintain DIRECT CONTACT with the agencies (CEQ) and people (governor) involved in making decisions. Providing sound, reliable data is an absolute necessity in order for these people to depend on you.
- (5) Know the positions and views of the opposition and let THEM deal in generalities and opinions.
- (6) Involve local people. If some of these people are not involved, federal agencies and disinterested groups will turn a deaf ear to your position.
- (7) Involve "young" and "old" people. Young people have the energy and stamina to keep the organization running smoothly and older people can provide a lifetime of experience in dealing with people and organization.
- (8) Be prepared for a long struggle and unpleasant moments. The opposition is probably as determined as you are.
- (9) Money. Establish a fund raising segment of the organization. The allied conservation organizations will be an important source. Ask early contributors for more funds; if they responded well the first time, they will probably respond again.
- (10) If the issue has regional significance, it may be useful to establish an "Advisory Board of Directors" of well-known, prominent conservationists. You will have a valuable source of advice particularly in political and personality matters as well as achieving some credibility and free publicity as an organization.

Concluding Remarks

The growth, demands and values of the American population will continue to place extreme pressure on irreplaceable biological and environmental resources. From this one issue it can be shown that the rate of disappearance of natural

habitat *can* reverse decisions of powerful and organized opposition if they unite and prepare their case well.

We can hope that the Red River Gorge ecosystem will continue to exist as a natural island that provides a refuge for a diverse, unique assemblage of plants and animals in an area that has long known exploitation and land abuse. It is the responsibility of biologists to see that this "hope" for natural systems in Kentucky and the Southeast achieves higher expectations.

Acknowledgments

I wish to thank Dr. Branley Branson, Eastern Kentucky University, and Dr. Mary Wharton, Professor Emeritus of Georgetown College, for reviewing the manuscript. Throughout the controversy, they were major leaders among the biologists. Other biologists that should also be recognized for their role in preserving the Gorge include Drs. Roger Barbour, Robert Kuehne, Willem Meijer of the University of Kentucky, and Mr. Johnnie Varner, Cynthiana, Kentucky. Mr. Robert Reeves, a Lexington attorney, provided useful information regarding organization of a coalition of groups and individuals into effective opposition to the Red River Lake project.

Finally, all of the people who contributed time, effort, money to the Red River Gorge Legal Defense Fund, Inc. should be recognized for their contributions. Without them, Kentucky would have one more dam and one less valuable natural area.

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THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS TREASURER'S REPORT

January 1, 1975 — December 31, 1975

I. SAVINGS ACCOUNT

A. Regular Savings	\$4,500.00		
Transfer from Checking	2,657.99		
Interest	387.10		
Total Regular Savings Account			\$ 7,545.09
 B. Contingence Savings	\$2,846.29		
From Checking	563.91		
Interest	117.84	\$ 3,528.04	
Bank Error		-.50	3,527.54
 TOTAL SAVINGS			\$11,072.63

II. CHECKING ACCOUNT

Balance on hand — 1 Jan. 75		\$ 963.80	
 A. Receipts			
Dues and Subscriptions	\$9,019.00		
Reprints and Back Issues	699.00		
Annual Meeting	2,345.61		
Meritorious Teaching Award (SP)	500.00	12,563.61	
 TOTAL RECEIPTS & BEGINNING BALANCE			\$13,527.41
 B. Disbursements			
To Savings Accounts		\$ 3,221.90	
Office			
President	\$ 80.00		
Treasurer	170.00		
Conservation Committee	90.00	340.52	
Publishing			
ASB Bulletin 22 (1, 2, 3, 4)	\$5,612.40		
Reprints	381.15		
Call for Papers	243.00		
Production and Mailing	1,088.58	7,325.13	

Awards

Student Travel	\$ 468.00	
Meritorious Teaching	500.00	
Posters	<u>83.20</u>	1,051.20
Interim Meeting (Atlanta, 4 Oct. 75)		692.95
AIBS Adherent Dues		<u>500.00</u>
TOTAL DISBURSEMENTS		<u>13,131.70</u>
BALANCE IN CHECKING — 31 Dec. 75		<u>395.71</u>
TOTAL ASSETS — 31 Dec. 75		\$11,468.34

Respectfully submitted,
 (Signed) R. O. FLAGG
 R. O. FLAGG, *Treasurer*

Dr. Westfall Wins Meritorious Teaching Award

Dr. Jonathan J. Westfall of the University of Georgia was the recipient of the 1976 Meritorious Teaching Award at the 37th annual meeting of ASB at New Orleans, Louisiana. Dr. Westfall was honored for an outstanding teaching career of over 40 years. The Meritorious Teaching Award is supported by Scientific Products and is presented annually.

Dr. Westfall began his career in 1932 when he received his B.S. from West Virginia Wesleyan College. He then taught for four years at Weir High School, Wierion, West Virginia, and served as summer session instructor at West Virginia Wesleyan College. After taking the M.S. (1938) and Ph.D. (1939) from the University of Chicago, he served at Moorhead (Minnesota) State College from 1939-47. In 1946-47 he was Acting Head of the Division of Science and Mathematics. In 1947 he was appointed Professor and Head of the Botany Department at the University of Georgia, a position he held until 1962. In addition, he served at the University of Georgia as Acting Chairman of the Biology Division in 1959-60 and 1963-64. Dr. Westfall received regional and national recognition for his work as Director of NSF Academic Year Institutes for High School Teachers of Science and Mathematics from 1959-71, and numerous activities with BSCS. He served as BSCS writer, summer, 1960, Supervisor of BSCS Writing Team, summer, 1961, Consultant and writer, summer and fall, 1962, and Evaluation Committee, AIBS, BSCS, 1961-62, and 1962-63. In 1965 he served as Supervisor of Summer College Biology Institutes in India.



Dr. Westfall has been active in a number of societies in addition to ASB, such as Sigma Xi, Phi Kappa Phi, Botanical Society of America, and National Association of Biology Teachers.

A true measure of Dr. Westfall's contributions is more than just a compilation of positions held and honors and degrees gained. His nomination was supported by numerous letters from former undergraduate and graduate students, and colleagues. Excerpts from some of these

letters express the sincere appreciation felt for Dr. Westfall.

A former graduate student now teaching at a major western university writes: "I can say without hesitation that Dr. Westfall is the most outstanding and best teacher that I have ever had in my entire career as a student. To support this statement I submit the following evidences for your consideration: Dr. Westfall is a warm and human person who understands his students and treats each person as an individual, very receptive and eager to listen to everyone and help each with his or her

problems; he makes subject matter 'come to life' and have relevance for all to use in their daily lives and for future use in our classrooms. Dr. Westfall has a knack of making very complicated concepts simple to understand by application of a variety of teaching techniques, particularly through the use of multi-media . . ."

A former dean of Dr. Westfall's comments: "Dr. Westfall has all of the attributes one normally associates with good teaching—enthusiasm for subject, well organized, good delivery, no distractive mannerisms, etc. Of all of these, however, I am most impressed with the seriousness of his preparation. He has no "yellow notes." His lecture today is just as new and updated as his first lecture must have been years ago. I have never known a professor to take more seriously the preparations of his classwork. He can be just as excited and enthusiastic about reviewing the literature in the preparation of a lecture as a researcher can be on the threshold of a big discovery."

A colleague and department chairman of Dr. Westfall writes: "There is no doubt that Dr. Westfall has strongly influenced the teaching of Biology in the United States through his cooperative work in assembling, writing, and editing the BSCS Green Version of HIGH SCHOOL BIOLOGY. Furthermore he did not stop there. He has for about 12 years now conducted a course explaining, outlining, detailing, and illustrating the book for high school teachers who have attended the University of Georgia. The results of such a continuous dedicated effort will be reaped for many years by the children of the southeastern United States as well as the nation."

Another supporter comments: "As an individual hu-

man being, Dr. Westfall stands above those of us who know him. His sensitivity to others, his personal warmth, his genuine concern for each and every student he teaches makes him the epitome of teaching excellence. I speak from a position of having known Dr. Westfall as both a student and a colleague. The human qualities of this gentleman run so deep and are of such magnitude that he is an inspiration to everyone he touches."

Another individual who studied under Dr. Westfall at both the undergraduate and graduate level writes: "Dr. Westfall is an exceptional teacher and professor in every sense. He is a scholar, not only in his specialty, but one of the best well-rounded botanists in the country. His interests are broad, and his ability to relate his thoughts and experiences to students is superb. Whatever contributions I may have made to botany and plant sciences now or in the future, I owe in large part to Dr. Jonathan J. Westfall for his enlightening lectures and encouragement to pursue the study of plants."

Perhaps the most fitting tribute of all comes from a former student currently teaching in a southern university: "When a student is working on the Ph.D. with the intention of becoming a teacher, it is inevitable that he watches his professors with more than a gain of information in mind. The student has to wonder whether he could do as well as the professor in teaching the course, or hopefully better. Few people have influenced as many individuals who teach as Dr. Westfall. Those of us who worked and took courses under him were doubly lucky. We also found a teacher worthy of imitation."

—L. B. DAVENPORT, JR.

FREDERICK ADOLPH WOLF
June 25, 1885 — November 7, 1975

Frederick A. Wolf, emeritus professor of botany at Duke University, died at his home in Durham, N.C. at the age of 90. The son of August and Wilhelmina (Kracht) Wolf, he was born in Odell, Nebraska. After graduation from high school, he taught high school for a year, and in 1903 entered the University of Nebraska, from which he graduated in 1907 and obtained his Masters degree in 1908. The next two years were spent in graduate work at the University of Texas, and he obtained the doctorate from Cornell University in 1911.

He lived in the southeastern United States for the remainder of his life. From 1911 to 1915 he was a plant pathologist with the Alabama Agricultural Experiment Station at Auburn, Ala. He married Wynnette Taylor, of Montgomery, Ala. in 1914. In 1915 he moved to Raleigh, N.C., where he was a plant pathologist with the Agricultural Experiment Station at N.C. State College (now N.C. State University) for ten years. During World War I he served as a First Lieutenant in the Sanitary Corps, U.S. Army, principally in bacteriological work in the hospital of Camp Greene, near Charlotte, N.C. From 1925 to 1927 he was a plant pathologist with the U.S. Department of Agriculture Bureau of Plant Industry laboratory in Orlando, Florida.

In 1927 he became a professor of botany at Duke University, Durham, N.C., and was later honored with a James B. Duke professorship. His classes included mycology, bacteriology, and forest pathology. Because a number of his students came from departments other than Botany, with consequent scheduling problems, some of his classes were extremely informal, held over the noon hour, the students bringing their lunches while he presided over the coffee pot. Some thirty students obtained graduate degrees under his direction during his 27 years as a faculty member at Duke. With many of these he kept in close touch, and was gratified to follow their progress in a variety of professional careers.

Much of his early research at Duke was con-



cerned with diseases of tobacco, in which he had become interested upon his arrival in North Carolina in 1915, and in which he maintained an interest throughout his life. The year 1933-34 he spent on sabbatical leave at Harvard University. His book, *Tobacco Diseases and Decays*, was published in 1935.

During World War II, while continuing his teaching, he was involved in an investigation for the War Production Board, in collaboration with H. J. Humm and others, of the possibilities of commercial production of agar from seaweeds along the Atlantic coast. In 1947 he published a two-volume textbook of mycology, which enjoyed wide acceptance for a number of years, both in this country and abroad.

In 1947-48 he again took a sabbatical leave, working with the Ministry of Agriculture of Venezuela in attempting to improve the practices employed in the cultivation of tobacco in that country. Ten years later, he was invited back, to be shown how some of his recommendations had

borne fruit. In 1948-49, at the request of the Quartermaster Corps, U.S. Army, he undertook a project concerned with the spoilage of meats by fungi.

Obligatory retirement from teaching in 1954 enabled Dr. Wolf to enjoy more freedom for research. He maintained an office in the Biology building at Duke, and worked regularly until a year prior to his death. A second revised edition of *Tobacco Diseases and Decays* was published in 1957.

For some years he had been involved with others in attempts to grow Turkish or oriental tobacco in this country, a project which proved to be scientifically successful but doomed to economic failure by high labor costs. These studies, together with a trip to Greece and Turkey which he made in 1959, formed the basis of his book, *Aromatic or Oriental Tobaccos*, published in 1962.

In 1963, he participated in the Tobacco Congress in Salisbury, Rhodesia, but was forced to decline an honorary office in the 1966 Athens Congress because of declining health. In his later years, he was engaged in examining cores from sediments of East African lakes for fungus spores, thousands of years old. These required only a microscope, and could be carried on intermittently, as time and inclination permitted.

Dr. Wolf was a member of a number of professional societies, including the American Association for the Advancement of Science, the Botanical Society of America, the Mycological Society of America, the American Phytopathological Society, the British Mycological Society, the Torrey Botanical Club, the Association of Southeastern Biologists, and the North Carolina Academy of Science. He was a charter member of the Association of Southeastern Biologists, the Mycological Society of America, and the American Phytopathological Society.

He had served as president of the North Carolina Academy of Science, was a Fellow of the American Phytopathological Society, and was selected as one of *Tobacco International's* Men of the Year in 1970. In 1965, he received from the Governor the North Carolina Gold Medal for devoting "a great measure of his scientific talents and gifts" to research. In addition to his books,

he was author or co-author of some 240 papers in scientific journals.* He is survived by his wife of more than 61 years, a daughter, a son, four grandchildren and two great grandchildren.

— FREDERICK I. WOLF

* A list of his publications may be obtained upon request to the Department of Botany, Duke University, Durham, N.C. 27706.

Letters Received

Dear Fellow Naturalists:

Sixty million springs have witnessed the annual pondward scramble of ambystomatid salamanders. For years they have been seen crossing highways, roads and ditches, singly and in groups, moving toward their breeding sites in temporary ponds. Herpetologists know a good deal about *Ambystoma maculatum*, but have virtually no information on the schedule of migration, mating, egg masses, larvae and metamorphosis over the range of the species.

It would be extremely useful to have a maintenance-free mechanism which would "time" the salamanders for us. This mechanism may exist in early flowering plants. If we could correlate, for example, the flowering of some plant with the arrival of adults at temporary breeding pools, we would have a useful parameter for comparing seasonal cycles within the geographic range of a species.

I am trying to establish a network of interested naturalists who would report phenological data concerning *Ambystoma maculatum*, spotted salamander, and *Symplocarpus foetidus*, skunk cabbage, an early flowering plant. I have chosen *Ambystoma maculatum* because it is unmistakable, has a wide range and a restricted breeding season. *Symplocarpus foetidus* was chosen because it is distinctive and earliest to appear.

In the 1974 *Yearbook of Herpetology* H. G. Dowling suggested that phenological studies of reptiles and amphibians could be valuable. He stated that there exist scattered references to dates of salamander migrations, breeding, development of larvae, and emergence of metamorphosed young in the herpetological literature for specific locations, but no overall pattern for the range of a species has yet appeared. The paucity of such information is underscored in the newly-published book, *Phenology and Seasonality Modeling* (Helmut Lieth, ed., Springer-Verlag, New York) which contains phenological information on every terrestrial vertebrate *except* amphibians and reptiles.

If you or a member of your group know of a local breeding site for *Ambystoma maculatum*, it would be relatively simple to observe the progress of salamander breeding and development while noting the progress of a nearby patch of skunk cabbage. A suggested data page is enclosed.

If you would like to participate in this first effort toward the phenology of an amphibian species, please fill in the attached form and return it in the enclosed envelope. I will send you additional information.

Yours Truly,
(Signed) JANANN JENNER
Department of Biology
New York University
952 Brown Building
Washington Square
New York, N.Y. 10003
Telephone: (212) 598-3435

SAMPLE DATA SHEET

AMBYSTOMA MACULATUM ACTIVITY OBSERVED

DATE OF OBSERVATION

PLANTS OBSERVED (appearance of flowers, leaves, size of leaf in mm., etc.)

SKUNK CABBAGE (*SYMPLOCARPUS FOETIDUS*)

SPICEBUSH (*LINDERA BENZOIN*)

RED MAPLE (*ACER RUBRUM*)

OTHER ANIMALS OBSERVED

PLACE OF OBSERVATION

LATITUDE LONGITUDE ELEVATION ABOVE SEA LEVEL

METEOROLOGICAL INFORMATION: *

PRECIPITATION

TEMPERATURE

HUMIDITY

WIND

CLOUD COVER

NUMBER OF DAYLIGHT HOURS

* Such data may be valuable, even if obtained from the weather reports of a nearby town (but please indicate).

Name

Address

Yes, I will be able to participate. Send me additional information.

Norton and Davis Win Research Award

The 1976 Research Award was presented, at the April Meeting of the Association, to V. M. Norton and K. B. Davis of the Department of Biology at Memphis State University. The winning paper was "Effect of Abrupt Change in the Salinity of the Environment on Plasma Electrolytes, Urine Volume, and Electrolyte Excretion in Channel Catfish *Ictalurus punctatus*." In their work, Norton and Davis initiated physiological studies on regulation of body osmolality on warm water stenohaline freshwater species. In their paper they examine the effects of handling stress and abrupt change in osmotic concentrations of the environment, on plasma ion regulation and renal adjustments in channel catfish.

N.C. STATE MUSEUM ANNOUNCES NEW JOURNAL

The North Carolina State Museum of Natural History announces a new journal, BRIMLEYANA, the Bulletin of the N.C. State Museum. Contents will emphasize the zoology and general ecology of the southeastern United States, especially North Carolina and adjacent areas. Consecutively numbered issues will appear at irregular intervals.

Information for potential contributors to BRIMLEYANA may be obtained from the Editor (*Dr. John E. Cooper, Director of Research and Collections*), and purchase and exchange information from the Managing Editor (*Mrs. Sarah S. Robinson, Director of Publications*), N.C. State Museum of Natural History, P.O. Box 27647, Raleigh, NC 27611. Dr. John B. Funderburg, Director of the Museum, is Editor-in-Chief.

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The ASB

BULLETIN

Volume 23, Number 4

October 1976



White pelicans on Lake Matita, Romania

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FRONT COVER

White pelicans which migrate from Africa roost in the Danube Delta, Romania. Scene shows one of several flocks landing on the tranquil waters of Lake Matita surrounded by floating islands of the common reed, *Phragmites communis*. (See page 179).

ASSOCIATION AFFAIRS

**THIRTY-EIGHTH ANNUAL MEETING AT
NORTH CAROLINA STATE UNIVERSITY,
RALEIGH, NORTH CAROLINA
13-16 April, 1977**

In preparing for the 1977 Annual Meeting, please note the following deadlines. Members can facilitate arrangements for the meeting by sending in all requested material as far in advance of the deadlines as possible. Because time available for preparation of the program and publication of abstracts is already at a minimum, it is necessary for the Program Committee and Editor to adhere strictly to the deadlines in order for the programs and April Bulletin to be ready in time for the meeting. **LATE ABSTRACTS AND OTHER MATERIALS CANNOT BE ACCEPTED.** PLEASE remind your secretary and yourself that *all* material intended for the printer *must* be neatly typed, *double-spaced throughout* (this means title, authors, institutional affiliations, text, footnotes, *everything*). Poorly prepared material will be returned to the sender.

(Continued on page 186)

Deadline for January issue — November 1

Deadline for April issue — January 1



The Functions of Coastal Wetlands

ARMANDO A. DE LA CRUZ

Mississippi State University

During the last decade, the emphasis of coastal wetland research has been on the role of tidal marshlands as a natural producer of organic detritus which forms the base of the food web in the estuarine and marine environments, and the various processes that revolve about this function. Marsh plant production, detritus formation and decomposition on the marsh, its transportation from the marsh into the neighboring aqueous system, its nutritional value as food to marine consumers, its contribution to the marine food chains have, in one way or the other, dominated the approach taken by estuarine investigators in the studies of marshlands (de la Cruz 1973; Heinle et al., 1973). Fertile fishing and shell-fishing grounds occur in coastal areas subsidized by tides that flush vast expanses of highly productive wetlands. The link between the high net primary production in the tidal marshes and the rich fishery production in the estuaries has been attributed primarily to the post mortem breakdown products of marsh vegetations which enrich the estuarine waters. As a source of energy supporting coastal fishery production, the tidal marshland does play a basic role in the ecology of estuarine systems and its value to man can be estimated in terms of the dependent commercial fishery as attempted by Gosselink, Odum, and Pope (1974).

Recent emphasis on coastal zoning, the increasing public concern regarding the legal definition of tidal wetland boundaries relative to ownership and environmental legislations, and the omnipresence of impending threats from industry and land developers led to attempts at monetary evaluations of coastal wetlands. The philosophy be-

hind the resulting assignment of dollar and cents value to a parcel of wetland and the consequence of treating this once pristine and wild "wasteland" as just another form of real property can lead to considerable debate. What is undebatable is the fact that any type of evaluation must take into consideration the various uses we make of the marsh and the different form of products we presently harvest from this environment.

The purpose of this paper is to review the various functions of coastal wetlands. These can be categorized at two levels: 1) at an ecosystem level, that is, the use of wetlands as a whole including the intertidal zone and the immediate dryland and neighboring littoral areas for various system functions; 2) at a component level, that is, the use of the major biotic component, mainly the vascular plants, for various purposes.

Uses of Coastal Wetlands at an Ecosystem Level

For centuries man has pastured stock on wetlands. The practice was healthy for as long as the herd remained small and the operation was kept as a backyard enterprise. Even today, small herds of sheep, goats, hogs, and cattle may be seen roaming the verdant swamps of the vast Danube Delta in Romania, the Volga Delta in the Soviet Union, and the Po Delta in Italy (Fig. 1). In the United States, observations of cattle and feral pigs grazing on the *Spartina alterniflora* marshes in the South Atlantic Coast and in the deltaic marshes of Louisiana have been reported. The high marsh salt grass *Spartina patens* has served as forage for cattle but is now farmed and baled by the tons for commercial use as garden mulch. The economic feasibility of large scale



FIGURE 1.—Herd of sheep grazing on the verdant marshes of the Danube Delta in Romania.

herding of ungulates on wetland meadows has definitely taken the interest of marshland owners. Estuarine ecologists, on the other hand, are becoming aware of the ecological consequences of cropping the marshland by ungulate herding (Reimold 1976). For one thing, permanent modification of the tidal marsh environment will be necessary as tidal water level is lowered through diking, ditching, and draining. More importantly, the grazed hectareage is consequently removed from fishery production since the bulk of marsh plant production is removed from detritus formation and tidal flushing is reduced, if not totally eliminated because of physiographic alterations. Nevertheless, coastal wetlands have served as pasturelands through the years in limited and isolated cases and have benefited man to a certain degree.

The role of tidal wetlands as habitat for birds and other wildlife is obvious, but difficult to evaluate. The number of ducks, geese, herons, and kindred birds that migrate from Canada and northern regions to the marshes of the South Atlantic and Gulf Coasts is phenomenal (Cover). In the vast reedlands of the Danube Delta in Romania, some 300 species of birds have been identified (Talpeanu and Paspaleva 1973). The great majority of these birds come from far away regions: from Asia, Siberia, and arctic regions. From the south, come to the Danube Delta to nest the common and curly pelicans. Pelt mammals such as otter, mink, nutria, muskrat, rac-



FIGURE 2.—Stand of dead *Phragmites communis* reeds growing along the Mississippi Gulf Coast. The same species occur in Europe and in the deltaic marshes of Louisiana where they have been shown to be efficient assimilators of domestic waste. At the background is an overland portion of Interstate 10.

coon, and others hunted for their precious fur are familiar inhabitants of coastal wetlands.

Alterations and sometimes total destruction of wetland habitats in favor of other land-use practices are encroaching heavily on the sustained survival of marsh birds and mammals. Chabreck (1976) pointed out that special management procedures, for examples, shallow water improvements, water control structures in drainage systems, marsh ditches, and artificial potholes, are needed in order to maintain or improve habitat quality. Other treatments frequently applied to enhance wildlife are marsh burning, herbicidal treatment, and planting. In the implementation of any management procedure, of primary concern would be the maintenance within acceptable limits of variables affecting plant production and enhancement of other factors required by wildlife species.

Stephen W. Hitchcock (1972) perhaps best described the role of marshes as nursery grounds for commercial fish and shellfish. Unfortunately, there is very little hard data on the extent by which larvae, juveniles, and young adults of marine animals use the estuarine waters of the marsh environment as feeding ground, or on their ultimate value to the total coastal fishing. Studies by Rekas (1973) and Blackmon (1974) on the migration of postlarval and subadult commercial



FIGURE 3.—An oil rig in the heart of the Louisiana marshlands. Eight-foot wide canals fanning out of main canals are dredged to accommodate barges ferrying-in oil rig equipment and support platforms. Photograph courtesy of Prof. W. D. McCain, Jr. of Mississippi State University.

shrimps and preliminary results of our current work on animal movement in a Mississippi tidal marsh creek do reflect the fact that the young of fish and shellfish enter the marsh estuarine areas seasonally and leave the marsh for the open waters after undergoing a period of rapid growth. What we are dealing with here essentially is the export of "fattened" animal tissue to the sea, which is probably as important a contribution to marine productivity as the export of particulate (detritus) and dissolved (nutrients) organics.

The recreational use of wetlands is closely related to wildlife management and fishery production in terms of the sport fishing and hunting that goes on in coastal estuaries and bays. Family boating, skiing, picnicking, swimming, bird watching and nature photography are also some of the activities I have observed in the Gulf and South Atlantic marshes. In the reed or roseau cane marshes of the Danube and other European river deltas, guided educational and sightseeing tours are also a favorite past-time. Pope (1975) observes that these forms of recreation which can be enjoyed in wetlands are not presently utilized for several reasons. In the United States, a great deal of marshlands is in private ownerships and those that are public domain are largely inaccessible. More importantly, the demand for commercial and residential lands is steadily encroach-



FIGURE 4.—Pile of dead marsh plant leaves and stems washed onto the beach of the Mississippi Coast. A spring tide washes out this mass of organic matter into the ocean where it will continue to break down releasing nutrients and particulate detritus.

ing on the existing wetlands — a sad phenomenon which is happening at a time when the demand for recreational lands is also increasing.

The potential for aquaculture development of estuarine marshes have been reviewed by Gosse-link et al. (1974). At the present level of use, it is not mere coincidence that the Gulf Coast, where about 65% of the total coastal marshes in the continental United States is located, contributes the highest revenue from fishery and shellfishery industries in the United States. The ideal aquaculture use of estuaries is in the oyster (e.g., Japan) and mussel (e.g., Spain) industries since they involve minimal modification of the marsh-estuarine environment. In some areas, particularly in Southeast Asia, intensive shrimp and fish cultures are currently practiced in the tidal wetlands (primarily mangroves) which creates conflicting interests between silviculture (mangrove logging) and aquaculture (fish ponds). Recent studies by Lawas et al. (1974) showed that on a per hectare basis of utilizing the mangrove swamps, there is a more economic return on investment in fish pond development than in wood production. The income that would accrue from the former is 730 pesos (approx. \$100.00) more per hectare than the income that would accrue from the latter. Moreover on a long term basis, it will be observed that a one-hectare mangrove swamp developed into fish pond will continuously

produce a fish output every year, whereas, a one-hectare mangrove forest reserve, wherein a silviculture system is applied in logging, will yield its wood output only once in twenty years.

The role of wetlands as a component of waste treatment systems is one of far ranging economic significance as indicated by Gosselink et al. (1974). The words of Grant and Patrick (1970), Valiela and Teal (1972) and more recently by Day, Turner and Meo (1975) show that marshes remove nitrogenous and phosphorus nutrients from contaminated or waste waters. Valiela et al. (1976) further observe that heavy metals, chlorinated hydrocarbons and petroleum hydrocarbons have high affinities for marsh sediments and can, thereby, undergo microbial degradation. Studies on other types of wetland habitats such as polders, cypress, papyrus swamps, mangroves, and bogs have likewise demonstrated effluent-processing properties. While the use of a bulrush marsh in waste assimilation has been carried out successfully on a pilot-project scale in Krefeld, Germany (Seidel 1975) and has indeed proved effective in tertiary treatment of domestic sewage (Burkhart 1975), there is mounting concern as to the ability of wetland vegetations to withstand acute and chronic exposure to pollutants. The resilience of marsh plants in severely polluted areas is astounding. That plants take up heavy metals (Wolverton et al. 1975; Wolverton and McDonald 1975a & b; Wolverton et al. 1975b; Wolverton 1975a), phenols and phenolic derivatives (Wolverton 1975b), chlorinated hydrocarbon (Beall and Nash 1969; Bingham 1973; de la Cruz and Rajanna 1975), and petroleum hydrocarbons (Burns and Teal, 1972) is known. What we do not know is the fate of these pollutants that have accumulated in the plant tissue. Unless they are metabolized or otherwise degraded upon death and decomposition of the plant, it is likely that the "detritus pathway" so prevalent in the coastal estuaries can become a pathway for the biological magnification of such compounds in the estuarine food web. The potential health hazard that could arise from the biological magnification of carcinogenic compounds from oil and other pollutants need some consideration (Brown 1975).

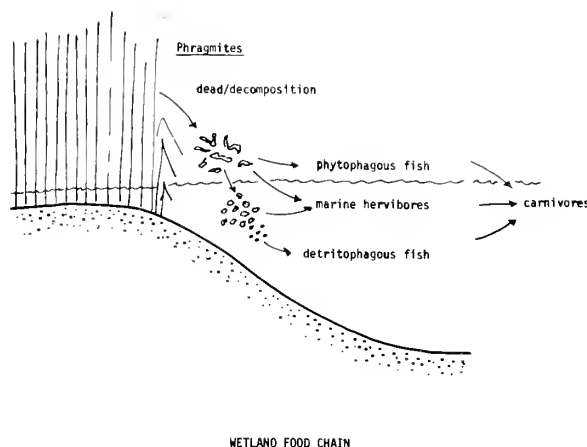


FIGURE 5.— Pathway of food energy in a typical marsh-estuary. Decomposed plant material rich in microbial life serve as food to the juveniles and adults of commercially important species, and to other small organisms that are fed upon by larger animals in the sea.

Transportation has played a key role in the economic and technological progress of the United States. For the last several decades, vast areas of coastal wetlands are diked, dredged, filled or otherwise permanently altered to give way to interstate highways, intercoastal waterways, and sprawling airport terminals and runways (Fig. 2). Reasons for these uses are obvious: coastal marshlands offer scenic routes for roads, they are inevitably a logical place for coastal waterways, and the flat unobstructed locale is exceptionally suitable for jet planes to land and take off. Basically, coastal marshlands are cheap in terms of real property value, so much so that land developers are increasingly cashing in on the marshlands for residential and industrial developments.

For the last 30 years or so, extensive areas of marshes of Louisiana have been explored and drilled for oil (Fig. 3). The amount of production of petroleum from tidal marsh oil wells is known. What we are not sure of is the long range impact of marsh-produced petroleum and its derivatives to the environment. Until recently, exploration of wetlands has virtually neglected the consequences of large scale dredging of natural marsh when drilling for oil and the persisting threat of oil spills (acute and chronic) and what they will do to the marsh biota. Nevertheless, the use of coastal marshes as a source of petroleum energy takes on an added significance at this



FIGURE 6. — Harvested stems of the common reed awaiting hauling by barges to the cellulose processing plant in Braila, Romania. Annually, approximately 120,000 tons of dry reed is harvested and processed yielding 60% dry pulp.



FIGURE 7. — Garbage thoughtlessly dumped along the fringes of a marsh. The dump is not only an eyesore but provides habitat for rodents and other vectors of diseases.

time when energy supply in the United States has reached a shortage proportion.

Uses of Coastal Wetlands at a Component Level

The major component of coastal wetlands is the vascular plants that form the basic structure of the habitat upon which reference is made of the community (e.g., *Spartina* marsh, *Juncus* marsh, *Phragmites* marsh, Fig. 4). The literature is replete with studies and references to the high primary productivity of coastal marshes (Keefe 1972). This production has always been linked with the fertility of coastal estuarine and marine fisheries (de la Cruz 1974) because of the detritus derived from the marsh plants (Fig. 5).

Through centuries, vascular wetlands plant and/or their by-products have been harvested for a variety of uses all over the world. Morton (1976) in a review of the craft industries from coastal vegetation points out some of the valuable uses (e.g., hut building, thatching, screens, matting, fencing, baskets, brooms, cordage, upholstery, etc.) of certain valuable wetland sedges and grasses (e.g., *Scirpus*, *Fimbristylus*, *Spartina*, *Phragmites*); palms (*Nypa*); and mangroves (*Rhizophora* and *Avicennia*). In many instances, these craft industries occupy an important role in a nation's economy as exemplified by the nypa palms, a basic thatching material and the mangrove, a major source of tannin, wood, and charcoal fuel in the Philippines and other southeast Asian countries.

Perhaps the most impressive utilization of a wetland plant is the production of pulp and other cellulose derivatives from the common reed or roseau cane *Phragmites communis*. The Danube Delta Institute in Tulcea, Romania, has developed locally an adequate technology to harvest *Phragmites*, the principal natural vegetation of the Danube Delta (Fig. 6). An elaborate gathering and transportation system which includes 3 types of self-powered harvesters (tractors for dry land, airboats for swampy areas and vessels with ballooned tires for the floating islands), floating quarters for crew, and fleets of barges, is maintained for the annual production of some 125,000 tons of dried reed. Each ton of air-dried reed is supposed to yield 60% of unbleached pulp. *Phragmites* is harvested from November to March from the swampy areas and from floating islands. To maximize production, the Romanian government has simulated natural conditions for reed growth by a production system which involves diking certain dry land areas and constructing locks and pumping stations for controlling the water level (Rudescu et al. 1965). Pulp processed from reed is mostly mixed with wood pulp to increase the tear strength and the density of fabricated paper.

For over a decade now, the Japanese have been producing viscose-rayon fiber from the mangrove *Rhizophora mucronata* Lam. imported from the Philippines and elsewhere in Southeast Asia.



FIGURE 8. — A filled-up area of a *Spartina* sp. marsh used as a cemetery plot in a seaport city of Sulina on the Black Sea coast of Romania.

High alpha (dissolving) pulps were prepared by the prehydrolysis-sulfate pulping and multi stage bleaching processes from *Rhizophora* (Nicolas and Bawagan 1970). *Rhizophora mucronata* grows with other mangrove trees in very soft muddy soil, in brackish or salty swamps, or on river banks over which tide from the sea occasionally flows.

Intriguing possibilities are apparent in the current investigations of Miles and de la Cruz (1976) on the pharmacological potential of coastal-estuarine marsh plants. Three chemical aspects are being studied: 1) crude alkaloid content, which has been found to be high (1.5-2.0 g/kg) in *Juncus roemerianus*, *Spartina cynosuroides*, and *Scirpus americanus*; 2) volatile oils, which have been determined in 4 species of marsh plants from Mississippi; 3) anti-tumor agents, which might occur in 12 of the 16 species of marsh plants so far screened by the National Cancer Institute. Of immediate interest is the anti-tumor compound *juncusol* which Miles and his colleagues at Mississippi State University have isolated from *Juncus roemerianus* (Mody 1975). Various medicinal uses of other coastal wetland plants, for example the red mangrove, *Rhizophora mangle*, have been recorded (Morton 1965).

Finally, this review of wetland uses will not be complete without mention of the human food potential of wetland plants. References to edible parts of various wetland vegetations including the eel grass *Zostera marina* (Felger and Moser

1973) are plentiful. Morton (pers. commun.) indicates that the food uses of many wetland vegetations such as *Typha*, *Pandanus*, *Nypa*, etc. are important aspects of economic botany. In the tropics, fruit of mangrove trees are eaten (Tadeo 1962) and the leathery leaves dried and brewed as tea (Morton 1965). The potential possibility of widespread use of wetland plants and seed-bearing halophytes as direct source of food for man exists (Somers 1975) although gastronomic acceptance by the general public may have to be stimulated by enterprising individuals.

As one can see, the uses of coastal wetlands are virtually unlimited. Plant species that dominate particular wetland communities have been used for housing and clothing materials; as sources of fuel, medicine, and food. The wetland-estuary ecosystem has multi-purpose functions from the most widespread use, as a place for garbage disposal (Fig. 7), to the most unusual if not bizarre use, as cemetery plots (Fig. 8). Whether coastal wetlands are used in their natural condition or managed for various other uses, the vital issue, relative to the preservation of this estuarine ecosystem so that man will continue to reap its benefits, is their wise use rather than exploitation, and regulated alterations that will not inflict permanent damages.

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ASSOCIATION AFFAIRS

(Continued from page 178)

DEADLINES

November 1 — Deadline for receipt of material to appear in the January ASB Bulletin.

December 1 — Deadline for receipt of titles and abstracts of papers to be presented at the Raleigh Meeting (See Call for Papers, to be mailed separately, for detailed instructions).

December 15 — Deadline for suggestions for nominations for ASB officers and executive committee members (See Call for Papers).

January 1 — Deadline for receipt of material to appear in the April ASB Bulletin (other than abstracts).

January 15 — Deadline for nominations for the Meritorious Award for Teaching (see page 187).

February 1 — Deadline for Applications for Travel Awards to Graduate Students (see below).

— Deadline for papers to be considered for the Association Research Prize.

ASSOCIATION RESEARCH PRIZE

If you intend to present a paper at the Raleigh meeting, you are invited to submit your manuscript in competition for the Association of Southeastern Biologists Research Award. The Award, a handsome medallion, is sponsored by the Carolina Biological Supply Company, Burlington, North Carolina.

Rules of the competition are as follows:

1. The Research Award is given annually for an especially meritorious paper actually presented by the author(s) at the Annual Meeting. *If the paper is not presented, it will be disqualified.*

2. Only members are eligible to submit papers in competition for the Award. This applies to all names on the paper.

3. Papers submitted in competition may be in press but must not have been published prior to the *previous* Annual Meeting.

4. Papers are judged by eminent scientists selected by the Research Award Committee from institutions outside

the Southeast. Every effort is made by the Research Award Committee to keep the authors of submitted papers anonymous. Criteria for the Award are left to the discretion of the judges, who may withhold the Award if no paper is deemed to have sufficient merit.

5. Papers must be submitted in triplicate and in their entirety no later than February 1, 1977 to *Dr. Thomas Peter Bennett, Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, PA 19103.*

Announcement of the winner of the Research Award will be made at the Annual Meeting. Xerox or similar copies will be accepted if illustrations are clear. The original copy of the award-winning paper will be sent to the sponsor of the prize.

The 1976 Research Award went to V. M. Norton and K. B. Davis of the Department of Biology, Memphis State University.

BRUCE B. SMITH

J. FRANK MCCORMICK

THOMAS PETER BENNETT, *Chairman*

PAYING DUES AT ANNUAL MEETING — PLEASE DON'T

In past years, much confusion has arisen when members paid dues when they registered at the Annual Meeting. Therefore, at the Blacksburg and New Orleans Meetings, dues were not accepted at the registration desk. The Executive Committee staffed a booth in the exhibit area where extra copies of the Bulletin and other materials explaining the purpose and activities of ASB were available. New members were encouraged to fill out application forms and pay their dues there. Old members were urged to mail their dues directly to the *Treasurer, Dr. Raymond O. Flagg, Carolina Biological Supply Company, Burlington, North Carolina 27215.*

This procedure will be continued at the Raleigh Meeting. Suggestions for improvement of the ASB booth display and operation will be gratefully received by the Executive Committee.

TRAVEL AWARDS FOR GRADUATE STUDENTS

Since 1957, funds have been available for partial compensation of travel expenses of graduate students. Approximately \$500 will be dispensed by the committee with preference to those presenting papers and having greater distances to journey.

As prescribed by the bylaws, the rules for application follow:

1. Give a conservative itemized estimate of travel expenses.

2. Give information as to whether or not a paper is being presented by the applicant.

3. In a paragraph, give a brief history of your education to date, of how many years you have been — and plan to be — in graduate school, of your major field or fields of interest, of any publications which have appeared or which may be in preparation, and any other pertinent professional details. Give information on marital status and number of children.

4. Give your source or sources of support while in graduate school such as G.I. Bill, N.S.F., N.I.H., teaching assistantship, etc.

5. Have your major professor or departmental head write a letter supporting your application.

6. Applications and supporting letters, both in triplicate, should be in the hands of *Dr. Averett S. Tombes, Clemson University, Clemson, South Carolina 29613* by February 1, 1977. Applicants will be notified of the decision of the Committee as soon as possible.

Awards have usually been about \$20-30 in the past several years.

J. KENNETH SHULL
HARRY E. SHEALY
AVERETT S. TOMBES, *Chairman*

MERITORIOUS TEACHING AWARD NOMINATIONS

For the twenty-sixth time, an ASB member will be recognized for especially meritorious teaching at the April, 1977, annual meeting. The Meritorious Award for Teaching is sponsored by Scientific Products, Chamblee, Georgia. The regulations governing the award are as follows:

The recipient must be a member of ASB in good standing. He or she should have taught biology in a southern institution for at least ten years, and must be currently teaching. He or she must not be a dean or have regular administrative duties beyond the department level (this particular criterion requiring interpretation in individual

cases). Among evidences of the qualifications of the candidate are the progress of the candidate as indicated by recognition in his or her institution (important assignments and other contributions specifically related to good teaching) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially those who later received advanced degrees.

Past recipients of the Meritorious Award for Teaching are as follows:

- 1952 — Dr. Mary Stuart MacDougall (Agnes Scott)
1953 — Dr. Orland E. White (University of Virginia)
1954 — Dr. W. B. Baker (Emory)
1955 — Dr. John N. Couch (University of North Carolina)
1956 — Dr. Hugo L. Blomquist (Duke)
1957 — Dr. Ezda Deviney (Florida State)
1958 — Dr. Henry R. Totten (University of North Carolina)
1959 — Dr. Margaret Hess (Winthrop College)
1960 — Dr. Ora C. Bradbury (Wake Forest College)
1961 — Dr. Warren Deacon (Vanderbilt)
1962 — Dr. Septima C. Smith (University of Alabama)
1963 — Father Patrick H. Yancey (Spring Hill College)
1964 — Dr. Ruskin S. Freer (Lynchburg College)
1965 — Dr. H. P. Sturdivant (Western Maryland College)
1966 — Dr. Charles Ray, Jr. (Emory University)
1967 — Dr. H. J. Oosting (Duke University)
1968 — Dr. Wade T. Batson (University of South Carolina)
1969 — Dr. William L. Mengebier (Bridgewater College)
1970 — Dr. Elton C. Cocke (Wake Forest University)
1971 — Dr. Earl L. Core (University of West Virginia)
1972 — Dr. A. J. Sharpe (University of Tennessee)
1973 — Dr. Horton H. Hobbs (Smithsonian Institution)
1974 — Dr. Grace Thomas (University of Georgia)
1975 — Dr. L. M. Outten (Mars Hill College)
1976 — Dr. Jonathan J. Westfall (University of Georgia)

Members are urged to nominate outstanding teachers for this award. Nominations are kept on file from year to year, and those who do not receive the award when they are first nominated are reconsidered by the Committee in subsequent years. Nominations and supporting documentation should be sent to *Dr. George S. Ramsaur, University of the South, Sewanee, Tennessee 37375* no later than January 15, 1977.

GEORGE G. MURPHY
RICHARD SMYTER
GEORGE S. RAMSAUR, *Chairman*

Emeritus Membership

The following persons were elected to Emeritus Membership at the Thirty-seventh Annual Meeting in New Orleans. The year in which each became a member of ASB is given in parentheses after the name.

John G. Arnold (1956)
Frank H. Barclay (1965)
Jane C. Belcher (1949)
Edmund Berkeley (1950)
Josephine Bridgman (1939, Charter Member)
John M. Carpenter (1954, Treasurer 1965-68, President 1969-70)
Arthur C. Cole, Jr. (1947)
H. L. Hull (1950)
John F. Locke (1961)
Tully S. Pennington (1962)
B. F. D. Runk (1947)
Alex Stump (1948)
H. P. Sturdivant (1947, President, 1952, Meritorious Teacher, 1965)
John A. Yarbrough (1949)
Martin D. Young (Founding Member, 1937; Secretary-Treasurer 1942-46, President 1947-48)

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg*, Carolina Biological Supply Company, Burlington, N.C. 27215.

NOMINATIONS

The Nominating Committee would welcome suggestions from members in selecting nominees for offices and executive committee positions. The following positions will be filled at the Raleigh Meeting: President-Elect, Vice-President, Treasurer, and two seats on the Executive Committee. Please send suggestions to *Dr. Grover C. Miller*, Department of Zoology, North Carolina State University, Raleigh, North Carolina 27607.

DAVID J. COTTER
C. WILLARD HART
GROVER C. MILLER, *Chairman*

Change of Address

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard*, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.

Please PRINT new address below:

Name:

New Address:

City: State: Zip code:

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

Time and Place of Future Meetings

1977 April 13-16 University of North Carolina, Raleigh
1978 April 13-15 University of Alabama, University, Alabama
1979 University of Tennessee, Chattanooga

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University
Florida — Vacant
Georgia — Fred K. Parrish, Georgia State University
Illinois — George T. Weaver, Southern Illinois University
Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University
Mississippi — Jon R. Fortman, Mississippi University for Women
North Carolina — Maurice Whittinghill, University of North Carolina
South Carolina — G. Thomas Riggan, Jr., Newberry College
Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Mr. John W. Everest has been appointed an instructor in general biology in the Department of Botany and Microbiology at Auburn University. He holds degrees from the University of Alabama and Auburn University and is completing doctoral degree requirements in plant microecosystems. **Drs. U. L. Diener** and **W. D. Kelley** of Auburn University have been elected by the American Phytopathological Society for 3-year terms in 1976-79 as Associate Editor of the international journal *Phytopathology* and member of the Forest Pathology Committee, respectively. **Dr. R. Rodriguez-Kabana** presented an invitational seminar on "Non-Target Effects of Nematicides in Soil" to students and faculty in the Department of Biology, Johnson C. Smith University, Charlotte, North Carolina. **Dr. John D. Weete** participated in an international symposium on "Lipids and Lipid Polymers in Higher Plants" at the University of Karlsruhe, Karlsruhe, West Germany, in July 1976. **Dr. R. Rodriguez-Kabana** presented two invitational research papers on "Treatment of Potato Seed Pieces with Oxamyl for Control of Plant Parasitic Nematodes" and "Nematicidal Activity of the Fungicide Terrazole" at the 13th International Nematology Symposium in Dublin, Ireland.

Dr. Michael S. Golden, assistant professor of forestry at Auburn University is a visiting scientist at the USDA Forest Service's Institute of Pacific Islands Forestry, Honolulu. He is conducting a summer-long study in how to use high-altitude photographs to locate, identify, and map species of forest trees in Hawaii. He is working with black-and-white, color, and color infrared photographs, taken from cameras mounted in U-2 jets flown at an altitude of 65,000 feet in photo missions in 1974 and 1975. He plans to work out a procedure that will make it easy, accurate, and relatively inexpensive to use these photos and others for mapping the major tree species in Hawaii's 2 million acres of forests.

The following individuals have joined the faculty of the Department of Zoology-Entomology at Auburn University as assistant professors: **Dr. James T. Bradley**, Ph.D. University of Washington, Cell Biology; **Dr. Paul R. Krausman**, Ph.D. University of Idaho, Wildlife Man-

agement; **Dr. Robert S. Lishak**, Ph.D. Ohio State, Animal Behavior.

Several faculty members of the Department of Biology, University of Alabama at Tuscaloosa have received funds from a University-Wide Institutional Biomedical Research Support Grant from the Public Health Service. The faculty members include: **Drs. John K. Hardman, Ronald D. Hood, Ronald Lindahl** and **John L. Mego**. The funds will be used by each recipient in partial support of research ongoing in their laboratories. The Biology Department at the University of Alabama is pleased to announce the appointment of three new faculty as assistant professors. They are **Drs. Robert R. Haynes, Joseph F. Scheiring** and **Harriett E. Smith**. **Dr. Haynes**, a plant taxonomist, comes to the department from Louisiana State University at Shreveport. **Dr. Scheiring**, an aquatic entomologist, leaves a post-doctoral position in the Department of Entomology at Michigan State University. **Dr. Smith** joins the Department from the Department of Medicine at the University of Chicago, where she was a research associate. **Dr. Smith** is a developmental cell biologist.

The Biology Department, University of North Alabama announces the appointments of **Dr. Raymond W. Bouchard**, Invertebrate Zoology-Ecology, **Dr. Thomas H. Ely**, Physiology, and **Mr. A. R. Koch**, Phycology-Limnology as assistant professors of biology. **Drs. Jack S. Brown** and **Jack H. Moore** received a second year grant from the Appalachian Regional Commission for the continuation of a pollution study on Shoal Creek.

Dr. Walter Auffenberg, Curator of Herpetology, Florida State Museum, University of Florida, will be traveling to the Philippines to study a large varanid lizard, *Varanus grayi*, and to Madagascar to do preliminary work with radiated tortoises. Both trips are being supported by the New York Zoological Society. **Dr. Fred G. Thompson**, Curator of Malacology, **Richard Franz**, Associate in Natural Sciences, and **Ray Ashton**, Associate in Education, have received funds from the U.S. Fish and Wildlife Service for studies of threatened and endangered species in the Osceola National Forest and upper Suwannee River basin. **Dr. Thompson** will be

surveying the freshwater mollusks, **Mr. Franz** the crayfish, and **Mr. Ashton** will monitor movements and behavior of certain reptiles and amphibians using Cobalt 60. **Ray Ashton** has received a grant from the Office of Endangered Species for computerization and updating the data base of the Society for the Study of Amphibians and Reptiles "Threatened and Endangered Species Report." **Dr. Joe T. Marshall**, U.S. Army Medical Corp., Bangkok, Thailand, will present his original recordings of North and Middle American birds, plus those of Southeast Asia, to the Florida State Museum Bioacoustic Archive.

Dr. A. Gib DeBusk has been appointed Chairman of the Department of Biological Science, Florida State University, for a 4-year term beginning August 1, 1976.

Dr. Kathryn L. Edwards has been appointed assistant professor of Biology at Rollins College. She comes from Yale University where she was a post doctoral associate under **Mary Helen Goldsmith**. She will teach plant physiology and ecology. **Dr. James W. Small, Jr.** has been appointed head of the Biology Department at Rollins assuming the position June 1, 1976. Both **Dr. Small** and **Dr. Mary Ann Henderson** were appointed associate professor.

Dr. Lafayette Frederick, former professor and chairman of the Department of Biology, Atlanta University, has been appointed professor and chairman, Department of Botany, Howard University, Washington, D.C. **Dr. Roy Hunter, Jr.** professor of biology, Atlanta University, has been appointed chairman of the Department of Biology. **Dr. John Mayfield**, formerly at Alabama State University, has been appointed associate professor of biology at Atlanta University. **Dr. Kiah Edward**, post-doctoral research fellow in the Biology Division at the Oak Ridge National Laboratories has been appointed assistant professor of biology at Atlanta University.

Dr. Emil K. Urban has been appointed professor and chairman of the Department of Biology, Augusta College. **Dr. Urban** spent last year in the Department of Zoology, University of Arkansas. **Ms. Judith Baroutsis** will join the Department of Biology as assistant professor after completion of her Ph.D. from Indiana University.

Dr. Gary W. Harrison, a mathematician at the Institute of Ecology, University of Georgia, has received a National Science Foundation grant to convert concepts of the word "stability" as used in scientific jargon, into numerical definitions. This word is quite ambiguous and **Dr. Harrison** feels that if the concepts of stability are put into mathematical form, communication problems between scientists will be diminished.

The "news" section of the ASB Journal is pleased to add Southern Illinois University at Carbondale to the growing list of institutions which regularly submit news about members involved in the biological sciences. **Dr. Donald R. Bissing**, Ph.D. Claremont Graduate School, has been appointed assistant professor in the Botany Department at Southern Illinois University. Other ap-

pointments include: **Dr. W. Carl Taylor**, Ph.D., Southern Illinois University, as assistant curator of Botany, Milwaukee Public Museum. **Dr. Taylor** will have primary responsibility for curating and expanding the plant collection which includes more than 150,000 specimens. **Dr. George T. Weaver**, associate professor, Forestry at SIU, will serve as Coordinator for the North Central Region for the Society of American Foresters project to revise the SAF publication "Forest Cover Types of North America." **Dr. John H. Yopp**, associate professor of botany and **Dr. William M. Lewis**, chairman and professor of zoology at SIU are co-principal investigators of a project entitled "A Recirculated Fish Production Unit in Combination with a Hydroponics System." The project has been funded by the National Marine Fisheries Service, Oceanic and Atmospheric Administration, Department of Commerce through the Illinois Department of Conservation. **Drs. John H. Yopp** and **Donald M. Miller**, professor of physiology have received NASA funds for a project entitled "The Role of Osmotic and Matric Forces in Regulating Water Potential in Extreme Halophile." **Dr. Donald Tindal**, associate professor of botany at SIU has received a grant from Argonne National Laboratory to study algae populations in waters affected by coal mine drainage in Wyoming.

Dr. William Farrar, enzymologist and neuroanatomist from Virginia Polytechnic Institute, will join the faculty of the Department of Biological Science at Eastern Kentucky University, August 1976. **Dr. David Marden**, microbiologist from Syracuse University will also join the faculty.

The Biology Department of Northeast Louisiana University announced the promotions of **Dr. R. Dale Thomas** from associate professor to professor, and **Dr. Russell A. Normand** from assistant professor to associate professor. The following grants have been received in the Biology Department at Northeast Louisiana University: **Dr. Harold C. Bounds**, \$7,500 from the National Science Foundation's Instructional Scientific Equipment Program to improve instruction in microbiology; **Dr. William W. Norris, Jr.**, \$11,000 from the National Science Foundation to prepare audio-visual tapes for demonstration of difficult microscopic material in histology and embryology.

Dr. John Scott Ziesenis (Ph.D. North Carolina State University) will join the faculty of the Department of biology, University of Southwestern Louisiana as assistant professor. **Dr. Billie L. Perkins** has resigned her position as assistant professor of biology to enter private business. **Mrs. Lola Eshelman**, long-time teaching assistant in the Department of Biology, retired on 30 June 1976. **Dr. E. D. Keiser**, has resigned his position as associate professor of biology to accept the post of Chairman of the Department of Biology at the University of Mississippi.

Dr. R. Bruce Lacey of the Department of Biological Sciences, Mississippi University for Women, has been

promoted from assistant professor to associate professor of biology.

Mr. Grady Edward Williams, III has been added to the staff of Delta State University Department of Biological Sciences. **Mr. Williams** will receive the Ph.D. in fishery sciences from Texas A&M in December 1976.

The Mississippi Marine Resources Council has awarded three research grants totaling \$11,499 to the Gulf Coast Research Laboratory of Ocean Springs, Mississippi. Projects funded are: "Evaluation of the Nutritional Value of High Marsh Grass for Brown Shrimp, *Penaeus aztecus* Ives," **Dr. A. Venkataramiah** and **Dr. David W. Cook** principal investigators; "Evaluation of Methods for Long-Term Freezer Storage of Blue Crabs for Use in Picking Plants" **Dr. David W. Cook** and **Sandra Lofton**, principal investigators; "Bait Fish Rearing," **Thomas D. McIlwain**, principal investigator. A six months extension of time and additional funds of \$44,000 have been granted to the Gulf Coast Research Laboratory for the project entitled "Fisheries Resources Assessment and Monitoring." Data from the project are currently being used by the Mississippi Marine Conservation Commission in the management of the shrimp fishery. **J. Y. Christmas**, senior fisheries biologist is the principal investigator on the project. A group of 10 students accompanied by **Dr. Glynn Hopkins** and his wife, **Frances**, both assistant professors at Southwest Baptist College in Bolivar, Mo., visited the Gulf Coast Research Laboratory on June 3-4, 1976. **Dr. Hopkins** is conducting a 30 day course in marine biology for which the students will receive five hours credit. The group will cover some 4,000 miles during the month they are away from the parent campus.

Dr. A. W. Cooper has returned to the Department of Botany, North Carolina State University as professor of forestry and botany. He has been on leave with the North Carolina Department of Natural and Economic Resources for the past five years. **Dr. C. E. Anderson** has also returned to the Department of Botany following a year with the Environmental Protection Agency. **Dr. Hugo H. Rogers** has been appointed assistant professor of botany (USDA). **Dr. Rogers** is a graduate of the School of Public Health and Engineering of the University of North Carolina. **Dr. Robert L. Beckmann** joins the department as an assistant professor. **Dr. Beckmann**, a taxonomist, received his degree from Vanderbilt University. **Dr. Linda M. Stroud** has been appointed research associate in the Department of Botany. She obtained her degree in botany-ecology from North Carolina State University.

Dr. John Clausz has accepted an appointment in the Biology Department at State University College of New York—Geneseo. He leaves St. Andrews Presbyterian College where he was chairman of the biology program and assistant professor of biology.

Dr. James Jackson and **Brother Jan Northcott** have been appointed to the biology faculty of Belmont Abbey

College, Belmont, North Carolina. **Dr. Jeanne Stuart** of Belmont Abbey College has received a grant from the United States E.R.D.A. to study the parasites of fish of the Savannah River Project.

The following promotions have been made in the Department of Biology, Wake Forest University: **Dr. Gerald W. Esch** (chairman) to professor of biology; **Dr. Ronald V. Dimock, Jr.**, to associate professor of biology; **Dr. Mary Beth Thomas** to associate professor of biology. **Dr. Hugo C. Lane** of Wake Forest University has received a \$5,000 grant from the North Carolina Board of Science and Technology to support research on erythropoiesis in trout. The study involves the role of the spleen and liver in erythropoiesis and choline deficiency in the diet. **Dr. Raymond E. Kuhn** has been awarded a Reynolds Research Leave to continue research on the immunology of host-parasite relationships. **Dr. Walter S. Flory** was one of 200 Distinguished American Botanists to be given Complimentary Fellowships to the Royal Horticultural Society. The gesture was in honor of our Bicentennial Celebration. The honor includes a plaque and tickets to various special garden shows in England.

Dr. D. Reid Wiseman, a phycologist, has been appointed as associate professor of biology, College of Charleston, Charleston, South Carolina. A \$70,000 grant from the Environmental Protection Agency to study "Food Webs, Populations and Productivity in a Southeast Coastal Marine Marsh" was awarded to **Dr. Norman A. Chamberlain** and six other members of the Department of Biology, College of Charleston.

The following appointments have been made in the Department of Biology, University of South Carolina: **Dr. Steven Handel** (Ph.D. Cornell University) assistant professor, plant ecology and evolution; **Dr. Aubrey Thompson**, assistant professor, molecular endocrinology; **Dr. Beverly Anne Weeks**, assistant professor, immunology. **Dr. Anthony H. C. Huang** has received a National Science Foundation grant for "Studies on glyoxysomes and related organelles"; **Dr. Nawin C. Mishra** received a National Institute of Health grant to study "Genetic effects of Exogenous Nucleic Acids in *Neurospora* (an eukaryotic microorganism)."

Fall additions to the faculty of the Department of Zoology, Clemson University, include **Dr. James E. Schindler**, associate professor, **Dr. Jack B. Waide** and **Dr. A. P. Wheeler** as assistant professors, and **Dr. John P. Wourms** as visiting assistant professor.

Dr. John A. Freeman has returned to fulltime teaching and research in the Department of Biology, Winthrop College, Rock Hill, South Carolina after 15 years as departmental chairman. **Luckett V. Davis** is acting chairman. **Kenneth W. Gregg** of Winthrop College is now vice-chairman of the Nuclear Advisory Council of South Carolina.

Dr. Walker O. Smith has joined the faculties of the Department of Botany and the Graduate Program in Ecology at the University of Tennessee. **Dr. Smith**, a

recent graduate of Duke University will offer courses in Marine Ecology and Phytoplankton Ecology. He will also continue his research on phytoplankton productivity and the role of phytoplankton production in ocean food webs. **Dr. Harrison Ambrose** has joined the faculties of the Department of Zoology and the Graduate Program in Ecology. **Dr. Ambrose** will supervise general biology courses at the University and will continue research on population regulation in small mammals.

The Department of Biology, Southwestern at Memphis, announced the appointments of **Dr. John N. Mugaas**, animal physiologist and **Mrs. Joyee Stone**, a geneticist.

Dr. S. K. Ballal received an U.S. Office of Education grant to conduct an In-Service Environmental Education Institute entitled Resources, Energy and Environment: Issues and Answers.

Additions to the Department of Biology, Virginia Commonwealth University (VCU) are: **Ms. Jane Bieber**, instructor, from Nazareth College of Rochester; **Dr. Arthur Conway**, assistant professor, from Hobart and William Smith College; **Dr. Carolyn Conway**, assistant professor, from Hobart and William Smith College; **Dr. Michael Scanlon**, assistant professor, from The College of St. Thomas; **Dr. Lynn Siegel**, assistant professor, from VCU Health Science Division; and **Mr. J. Miles Sharpley**, who returned to VCU after a year of leave. **Dr. Robert Maher** has received a VCU grant-in-aid to study the "Effects of induced obesity on early sexual development in the immature female rat." **Dr. T. Daniel Kimbrough** presented a seminar at the Department of Zoology, Sheffield University, Sheffield, England this summer on "The effects of Serotonin (5-hydroxytryptamine) on gut motility in mammals." **Dr. Gerald C. Llewellyn** presented a paper on Aflatoxin at the Third International Toxicology Symposium in San Jose, Costa Rica in August.

Dr. Bernice M. Speese retired from the Department of Biology, College of William and Mary, this past summer. She is replaced by **Dr. Stanton F. Hoegerman**, formerly a research scientist at Argonne National Laboratory. **Dr. Mitchell A. Byrd** has returned to full-time teaching after serving as the chairman of the Biology Department at William and Mary. **Dr. Stewart A. Ware** has been appointed as the new chairman.

Dr. Daniel B. Suter has been promoted to associate dean, at Eastern Mennonite College, with special assignment to the science and nursing departments. **Dr. A. Clair Melinger** will replace him as chairman of the department. **Dr. Kenton K. Brubaker** is directing a new Agriculture Development program at Eastern Mennonite College which will attempt to provide students with a wide range of skills for careers in rural and community development especially in the less developed countries.

New faculty in the Department of Biology at Virginia Polytechnic Institute and State University include: **Dr. Robert Elius**, Ph.D. Texas, Physiological Plant Ecologist; **Dr. Robin Andrews**, Ph.D. Kansas, Animal ecologist,

a visiting assistant professor from Washington University in St. Louis, Mo.; **Dr. Marjorie Woollacott**, Ph.D. University of Southern California; and **Dr. Richard Mayes**, Ph.D. Texas.

Bruce Sampson, plant morphologist and Senior Lecturer at Victoria University, Wellington, New Zealand will spend several months at Louisiana State University, Baton Rouge, as a special lecturer in botany and will work with **Dr. Shirley Tueker** on floral structure and development of primitive flowering plants.

About Institutions

A Master of Science in Biology program is now underway with 27 graduate students in the **Biology Department** at the **University of North Alabama**.

The **University of Georgia Institute of Ecology** is updating and computerizing a world census of scientists and their specialties to tell who is working on what in tropical ecology. Sponsored by a National Science Foundation grant for \$13,000, the project is directed by **Dr. Frank B. Golley**, institute director. By summer 1977 the list will provide communications networks and will serve as a valuable resource in tropical ecology.

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The ASB

BULLETIN

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Aerial View of North Carolina State University Campus

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Deadline for July Issue: May 15

ABOUT THE RALEIGH MEETING

The Association of Southeastern Biologists will hold its 38th Annual Meeting April 14-16, 1977 at North Carolina State University in Raleigh. Activities will center in the new *Jane S. McKimmon Extension Education Center* located at the southwestern edge of the campus. The Friday night banquet, Retiring President's address, and presentation of awards and new officers will be held at the *Faculty Club* just west of the campus. NCSU extends an invitation to all to visit the area and the campus, and to attend these meetings.

Societies Meeting with ASB

- Beta Beta Beta, Southeastern Region
- Southeastern Section, Botanical Society of America
- Southern Appalachian Botanical Club
- Southeastern Section, Ecological Society of America
- Southeastern Society of Parasitologists

Raleigh and NCSU

This Capitol City is on the eastern edge of the Piedmont Province. Rolling topography from about 200-500 feet elevation, mixed pine and hardwoods forest, pastures, and cultivated fields lend contrast and interest to the surrounding countryside. April is one of the most beautiful months, with mild weather and a great display of flowering trees, shrubs, vines, and herbs. Raleigh has a population of about 150,000. Museums, state government buildings, campuses of six colleges and universities, and the nearby Research Triangle Park are all within a few minutes drive from NCSU. The campuses of Duke University and the University of North Carolina at Chapel Hill are within 40 minutes drive. Information on Raleigh and its various attractions, especially for families, will be distributed at registration.

North Carolina State University has an enrollment of about 17,000 and a faculty and profes-

sional staff of about 1800. The University is organized into eight schools and the Graduate School. The biological science departments are in the School of Agriculture and Life Sciences. As a Land-Grant Institution, the University maintains broad academic offerings, extensive public involvement, national and international activities, and large-scale extension and research programs. All of these are particularly evident among the biological sciences.

Travel to Raleigh

Highways passing through Raleigh are as follows: east-west U.S. 70, I-40, and U.S. 64; north-south U.S. 1, U.S. 401, and N.C. 50. *Airlines* serving Raleigh-Durham Airport are: Eastern, Piedmont, and United. Limousine fare one way is \$3.25 (Taxi \$8.00) to the McKimmon Center. *Busses* are Greyhound and Carolina Trailways. *Rail* service, north-south, is provided by Amtrak.

The NCSU Campus and McKimmon Center are located on the west side of the city, on Western Blvd., east of the U.S. 1 & 64 beltline. Free and adequate parking is available at the Center. Parking is not available on the main campus, but the biological sciences are within walking distance.

Dining Facilities

A snack bar will be available at the McKimmon Center, and several short-order restaurants are within walking distance of the Center.

Local Alcohol Mores

Beer and wine are sold in most restaurants, grocery stores, etc. "Hard liquors" are available only at ABC Stores and "brown-bagging" is permitted in the larger restaurants.

Accommodations

No campus housing is available. It is advisable to make room reservations as soon as possible. Write or call directly to the motel of your

choice and indicate attendance at the ASB meeting. Special conference prices are available only at the John Yancey Motor Hotel. Only the Mission Valley Inn is within walking distance of the McKimmon Center.

PETS ARE NOT ALLOWED in motels by state law, and this is strictly enforced.

- John Yancey Motor Hotel, 2200 Hillsborough St. (across from NCSU)
(919) 828-9091; 126 rooms; Single \$15.00, Double \$20.00 (special ASB rates)
- Mission Valley Inn, 2110 Avent Ferry Rd. (at Western Blvd.)
(919) 828-3173; 120 rooms; Single \$14.50, Double \$17.00
- Hilton Inn, 1707 Hillsborough St. (east side of campus)
(919) 828-0811, 1-800-446-3811; 195 rooms; Single \$18.00, Double \$23.00
- Velvet Cloak Motor Hotel, 1505 Hillsborough St. (east of campus)
(919) 828-0333, 1-800-662-7987; 172 rooms; Single \$20.00, Double \$23.00
- Holiday Inn – Downtown, 320 Hillsborough St.
(919) 832-0501, 1-800-238-5400; 204 rooms; Single \$19.00, Double \$25.00
- Sheraton Crabtree Motor Inn, U.S. 70 west (near beltline)
(919) 787-7111; 143 rooms; Single \$16.00, Double \$19.00-\$20.00
- Ramada Inn – Crabtree, 3920 Arrow Drive (intersection of beltline & U.S. 70)
(919) 782-7525; 124 rooms; Single \$16.50, Double \$18.00-\$21.00
- Howard Johnson's – Crabtree, Highway 70 West at the Beltline
(919) 782-8718; 176 rooms; Single \$16.00, Double \$18.00-\$21.00
- Royal Villa Motor Inn, 6339 Glenwood Avenue (west on U.S. 70)
(919) 782-4433; 312 rooms; Single \$17.25, Double \$22.25

Camping facilities —

- Umstead State Park, ca. 5 mi. west on U.S. 70

(919) 787-3033; gates are locked at 8:00 P.M.

— College Park, 4208 New Bern Ave. (east of the city)

Full hook-ups, \$4.00 for 2 people, .25 each additional person at site

Registration

Lobby of McKimmon Center, 6-9 P.M. Wednesday, 8 A.M.-7 P.M. Thursday, 8 A.M.-noon Friday. Students \$3.00, others \$5.00. The lower student registration fee is to encourage undergraduate and graduate student attendance and participation in the meetings.

General Schedule

Thursday: Individual paper sessions, morning and afternoon

Symposium: "*Recognition and Protection of Natural Areas of the Southeastern United States*" sponsored by the ASB in association with the Nature Conservancy, SE Chapter of Ecol. Soc. Amer., and SE Sect. of Bot. Soc. Amer. Dr. W. H. Martin presiding.

Executive Committee Meeting: 3:30 P.M., room 9.

Exhibits: 8 A.M.-5 P.M., 9-11 P.M., room 1

Placement service: 8 A.M.-5 P.M., room 10

General Session: 7:30 P.M., room 2; speaker to be announced

Smoker: 9-11 P.M., Lobby

Friday: Individual paper sessions, morning and afternoon

Invited Paper Sessions (morning and afternoon): "*Chromosome Structure and Function*." Dr. Margaret Y. Menzel presiding.

Business meetings, breakfasts, and luncheons

Exhibits: 8 A.M.-5 P.M., room 1

Placement service: 8 A.M.-5 P.M., room 10

Banquet, 7 P.M. at Faculty Club;
Seafood buffet (tickets will be
available at registration)

Retiring President's Address: "*The
Worm and I*" by Dr. Perry Holt,
Virginia Polytechnic Institute and
State University

Saturday: Executive Committee Breakfast and
Meeting, 8:30 A.M., room 9

Field trips — meet in parking lot of
McKimmon Center.

Field Trips

Local, during the meetings

1. On-campus facilities of special interest, such as Phytotron, Tissue-culture laboratory, Electron microscopes (TEM and SEM) laboratory, and The Herbarium. Open during entire meeting, and also Saturday morning.

2. N.C. State Museum of Natural History. This will be open for visitors during entire meeting and special visits can also be arranged. Dr. John B. Funderburg, Director; Dr. John Cooper, Curator of Research and Collections.

3. Early morning bird trips, at sunup until 8 A.M., to diversified habitats near campus. Each morning. Dr. T. L. Quay.

Off-campus, Saturday

1. N.C. Botanical Gardens in Chapel Hill and The Sarah B. Duke Gardens in Durham. Led by Dr. G. Ray Noggle. All day.

2. Plant communities of the Raleigh area. An all-day trip to a series of locations of special interest, such as the disjunct hemlock stand at "Hemlock Bluffs"; primary succession and endemics on granite flatrocks near Rolesville; mesic woods with rich spring flora along Crabtree Creek. Led by Dr. Jon Stucky.

3. Plant communities of the Southeastern Coastal Plain of N.C. An all-day trip to the Wilmington area and return. Distinctive communities include: salt marsh, dunes, live oak forest, pocosin (evergreen shrub bog), Carolina Bay, pine savanna, cypress swamp, longleaf pine-turkey oak on coarse sand, and upland hardwoods.

Led by Dr. Ernest D. Seneca. Limit of 30 participants.

4. Floristic and Community Diversity Related to Habitat Diversity. A one- or two-day trip, according to interest, along the Fall-line of South Carolina and Georgia; overnight in Augusta, Ga. Habitats from hydric to xeric, on a variety of soil types and geological formations; much diversity and with many disjunct and endemic species. Day 1: turkey oak and pocosins, pioneer communities over hematite, swamp forest, white cedar, and aquatic communities. Day 2: granite outcrop communities, serpentinite communities, syenitic gneiss communities, and diabase communities. This "ecosystematics" trip led by Dr. A. E. Radford, Univ. of N.C. at Chapel Hill. Limit of 30 participants.

5. Sand Hills Ecology. This trip will center at the Weymouth Woods-Sand Hills Nature Preserve near Southern Pines, 75 miles southwest of Raleigh. Fire ecology and endangered species management will be stressed in this area of longleaf pine and associated vegetation types. All day, no limit. Led by J. H. Carter, Park Naturalist.

More detailed information will be available at the registration desk, or can be obtained by writing to the leaders or to Dr. T. L. Quay, Dept. of Zoology, NCSU. The Saturday trips and 2-day trip require your own means of transportation. Those wishing to participate in either No. 3 or 4 should write to Dr. Seneca, Dept. of Botany, NCSU, or Dr. Radford, Dept. of Botany, Univ. of N.C., Chapel Hill as soon as possible. Sign-up sheets will be available at Registration. We consider the field trips to be a very important aspect of these meetings and invite your participation.

Local Arrangements Committee

Chairman — James W. Hardin

Program — J. E. Cooper, L. F. Grand, J. W. Hardin, B. S. Martof, G. R. Noggle

Registration — J. M. Stucky

Exhibits — W. C. Grant, G. C. Miller

Housing & Family Activities — R. L. Mott

Banquet & Food Services — C. E. Anderson

Meeting Rooms — U. Blum

Field Trips — T. L. Quay

CANCELLED AND NO SHOW PAPERS

ASB program sessions have been increasingly plagued in recent years by papers that are scheduled and then not delivered. Such gaps in the schedule disrupt the program, disconcert those scheduled later in the session, and disappoint the audience. Professional courtesy requires a person who submits a paper to accept the obligation to see that the paper is presented. If one cannot be present because of unforeseen circumstances, it is usually possible to arrange for a colleague to read the paper. If this is not feasible, it is incumbent upon the author to notify the Program Chairperson and the person chairing the session at the earliest possible moment.

Papers cancelled before the April Bulletin and the Program go to press (about the first of February) can be removed from the program and the other papers in the session rescheduled to avoid inconvenience. A phone call to the Editor—(904) 644-5228—can be helpful in this case.

Please call the attention of your graduate students and colleagues to this matter. The Executive Committee hopes that no further action will be necessary to remedy the situation.

PAYING DUES AT ANNUAL MEETING — PLEASE DON'T

In past years, much confusion has arisen when members paid dues when they registered at the Annual Meeting. Therefore, at the Blacksburg and New Orleans Meetings, dues were not accepted at the registration desk. The Executive Committee staffed a booth in the exhibit area where extra copies of the Bulletin and other materials explaining the purpose and activities of ASB were available. New members were encouraged to fill out application forms and pay their dues there. Old members were urged to mail their dues directly to the Treasurer, Dr. Raymond O. Flagg, Carolina Biological Supply Company, Burlington, North Carolina 27215.

This procedure will be continued at the Raleigh Meeting. Suggestions for improvement of the ASB booth display and operation will be gratefully received by the Executive Committee.

TIME AND PLACE OF FUTURE MEETINGS

1977	April 13-16	University of North Carolina, Raleigh
1978	April 13-15	University of Alabama, University, Alabama
1979		University of Tennessee, Chattanooga
1980		University of South Florida

EMERITUS MEMBERSHIP

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, Dr. Raymond O. Flagg, Carolina Biological Supply Company, Burlington, N.C. 27215.

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.

Please PRINT new address below:

Name:

New Address:

City: State: Zip code:

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

SREL Symposium

on

Energy and Environmental Stress in Aquatic Systems

November 2-4, 1977

Augusta, Georgia, USA

The Savannah River Ecology Laboratory, in cooperation with the University of Georgia's Institute of Ecology, will sponsor the fifth in a series of symposia on ecological research. Session topics will include: thermal ecology, heavy metal pollution, contamination from fossil fuels and their by-products, natural stressors and environmental fluctuations, synergistic stresses, and modeling environmental stress. Plenary meetings will be scheduled for invited speakers to review pertinent research on each of the six session topics. At the completion of each session a selected panel and the audience will discuss the papers presented and consider future avenues of research.

Papers for oral presentation and publication will be selected on the basis of quality of content, applicability to the proposed sessions, and balance within each session. Informative abstracts are due by July 15, 1977, and speakers will be notified of acceptance by August 1. Authors who desire to publish their work should submit their manuscripts no later than September 1, in order to guarantee consideration for publication in a volume of selected papers. For further information on abstract and manuscript preparation, lodging, registration, etc., contact: Dr. James H. Thorp, Chairman, Symposium Committee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina, 29801, USA.

News of Conservation in the Southeast

STATE CORRESPONDENTS

Alabama - Vacant

Arkansas - H. W. Robinson, Southern State College

Georgia - Billy Hillestad, University of Georgia; C. E. Stanton, Columbus College

Illinois - R. H. Mohlenbrock, Southern Illinois University

Kentucky - W. H. Martin, Eastern Kentucky University

Louisiana - M. G. Curry, VTN Engineers Planners; M. A. Fiehl, Baton Rouge

Mississippi - Vacant

Missouri - R. R. Pryor, Missouri Natural Area Survey

North Carolina - D. DuMond, Wilmington; J. D. Pittillo, Western Carolina University; R. P. Teulings, N.C. Dept. of Natural and Economic Resources

South Carolina - S. M. Jones, Clemson University; J. N. Pinson, Jr., University of South Carolina; R. D. Porcher, The Citadel

Tennessee - M. Halcomb, The Nature Conservancy; R. Jordan, Jr., Tennessee Valley Authority; D. Nelson, East Tennessee State University

Virginia - Vacant

West Virginia - R. B. Clarkson, West Virginia University; R. Fortman, Department of Natural Resources

C. E. STYRON - *Editor*

Division of Mathematical, Natural and Health Sciences

St. Andrews Presbyterian College
Laurinburg, North Carolina 28352

About People

George L. Vaught, former Conservation Committee state correspondent for Georgia, has accepted a position with Espey, Huston & Associates, Inc. of Austin, Texas.

Gail S. Baker has returned to Titusville, Florida after working in the Office of Endangered Species, Fish and Wildlife Service, Washington, D.C.

About Organizations

The Fish and Wildlife Service has inaugurated the **Endangered Species Technical Bulletin**, a monthly publication to foster communication among professionals in the field. For information contact: Director (FWS 1F), U.S. Fish and Wildlife Service, P.O. Box 19183, Washington, D.C. 20240.

The Botany-Microbiology section of the **Kentucky Academy of Science** has established a committee to develop a list of rare, endangered and threatened Kentucky plants. Willem Meijer (University of Kentucky) is committee chairman. A second committee has been established to join the Nature Conservancy in cataloging natural areas and providing support to implement the Nature Preserves Act.

The **Nature Conservancy** is the major United States conservation organization specializing in the preservation of natural lands including endangered species habitats, scientific research sites, examples of native ecosystems, and critical areas benefiting the environment. At the present time, Heritage programs are under way in various places in New Mexico, Tennessee, West Virginia, Ohio, Oregon, Mississippi and South Carolina. The first program began over a year ago, and currently discussions are under way with about a dozen additional states, several of which are expected to initiate programs in the near future.

The U.S. Fish and Wildlife Service has approved a Program for the Conservation of Endangered and Threatened Species in the **Missouri Department of Conservation**. Missouri is only one of a dozen states to have plans so approved as of June. The Department is now managing 49 natural areas in its system. At the recent annual meeting of The Nature Conservancy, the Department was presented TNC's Stewardship Award for its management of several Conservancy natural areas.

The newly re-established **Kentucky Chapter of The Nature Conservancy** has purchased its first natural area in northern Kentucky. The acquisition preserves 46 acres of forest and one of the few prominent and extensive glacial deposits in the state. Known as the Boone County Cliffs, it is considered to be the most unique natural area in northern Kentucky. Biologists on the board of trustees include Mary Wharton (Professor Emeritus, Georgetown College), William Bryant (Thomas More College) and William Martin (Eastern Kentucky University).

Thanks to Governor Julian Carroll and the state legislature, **Kentucky** now has a scenic easement law and a Nature Preserves Act. The preserves act provides for recognizing natural areas and the dedication of private land as a natural preserve. The Commission established by the act must make annual reports on the condition of natural ecosystems in the state. In the long run, this legislation should become most important in preserving wildlife habitats. Other conservation-oriented legislation did not fare so well. Land use and recycling legislation were the primary casualties.

Thanks to a recent contribution by an anonymous donor, the **Kentucky Academy of Science** provides financial support for floristic studies. For 1975-76, the academy's Floristic Survey Grant has been awarded to Patrick Applegarth, a student at Northern Kentucky University. He will conduct a floristic survey of Kenton County under the direction of John Thieret. The acad-

emy has also established the Botanical Research Foundation with an endowment from an anonymous donor. The Foundation award will support any botanical research. This provides a second avenue of support for research that can document location and extent of rare, unusual or threatened floristic and vegetational elements in the state.

Conservation of the nation's freshwater and estuarine marsh systems is of paramount concern. A source of existing marsh system alteration and/or destruction has been associated with dredging activities in the nation's harbors and waterways. The **U.S. Army Corps of Engineers (COE)** has the responsibility to plan, construct and maintain these facilities which are vital to our nation's economy. The need to maintain existing facilities in order to keep ports competitive and to extend the nation's waterways has caused large scale increases in the volume of materials dredged from the harbors and waterways and tightened restraints on the disposal of dredged material. The surge of public concern for the quality of our natural resources has caused many once routine dredging practices to be questioned. In 1969 the enactment of the National Environmental Policy Act, supported by court action, intensified the need for quantitative data to assess the impacts of proposed actions and called attention to the need to formulate and evaluate meaningful alternatives to existing practices. Acting under Congressional authority granted in the River and Harbor Act of 1970, the office, Chief of Engineers assigned the U.S. Army Engineer Waterways Experiment Station the lead role in planning and conducting a program of study, research and experimentation relating to dredged material.

Once the increasing volume of dredge material was viewed as a resource rather than a waste, many areas of application and use were opened; such as, enhancing existing habitats through artificial marsh/habitat creation. However, considerable speculation has been attached to whether dredged material placed under certain conditions will actually enhance fish and wildlife habitat values. As a result, the Habitat Development Project of the COE's Dredged Material Research Program (DMRP) has selected several marsh and upland terrestrial habitat sites throughout the United States in order to test concepts and methods of establishing artificial habitats on dredged material and evaluate artificial habitat development as a practical alternative method of dredged material disposal. One such marsh development study was initiated in July, 1975 at a small dredged material island (approximately 5 acres) in the Atlantic Intracoastal Waterway in Georgia. The site is located in Buttermilk Sound, on the west side of Little St. Simons Island. The Buttermilk Sound site was selected because the COE believes "it offers the potential to evaluate the survival and the productivity of several species of marsh plants under different fertilization and tidal influences in a relatively homogenous environment." This 2½ year study is sponsored by the DMRP and con-

tracted through the COE's Savannah District to the Marine Resources Extension Center of the University of Georgia, Brunswick. A progress report on the Butter-milk Sound marsh development site was presented in the December 1975 DMR news letter (miscellaneous paper D-75-12).

About Biota

The **snail darter** (*Percina tanasi*) is the first animal to have its habitat requirements defined and officially determined as "critical" to its survival (F.R. 4/1/76). The law obliges all Federal agencies to insure that actions authorized, funded, or carried out by them do not result in the destruction or adverse modification of habitat that has been determined as critical to an endangered or threatened species. Impoundment of water behind the Tennessee Valley Authority's Tellico Dam on the Little Tennessee River poses a threat to the snail darter. The Fish and Wildlife Service has determined that the darter's only present known habitat — clean gravel shoals with swift, cool, low turbidity water along a 17-mile stretch in Loudon County, Tenn. — would be oblit-

erated. Private citizens brought suit to stop work on the partially completed dam. A Federal court has ruled in favor of continuing construction on grounds that a large amount of capital has been invested in the project and the fact that the darter was discovered after construction started. The case is under appeal and construction is proceeding. (Endangered Species Technical Bulletin 1(1):2).

The Sixth Circuit Court of Appeals scheduled a hearing in October (1976) on an appeal of a lower court decision allowing construction to proceed on the Tellico Dam in spite of threats posed to the critical habitat of the snail darter. The dam is scheduled for closure in January 1977. Conservationists who brought the suit claim impoundment of water by the dam will create a lake that will destroy the small fish's principal habitat. On July 28 the circuit court issued a stop-work order on the \$100-million Tennessee Valley Authority project on the petition of three people from the University of Tennessee Law School. Five days later, the court amended the injunction, limiting it to the issue of closure of the nearly completed dam. This allowed construction to proceed.

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University
Florida — Vacant
Georgia — Fred K. Parrish, Georgia State University
Illinois — George T. Weaver, Southern Illinois University
Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University
Mississippi — Jon R. Fortman, Mississippi University for Women
North Carolina — Maurice Whittinghill, University of North Carolina
South Carolina — G. Thomas Riggan, Jr., Newberry College
Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Margaret Browder has joined the faculty of the Department of Biology, Troy State University, as instructor of human biology. **Ms. Browder** completed her M.S. at Auburn University. **Dr. F. Wayne Adams**, Troy State University, has received a National Science Foundation grant of \$105,700 to conduct a three year program in Comprehensive Assistance to Undergraduate Science Education.

Dr. R. Rodriguez-Kabana of the Botany and Microbiology Department, Auburn University, presented two invitational addresses on plant parasitic nematodes at the 13th International Nematology Symposium in Dublin, Ireland, September 5-11, 1976. **Dr. R. M. Cody** presented an invitational lecture on "Infection Control in Hospitals" to the staff of the Randolph County Hos-

pital at Wedowee, Alabama during September, 1976. **Dr. U. L. Diener** has been appointed as an Associate Editor of *Phytopathology*, the international journal for plant pathologists.

Dr. Herbert Boschung, Department of Biology, University of Alabama-Tuscaloosa, has received \$64,789 in a contract from the United States Department of Agriculture Forest Service to study "The Effects of Forest Clear-Cutting on Fishes and Aquatic Macroinvertebrates." **Dr. Boschung** and his group will measure the overall impact of Harvesting and regenerating timber on the aquatic organisms in warmwater streams in National Forests of Alabama. **Dr. John K. Hardman**, University of Alabama, has received \$70,000 from the National Institutes of Health to continue his research on the

"Structural and Catalytic Properties of Tryptophan Synthetases." These studies will lead to a clearer understanding of the mechanism by which this complex enzyme system functions and is regulated by the organism.

Professor Allen Hayse has returned to the Department of Biology at Samford University after two years leave for work on the Doctorate Degree. He resumes his duties in the general area of Physiology.

Dr. Neil Greenberg, currently with the National Institute of Mental Health laboratories in Bethesda, Maryland, has accepted an adjunct assistant curatorship in the Florida State Museum for the current academic year. **Dr. Greenberg** will continue his work on lizard behavior in his present location but a pending grant application would bring him to the Museum thereafter for an extended period for cooperative work with **Dr. Walter Auffenberg**, Curator in Herpetology.

The following grants have been awarded to members of the faculty of the Department of Biological Science. The Florida State University: **Dr. E. I. Friedmann**, National Science Foundation, "Endolithic Algae in the Dry Valleys (Antarctica)"; "Fine Structural and Developmental Characters in the Taxonomy of Udoteaceae"; **Dr. Andre Clewell**, Environmental Protection Agency, "Fellowship Grant"; **Dr. L. M. Beidler**, National Institutes of Health, "Sensory Physiology"; **Dr. A. G. DeBusk**, Department of Health, Education and Welfare, "Cell Surface Function and Cellular Aging"; **Dr. N. H. Williams**, American Orchid Society, "Training Orchidologists for the Future."

Dr. Enola Stevenson returns to the Department of Biology, Atlanta University, as assistant professor from the United States Department of Agriculture Research Laboratory, Beltsville, Maryland where she was a MARC Fellow in Research on Viroids. **Dr. Kial Edwards** (Ph.D. Brown University, Developmental Biochemistry) has been appointed assistant professor in the Department of Biology, Atlanta University.

Dr. Robert K. Lampton, professor of biology and former chairman of the Department of Biology at West Georgia College, retired in June, 1976. **Dr. Lampton's** retirement ended 14 years of service to West Georgia College during its formative years when it grew from a student body of 600 to one of 6,000. **Dr. Lampton's** expertise in and enthusiasm for Bryophytes resulted in a List of Bryophytes of Georgia, and was extended to numerous graduate students who have subsequently continued their studies in this field.

Dr. Edmund D. Keiser assumed the chairmanship of the Department of Biology at The University of Mississippi in August 1976. **Dr. Keiser** is a graduate of Louisiana State University and was formerly on the staff at the University of Southwestern Louisiana. He has recently terminated a two volume study on the ecology and reproductive biology of the amphibians and reptiles of the Atchafalaya River Basin swamps and marshes. **Dr. Lyman Magee**, former chairman of the department,

has returned to research and teaching. **Dr. Magee**, a well known virologist, is now working on nitrogen fixation plasmids and transducing viruses in nitrogen-fixing bacteria. Three faculty members have recently retired from the "Ole Miss" Biology faculty: **Dr. Marcus E. Morrison** (M.D., University of Tennessee), **Dr. Irwin Clark Kitchin** (Ph.D., University of Freiberg), former chairman of the department and faculty member since 1951, and **Dr. Young John McGaha** (Ph.D., University of Michigan) a member since 1950. **Dr. Kitchin** and **Dr. McGaha** are continuing in an active research capacity in the department. **Mr. Paul Lago** (Entomology) is scheduled to receive his Ph.D. from North Dakota State University. His research concerns the taxonomy and ecology of phytophagous and scavenger scarabaeids.

Mr. J. Y. Christmas, senior fisheries investigator at Gulf Coast Research Laboratory of Ocean Springs, Mississippi and assistant director for fisheries research and development, has been elected to a three-year term as director of the Northeastern Gulf of Mexico District of the American Institute of Fishery Research Biologists. **C. E. Dawson**, Head of the Section of Ichthyology and Systematic Zoology, has returned to the Gulf Coast Research Laboratory after an absence of four weeks during which he attended an international meeting of ichthyologists in Europe and examined specimens of fishes in several European museums.

Dr. Robert L. Hellwig joins the faculty of the Department of Botany, University of North Carolina-Chapel Hill as a visiting assistant professor of botany from August 1, 1976 to June 30, 1977. He received his Ph.D. from Duke University.

Karen G. Burnett, Department of Biology, University of South Carolina, has received a two-year NIAA Grant for \$13,800 for "Studies on Mice Lacking Alcohol Dehydrogenase."

The Department of Botany of the University of Tennessee, Knoxville is pleased to announce its first award from the Aaron J. Sharp Endowment Fund in support of Graduate Research and Education in Cryptogamic Botany. **Ms. Yvonne Mescall** from SUNY College, Buffalo, New York is the recipient of this departmental fellowship which is in support of her M.S. Graduate Program in Ecology. **Dr. A. J. Sharp**, University of Tennessee, Knoxville taught the first course in bryology ever given in Venezuela at the Instituto Universitario Pedagógico Experimental at Maracay during July and August, 1976.

The following additions have been made to the biology staff at Old Dominion University: **Dr. Carl Erkenbrecher** (Microbial Ecology); **Dr. Joseph Merritt** (Mammalogy); **Dr. Lloyd Wolfinbarger** (Biochemical Genetics); **Dr. Raymond Alden** (Pollution Ecology); **Dr. Raymond White** (Population Genetics).

Royal F. Ruth, Head of the Department of Biology of Washington and Lee during the academic year 1975-76, has returned to the University of Alberta in Edmon-

ton, Canada. **James H. Starling** is the new Head. **John S. Knox**, assistant professor of biology and formerly of the faculty at Southern Seminary, has replaced **William E. Bryant**, who has accepted a position with Monsanto Chemical Company in Kansas City.

Appointments to the Biology Department, Radford College, Virginia are: **Dr. Charles Fisher** from Oak Ridge Laboratories to associate professor of biology; **Dr. Michael Maloney** from the University of Kansas to assistant professor of biology; **Dr. Virginia Tipton** from Michigan State University to assistant professor of biology.

About Institutions

The Department of Biology, University of Southwestern Louisiana, has acquired several vessels, for use in teaching and research. The boats were donated by area citizens. They include a 32-foot wooden-hulled boat powered by two Chrysler Marine inboard engines; a 30-foot wood-hull Chriscraft with two inboard engines and a 20-foot fiberglass Sterncraft inboard-outboard.

A recently approved bond issue includes funds for the construction of an instructional wing to the present life science building at **North Carolina State University**. The new wing will contain teaching laboratories for undergraduate courses. A grant from the Carolina Power and Light Company to the **Department of Botany, North Carolina State University** has been expanded to cover the use of aerial photography in assessing plant primary productivity in the Southport, N.C. area.

A greenhouse-headhouse complex was opened this summer on the campus of the **College of Charleston**. Also, an addition to the Grice Marine Biological Laboratory was recently completed.

The new eight story Biological Sciences Center at the **University of South Carolina at Columbia** has opened and classes will begin during the summer of 1976. The new facility is equipped with modern classrooms, teaching laboratories, and research areas which will house twenty of the Biology Department faculty, working in the areas of Developmental Biology, Microbiology, Genetics, and Botany.

The Department of Biology of the University of Tennessee at Chattanooga has recently moved into newly completed Holt Hall. The Biology area includes classrooms, offices and eleven laboratories adjacent to the faculty offices with separate research laboratories for the faculty and students.

A new curriculum in Mathematical Ecology is available within the **University of Tennessee Graduate Program in Ecology**. A sequence of courses in math, systems ecology and environmental quality assessment is intended to prepare students for employment in government and industry where there is a need for quantitative analysis of environmental quality. **The University of Tennessee** has completed renovation of 12,000 sq. ft. of laboratory facilities for the **Graduate Program in Ecology**.

These laboratories, and ten others obtained from the National Institutes of Health last spring, provide new opportunities for experimental and analytical research by faculty and graduate students.

Tennessee Technological University has received a contract with the Alcoa Company for an environmental quality control program.

The Life Sciences Departments of **Louisiana State University**, Baton Rouge, have received funds for the purchase of a scanning electron microscope. The new instrument will complement the transmission electron microscope facilities available in the Life Sciences Departments and increase the campus resources as well as coordinate and further develop research and teaching interest in electron microscopy.

Georgia Southwestern College has a contract from the National Aeronautic and Space Administration to conduct two workshops during the calendar year 1976 on the geological, botanical, and ecological applications of NASA's remote sensing data. This is a follow-up on a two year research study entitled "Geological-Vegetative Relationships" for NASA. The workshops will be under the direction of *Daniel D. Arden, Raymond Westra, and Jack C. Carter*.

The Department of Natural Sciences of the Florida State Museum has now assumed permanent responsibility for the Comparative Animal Behavior Laboratory after a one year trial period of such responsibility. New aviaries and other equipment and facilities are being organized to support several research projects by faculty and graduate students. *Dr. Sol Kramer*, formerly Director of the Laboratory when it was independent of the Museum, continues his research there on Cichlid fish behavior.

The Department of Botany and Microbiology, Auburn University has recently acquired the following research equipment for plant biochemical and physiological investigations: a Tetronix 4051 basic graphic computing system with a 4662 digital platter; a Beckman LS-1000 liquid scintillation counter and a Beathold TLC scanner.

Gulf Coast Research Laboratory has received a study grant in the amount of \$13,300 from the National Science Foundation in continued support of a project entitled "Systematics and Distribution of Syngnathid Fishes." This is the second annual increment for a three-year study of pipefishes being directed by *C. E. Dawson*. *Dawson* has worked for a number of years on the taxonomy of fishes native to the Atlantic and Caribbean coasts from Mexico to Brazil and native to the Pacific Coast. He is in charge of the Laboratory's ichthyology research collection which includes well over 150,000 identified fishes; more than 1950 different species are on file. The research museum has been ranked among the best of 20 of some 200 fish collections in this country and Canada.

A new Naturalist program leading to the B.S. degree is now being offered at **Appalachian State University**, Boone, North Carolina. The program stresses field

studies and includes a spread in the natural sciences. Also, the **Department of Biology** has recently been donated the shell collection and library of the late *Harley L. Freeman* of Ormond Beach, Florida. Facilities for housing the collection are presently being prepared and it should be available for research and study by mid-1977. The collection and library are valued at \$70,000.

A B.S. degree in Botany is now being offered at the **University of North Carolina at Chapel Hill** for the first

time. The new degree is designed for undergraduate students who wish to prepare for graduate study in the botanical, biological, environmental or health-related sciences. It will also provide preprofessional training in such fields as teaching, agriculture, horticulture, food production, forestry and pharmaceuticals. The new degree was prompted by an increase in botany majors from 15 to 62 in the last five years as well as the demand for more rigorous preprofessional training.



57.06

The ASB

BULLETIN

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April 1977



6 a.m. collection

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

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COVER

A group of algal physiology students at the University of South Florida prepare to sample populations of *Hypnea musciformis* (Wulfen) Lamouroux at the Sunshine Skyway Bridge near Tampa during low tide. Laboratory investigations will reveal its physiological responses to temperature, light and salinity. Photograph courtesy of Ralph E. Moon.

THE CHANGING OF THE EDITORIAL GUARD

With this issue, I complete five years as Editor of the ASB Bulletin and pass the torch to the very capable hands of Gary Dillard. To the many officers, committee chairmen, authors and members who sent me copy on time, neatly typed, and *double spaced throughout*, my heartfelt appreciation. To the few who didn't, go in peace and sin no more. And to all, thanks for an interesting and rewarding five years.

Copy for future Bulletins, beginning with the July 1977 issue, should be sent to *Gary E. Dillard, Biology Department, Western Kentucky University, Bowling Green, Kentucky 42101.*

Vale!
Margaret Menzel

Deadline for July Issue: May 15



Program of the 38th Annual Meeting of the Association of Southeastern Biologists

Jane S. McKimmon Extension Education Center
North Carolina State University, Raleigh
Phone: (919) 737-2277

A joint meeting with the Southeastern Section of the Botanical Society of America, Southeastern Chapter of the Ecological Society of America, Southern Appalachian Botanical Club, Southeastern Society of Parasitologists, and the Southeastern Region of Beta Beta Beta National Honorary Biological Society.

REGISTRATION

Lobby of McKimmon Center

Fees: \$3.00 students, \$5.00 regular

TICKETS FOR SPECIAL MEALS (at registration area)

Southeastern Society of Parasitologists: Thursday luncheon, approx. \$4.00 (obtain by 9:00 A.M. Thursday).

Southeastern Chapter, Ecological Society of Amer-

ica: Thursday luncheon, approx. \$4.00 (obtain by 9:00 A.M. Thursday).

Southern Appalachian Botanical Club and Southeastern Section, Botanical Society of America: Friday breakfast, approx. \$2.50 (obtain by 3:00 P.M. Thursday).

ASB Banquet: Friday evening, approx. \$5.00 (obtain by 5:00 P.M. Thursday).

PROGRAM SUMMARY

Wednesday, April 13, 1977

6:00 P.M.- 9:00 P.M. REGISTRATION
SPECIAL MEAL TICKETS

FIELD TRIP REGISTRATION
Lobby of McKimmon Center

Thursday, April 14, 1977

8:00 A.M.- 7:00 P.M. REGISTRATION, TICKETS,
FIELD TRIPS
Lobby of McKimmon Center

8:00 A.M.- 5:00 P.M. PLACEMENT
SERVICE **Room 10**

8:00 A.M.- 5:00 P.M. EXHIBITS **Room 1**

8:00 A.M.-12:00 Noon PAPER SESSIONS
(No Smoking)
Parasitology, I **Room 4**
Animal Physiology, I **Room 5**
Plant Ecology, I **Room 6**
Aquatic Ecology, I **Room 7**
Crustacean Biology **Room 9**

11:00 A.M. BUSINESS MEETING AND
LUNCHEON,
Southeastern Society of Para-
sitologists; **NCSU Faculty Club**
(obtain ticket at registration).
Speaker: *Dr. Martin J. Ulmer*,
Iowa State University.

11:00 A.M. BUSINESS MEETING AND
LUNCHEON,
S.E. Chapt. Ecol. Soc. Am.;
NCSU Faculty Club (obtain
ticket at registration). Speak-
er: *Dr. Frank B. Golley*, Inst.
of Ecology, Univ. of Georgia,
and President, Ecological So-
ciety of America. Topic: "The

1:00 P.M.- 5:30 P.M. PAPER SESSIONS
(No Smoking)
Cytology, Genetics, and Tissue
Culture **Room 3**
Parasitology, II **Room 4**
Animal Physiology, II **Room 5**
Recognition and Protection of
Natural Areas (Invited Pa-
pers) **Room 6**
Aquatic Ecology, II **Room 7**
Phytotronics **Room 8**

3:00 P.M. EXECUTIVE COMMITTEE
MEETING, ASB **Room 9**

7:30 P.M. GENERAL SESSION **Room 2**
Address of Welcome: *Chan-
cellor Joab L. Thomas*
Response: *Dr. John Herr*, ASB
President

9:00 P.M.-11:00 P.M. SMOKER, in **Lobby and with Exhibits**

Guest Lecturer: *Dr. Frederick
B. Bang*, Chairman and Pro-
fessor, Dept. of Pathology,
Johns Hopkins University.
Topic: "The Role of Inver-
tebrate Pathology in Biologi-
cal Research."

Friday, April 15, 1977

7:00 A.M. BUSINESS MEETINGS AND
BREAKFAST,
Southern Appalachian Botani-
cal Club and S.E. Sect. Botani-
cal Society of America. **Hilton
Inn** on Hillsborough St. east of
NCSU campus (obtain ticket
at registration).

8:00 A.M. PAST PRESIDENTS'
BREAKFAST,
Hilton Inn on Hillsborough St.
east of NCSU campus.

8:00 A.M.- 5:00 P.M. EXHIBITS **Room 1**

8:00 A.M.- 5:00 P.M. PLACEMENT
SERVICE **Room 10**

8:00 A.M.-11:00 A.M. REGISTRATION **Lobby**

8:00 A.M.-11:00 A.M. PAPER SESSIONS
(No Smoking)
Chromosome Structure and
Function, I (Invited Pa-
pers) **Room 3**
Plant Systematics, I **Room 4**
Cryptogamic Botany, I **Room 5**
Plant Ecology, II **Room 6**
Aquatic Ecology, III **Room 7**

	Animal Ecology Room 8		Ichthyology and
	Invertebrate Zoology Room 9		Herpetology Room 9
11:00 A.M.	BUSINESS MEETING, ASB Room 2	7:00 P.M.	BANQUET AND PRESENTA- TION OF AWARDS; NCSU Faculty Club (obtain ticket at registration) Association Research Prize, Sponsored by Carolina Bio- logical Supply Co. Meritorious Teaching Award, Sponsored by Scientific Products Retiring President's Address: "The Worm and I" by <i>Dr.</i> <i>Perry Holt.</i>
1:00 P.M.- 5:30 P.M.	PAPER SESSIONS (No Smoking) Chromosome Structure and Function, II (Invited Pa- pers) Room 3 Plant Systematics, II Room 4 Cryptogamic Botany, II Room 5 Plant Ecology, III Room 6 Beta Beta Beta Room 7a, b Plant Physiology Room 8		

Saturday, April 16, 1977

ALL DAY FIELD TRIPS, meet in parking lot of **McKimmon Center** (transportation not provided; register and see details at registration desk).

1. N.C. Botanical Garden in Chapel Hill, and the Sarah B. Duke Garden in Durham. Leader: *Dr. C. R. Bell.*
2. Plant communities in the Raleigh Area. Leader: *Dr. Jon Stucky.*
3. Plant Communities of the Southeastern Coastal Plain of N.C. Leader: *Dr. Ernest D. Seneca.*

4. Floristic and Community Diversity Related to Habitat Diversity (South Carolina and Georgia — 1 or 2 days). Leader: *Dr. A. E. Radford.*
5. Sandhills Ecology (Weymouth Woods near Southern Pines). Leader: *J. H. Carter.*
6. Carolina Biological Supply Company, Burlington. Leader: *Dr. R. O. Flagg.*

8:00 A.M.

EXECUTIVE COMMITTEE,
ASB Breakfast, **Room 9**
Meeting in **Room 10**

SCHEDULE OF PAPER SESSIONS

THURSDAY MORNING — APRIL 14

PARASITOLOGY, SESSION I

Room 4

Presiding: *Dr. Mary C. Dunn*, Middle Tennessee State University

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|------|---|-------|---|
| 8:26 | 1. ERNST, J. V., AND BILL CHOBOTAR (United States Department of Agriculture and Andrews University). The Life Cycle of <i>Eimeria utahensis</i> (Protozoa: Eimeriidae). | 9:31 | 6. HAZEN, T. C., J. M. AHO, AND G. W. ESCH (Wake Forest University). Observations on the Parasite Fauna of the American Alligator, <i>Alligator mississippiensis</i> , in South Carolina. |
| 8:39 | 2. DAY, STEVE, AND G. C. MILLER (North Carolina State University). Parasites of Fishes from Lake Hyco, North Carolina. | 9:44 | 7. MARSHALL, MATTHEW, AND G. C. MILLER (North Carolina State University). Digenetic Trematodes of Bats from Ecuador. |
| 8:52 | 3. EURE, HERMAN (Wake Forest University). Parasite Population Dynamics in Hatchery Rainbow Trout (<i>Salmo gairdneri</i> Richardson). | 9:57 | 8. TURNER, H. M., AND K. C. CORKUM (Louisiana State University). Phylogenetic Relationship of Three Genera of Southeastern Louisiana Freshwater Limpets (Pulmonata: Ancyliidae) as Suggested by Their Larval Digenetic Trematode Parasites. |
| 9:05 | 4. FLOYD, J. C., AND F. H. LAUTER (Voorhees College and University of South Carolina). The Occurrence and Distribution of Intestinal Flagellates in Anura of South Carolina (Zoomastigophorea). | 10:10 | 9. GREER, G. J., AND K. C. CORKUM (Louisiana State University). A Comparison of the Life Histories of Three Digenetic Trematodes (Trematoda: Opisthorchiida: Cryptogonimidae). |
| 9:18 | 5. LIMSUWAN, CHALOR, AND MARY C. DUNN (Middle Tennessee State University). A Survey of Helminth Parasites from Turtles in Rutherford County, Tennessee. | | |

- 10:23 10. HOYER, J. L., AND MARY C. DUNN (Middle Tennessee State University). A Survey for *Trichinella spiralis* (Nematoda) in Middle Tennessee Swine.

ANIMAL PHYSIOLOGY, SESSION I

Room 5

Presiding: *Dr. Dennis T. Burton*, Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory

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| 9:05 | 11. RHODERICK, JOHN C. (University of Maryland, Chesapeake Biological Laboratory), AND C. E. STYRON (St. Andrews Presbyterian College). Effects of Temperature and Pressure on the Excretion Rates of ⁶⁵ Zn in the Brine Shrimp (<i>Artemia salina</i>). | 10:23 | 17. BLOCK, R. M., J. C. RHODERICK, AND S. R. GULLANS (University of Maryland, Chesapeake Biological Laboratory). Physiological Response of White Perch (<i>Morone americana</i>) to Chlorine. |
| 9:18 | 12. CLEMENTS, LINDA C., AND D. E. HOSS (National Marine Fisheries Service, Beaufort, North Carolina). Effects of Acclimation Time on Larval Flounder (<i>Paralichthys</i> sp.) Oxygen Consumption. | 10:36 | 18. BRANNON, D. P., AND L. G. TATE (University of South Alabama). Effect of Salinity on Toxicity and Tissue Accumulation of Cadmium in the Sailfin Molly, <i>Poecilia latipinna</i> . |
| 9:31 | 13. VREENEGOR, SHEILA M., R. M. BLOCK, J. C. RHODERICK, AND S. R. GULLANS (University of Maryland, Chesapeake Biological Laboratory). The Effects of Chlorination on the Osmoregulatory Ability of the Blue Crab, <i>Callinectes sapidus</i> . | 10:49 | 19. VAUGHN, R. E., AND B. A. SIMCO (Memphis State University). Effects of Ammonia on Channel Catfish, <i>Ictalurus punctatus</i> . |
| 9:44 | 14. RHODERICK, J. C., R. M. BLOCK, K. G. DROBECK, AND W. H. ROOSENBURG (University of Maryland, Chesapeake Biological Laboratory). Effects of Chlorination to the American Oyster, <i>Crassostrea virginica</i> at Two Temperatures. | 11:02 | 20. HUEY, D. W., DARRELL CRISWELL, B. A. SIMCO, AND K. B. DAVIS (Memphis State University). Nitrite Toxicity and Methemoglobin Formation in Channel Catfish. |
| 9:57 | 15. LIDEN, L. H., D. T. BURTON, S. L. MARGREY, R. M. BLOCK, AND J. C. RHODERICK (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory and University of Maryland, Chesapeake Biological Laboratory). Effects of Chlorinated and Bromochlorinated Power Plant Condenser Cooling Waters on Survival and Blood pH of Atlantic Menhaden (<i>Brevoortia tyrannus</i>) and Spot (<i>Leiostomus xanthurus</i>). | 11:15 | 21. NORTON, VIRGINIA M., DARRELL CRISWELL, AND K. B. DAVIS (Memphis State University). Effect of Abrupt Change in Ionic Composition of the Medium on Plasma and Urine Electrolytes in Channel Catfish, <i>Ictalurus punctatus</i> . |
| 10:10 | 16. GULLANS, S. R., R. M. BLOCK, J. C. RHODERICK, D. T. BURTON, AND L. H. LIDEN (University of Maryland, Chesapeake Biological Laboratory and Philadelphia Academy of Natural Sciences, Benedict Estu- | 11:28 | 22. WEEKLEY, L. B., AND T. D. KIMBROUGH (Virginia Commonwealth University). Extraction and Fluorometric Analysis of an Isomer of a Postulated Alarm Substance. |
| | arine Research Laboratory). Effects of Continuous Chlorination on White Perch (<i>Morone americana</i>) and Atlantic Menhaden (<i>Brevoortia tyrannus</i>) at Two Temperatures. | 11:41 | 23. GREELEY, MARK, AND ROBERT MACGREGOR III (University of Alabama-Birmingham). Plasma Testosterone and Estrogen Levels in the Gulf Killifish, <i>Fundulus grandis</i> . (Pisces: Cyprinodontidae). |

PLANT ECOLOGY, SESSION I

Room 6

Presiding: *Dr. Thomas R. Wentworth*, North Carolina State University

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| 8:00 | 24. PINDER, JOHN E., III (Savannah River Ecology Laboratory). Relationships Between Structure and Function in an Old-Field Plant Community. | 8:26 | 26. SMOUT, G. A., AND G. T. WEAVER (Southern Illinois University, Carbondale). Heavy Metal Accumulation in Selected Tree Species Grown on Sewage-Sludge Amended Strip-Mine Spoils. |
| 8:13 | 25. PINDER, JOHN E., III (Savannah River Ecology Laboratory). The Effects of Nitrogen Enrichment on the Structure and Function on an Old-Field Plant Community. | 8:39 | 27. SVOBODA, DANIEL, AND G. T. WEAVER (Southern Illinois University, Carbondale). First Year Heavy Metal Accumulation by Tree Seedlings Grown on Sludge Ameliorated Strip-Mine Spoil. |

- 8:52 28. PEARSON, J. A., AND G. T. WEAVER (Southern Illinois University, Carbondale). Data Reduction by Seasonal Partitioning of Litterfall Biomass.
- 9:05 29. WEAVER, G. T., AND J. C. LUVALL (Southern Illinois University, Carbondale and Savannah River Ecology Laboratory). Forest Floor Dry Matter in Two Southern Illinois Upland Watersheds.
- 9:18 30. LUVALL, J. C., AND G. T. WEAVER (Savannah River Ecology Laboratory and Southern Illinois University, Carbondale). Distributional Patterns of Standing Crop Mineral Nutrients in the Forest Floor Horizons in Upland Oak-Hickory and Mixed Hardwood Forests in Southwestern Illinois.
- 9:31 31. CHRISTIANSEN, TIM A. (Savannah River Ecology Laboratory). Nitrogen and Phosphorus as Possible Limiting Factors in Lichen Growth.
- 9:44 32. MCLEOD, K. M., D. C. ADRIANO, D. PAINE, J. E. PINDER, M. H. SMITH, A. L. BONI, AND J. C. COREY (Savannah River Ecology Laboratory and Savannah River Laboratory). Impact of a Nuclear Fuel Reprocessing Facility on the Plutonium Concentration of Adjacent Ecosystem Components.
- 9:57 33. BRADSHAW, H. D., AND M. M. BRINSON (East Carolina University). Nitrogen Cycling in an Alluvial Swamp Forest.
- 10:10 34. HOLMES, R. N., AND M. M. BRINSON (East Carolina University). Phosphorus Cycling in an Alluvial Swamp Forest in the North Carolina Coastal Plain.
- 10:23 35. ELKINS, J. B., JR., AND M. M. BRINSON (East Carolina University). The Sulfur Cycle in a Coastal Wetland Ecosystem.
- 10:36 36. HACKNEY, C. T., AND A. A. DE LA CRUZ (Mississippi State University). Changes in Soil Salinity of a Mississippi Tidal Marsh.
- 10:49 37. CARLSON, PAUL R., JR. (University of North Carolina, Chapel Hill). Nutrients, Hydrogen Sulfide, and Dry Matter Production of *Spartina alterniflora* in Three Salt Marshes.

AQUATIC ECOLOGY, SESSION I

Room 7

Presiding: Dr. A. M. Witherspoon, North Carolina State University

- 8:00 38. SINKS, J. D., AND E. L. MORGAN (Tennessee Technological University). Annual Periphyton Community Dynamics in the Clinch River.
- 8:13 39. WINN, W. M., AND E. L. MORGAN (Tennessee Technological University). The Effectiveness of High Density Benthic Macroinvertebrate Subsampling.
- 8:26 40. EAGLESON, K. W., AND E. L. MORGAN (Tennessee Technological University). Growth Rates of *Corbicula manilensis* in the Clinch River, Tennessee.
- 8:39 41. PRICE, RICHARD E. (University of Mississippi, United States Department of Agriculture Sedimentation Laboratory). Mercury, Cadmium, Lead and Arsenic in Sediments, Plankton and Clams from Lake Washington and Sardis Reservoir, Mississippi.
- 8:52 42. SEAGLE, H. H., JR., AND A. C. HENDRICKS (Virginia Polytechnic Institute and State University). Temporal Recovery of the Lower South Fork of the Shenandoah River as a Result of the Construction of a Secondary Waste Treatment Plant at an Industrial Site.
- 9:05 43. WARK, KAREN E., G. B. HALL, AND G. M. SIMMONS, JR. (Virginia Polytechnic Institute and State University). The Effects of Reclamation Activities on Limnological Properties of an Acid Mine Arm of a Reservoir.
- 9:18 44. CLARK, J. R., J. H. RODGERS, JR., K. L. DICKSON, AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Indices for Organic Carbon Partitioning in Aufwuchs Communities.
- 9:31 45. RODGERS, J. H., JR., J. R. CLARK, K. L. DICKSON, AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Analyses of Aufwuchs Communities.
- 9:44 46. SMITH, H. W., S. D. CUNNINGHAM, D. B. JEFFREYS, G. J. DAVIS, AND J. C. ANDERSON (East Carolina University). Monitoring of Groundwater Along an Estuary After Introduction of Bacteriophage into Septic Tanks.
- 9:57 47. MARGREY, S. L., D. T. BURTON, L. B. RICHARDSON, AND L. H. LIDEN (Academy of Natural Sciences of Philadelphia). An Assessment of Continuous and Intermittent Chlorination and Bromochlorination Schemes for Control of Fouling Organisms in Cooling Water Systems Utilizing Estuarine Water.
- 10:10 48. CURTIS, J. F., AND D. A. BRAATZ (Duke Power Company). Distribution and Abundance of Macroinvertebrates in the Yadkin River, a North Carolina Piedmont Stream.
- 10:23 49. BRAATZ, D. A., AND J. F. CURTIS (Duke Power Company). Macro-Organic Drift in the Yadkin River, a North Carolina Piedmont Stream.
- 10:36 50. PERKINS, J. C., AND D. A. BRAATZ (Duke Power Company). Carbon Partitioning in the Yadkin River, a North Carolina Piedmont Stream.
- 10:49 51. CALHOUN, W. F., AND K. L. DICKSON (Virginia Polytechnic Institute and State University). An Evaluation of the Practice of Using Application Factors to Predict Sublethal Levels of Toxicants.

- 11:02 52. TRUSH, WILLIAM J. (Virginia Polytechnic Institute and State University). Detrital Accumulation in Sinking Creek, Virginia.
- 11:15 53. BENFIELD, ERNEST F. (Virginia Polytechnic Institute and State University). Leaf Pack Processing in a Pastureland Stream.
- 11:28 54. STONEBURNER, D. L., AND L. A. SMOCK (National Park Service and University of North Carolina, Chapel Hill). Winter De-
- 11:41 55. PAUL, R. W., JR., JUDITH G. CROXDALE, AND E. F. BENFIELD (Virginia Polytechnic Institute and State University). The Relationship of Microbial Colonization and Chemical Changes of Decomposing Leaf Material in a Large River.

CRUSTACEAN BIOLOGY

Room 9

Presiding: *Dr. John Holsinger*, Old Dominion University

- 8:00 56. POWELL, CHARLES E., JR. (Academy of Natural Sciences of Philadelphia). Cumeans (Crustacea: Malacostraca) in the Gulf of Mexico.
- 8:13 57. HUNER, JAY V. (Southern University). Observations on the Commercial Bait Fishery for Freshwater Shrimp, *Macrobrachium ohione* (Decapoda; Crustacea), in the Mississippi River near Baton Rouge, Louisiana.
- 8:26 58. BOUCHARD, RAYMOND W. (University of North Alabama). Threatened and Recently Extinct Crayfishes of the Western United States (Decapoda: Astacidae and Cambaridae).
- 8:39 59. CHAMBERS, CARLENE L., AND J. F. PAYNE (Memphis State University). Geographic Variation in the Form I Male Gonopod of the Dwarf Crayfish, *Cambarellus puer* (Crustacea: Decapoda).
- 8:52 60. BOUCHARD, RAYMOND W. (University of North Alabama). Taxonomy and Biology of *Orconectes transfuga* in the Rogue River System, Oregon (Decapoda: Cambaridae).
- 9:05 61. FITZPATRICK, J. F., JR. (University of South Alabama). Distribution of the subgenus *Pennides* of the crawfish genus *Procambarus* in Mississippi (Decapoda, Cambaridae).
- 9:18 62. LEE, D. S., RICHARD FRANZ, AND BRIAN HOUHA (North Carolina State Museum of Natural History, Florida State Museum, and University of Florida). Ecological Parameters Affecting Speciation and Distribution of Florida's Troglotic Crayfishes.
- 9:31 63. FRANZ, RICHARD, D. S. LEE, AND BRIAN HOUHA (Florida State Museum, North Carolina State Museum of Natural History, and University of Florida). Geologic and Geographic Distribution of Florida's Troglotic Crayfishes.
- 9:44 64. COOPER, J. E., AND MARTHA R. COOPER (North Carolina State Museum of Natural History). Comparative Activity Patterns and Movements of Shelta Cave Crayfishes.
- 9:57 65. FRANZ, RICHARD (Florida State Museum). Observations on the Natural History of the Black Creek Crayfish, *Procambarus pictus* (Decapoda: Cambaridae).
- 10:10 66. PRICE, J. O., AND J.F. PAYNE (Memphis State University). The Life Cycle of *Orconectes neglectus chaenodactylus* Williams (Crustacea: Decapoda: Cambaridae).
- 10:23 67. PAYNE, J. F., AND J. O. PRICE (Memphis State University). Studies of the Life History and Ecology of *Orconectes palmeri palmeri* (Faxon). (Crustacea: Decapoda: Cambaridae).
- 10:36 68. THORP, J. H., AND KAREN S. AMMERMAN (Savannah River Ecology Laboratory). Chemical Communication and Agonism in the Crayfish *Procambarus acutus acutus*.
- 10:49 69. WAKEFIELD, W. W., P. R. ABELL, D. T. BURTON, AND S. L. MARGREY (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). A Comparison of Oxygen Consumption Rates of Juvenile Blue Crabs (*Callinectes sapidus*) Acclimated to Constant and Cyclic Temperatures.
- 11:02 70. RICHARDSON, L. B., D. T. BURTON, P. R. ABELL, W. W. WAKEFIELD (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). The Effects of Rapid Temperature Changes on Oxygen Consumption Patterns of Amphipods (*Gammarus* sp.) and Juvenile Blue Crabs (*Callinectes sapidus*) Acclimated to Constant and Cyclic Temperatures.
- 11:15 71. PRUITT, NANCY L., AND R. V. DIMOCK, JR. (Wake Forest University). Compensation for Low Temperature: Oxygen Consumption by the Crayfish *Cambarus acuminatus* (Faxon).
- 11:28 72. SADEWASSER, STEVEN G. (Western Kentucky University). Aspects of the Measurement of Photoperiod by Crayfish.
73. PAPER CANCELLED
- 11:41 74. BOUCHARD, RAYMOND W. (University of North Alabama). Morphology of the Mandible in Holarctic Crayfishes (Decapoda: Astacidae and Cambaridae): Ecological and Phylogenetic Implications.

THURSDAY AFTERNOON — APRIL 14

CYTOLOGY, GENETICS, AND TISSUE CULTURE

Room 3

Presiding: *Dr. Sandra Bell*, University of Tennessee

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| 1:00 | 75. APPLIGATE, ARTHUR L. (St. Andrews Presbyterian College). The Staining Characteristics of a Family of Gallocyanin-Heavy Metal Dyes. | 3:10 | 85. RUSSELL, LINDA K. (Georgia Southern College). The Effect of Kanamycin on the Development of Several Organs in Fetal Mice. |
| 1:13 | 76. BELL, SANDRA L. (University of Tennessee). Effects of Paraquat on Rejoining of x-ray Induced Chromosome Aberrations. | 3:23 | BREAK |
| 1:26 | 77. BENNETT, SARA N., AND H. B. HOWE, JR. (Georgia Southern College and University of Georgia). Development of the Sexual Cycle in <i>Neurospora tetrasperma</i> . | 3:36 | 86. RUPERT, E. A., AND AIKO SEO (South Carolina Agricultural Experiment Station and Clemson University). Differentiation of White Clover Species and Hybrids from Callus and Cell Suspension Cultures. (<i>Trifolium</i> — Leguminosae). |
| 1:39 | 78. BAJAJ, RICKY, AND A. L. WILLIAMS (Alabama State University). The Utility of Bacteriophage Lambda to Study the Transcription of Isoleucine-Valine (ILV) Operons of <i>Escherichia coli</i> K-12. | 3:49 | 87. HUGHES, KAREN W. (University of Tennessee). Isolation of Protoplasts from Haploid Plants of the African Violet (<i>Gesneriaceae</i>). |
| 1:52 | 79. CARTER, CALEB, ANN C. WILLIAMS, AND A. L. WILLIAMS (Alabama State University). Regulation of the Isoleucine and Valine (ILV) Biosynthetic Enzymes in a Valine-Resistant Mutant of <i>Escherichia coli</i> K-12. | 4:02 | 88. PALTA, HARINDER K., AND R. L. MOTT (North Carolina State University). Interactions of Environment and Media Composition in Adventive Bud Induction on Cultured Embryos of Loblolly Pine (<i>Pinus taeda</i> L.). |
| 2:05 | 80. BENNER, D. B. (East Tennessee State University). A Temperature Sensitive Modification of the Cell-2 Phenotype in <i>Drosophila melanogaster</i> . | 4:15 | 89. AMERSON, H. V., R. L. MOTT, E. B. COWLING, AND W. R. JACOBI (North Carolina State University). Observations on Fusiform Rust (<i>Cronartium fusiforme</i>) in Axenic Culture and Dual Culture with Loblolly or Slash Pine. |
| 2:18 | 81. RICKOLL, W. L., AND S. J. COUNCE (Duke University). Ultrastructure of Morphogenesis in <i>Drosophila melanogaster</i> : The Mutant <i>Mat (3) 6</i> . | 4:28 | 90. CURE, W. W., AND R. L. MOTT (North Carolina State University). Tissue Culture Studies on a Salt Marsh Aster: Callus Initiation and Growth. |
| 2:31 | 82. BACCUS, RAMONE (University of Georgia). Linkage and Selection Analysis of Biochemical Variants of <i>Peromyscus maniculatus</i> (Rodentia). | 4:41 | 91. MOTT, R. L., R. H. SMELTZER, AND ASHA MEHRA-PALTA (North Carolina State University). The Need for Sequential Environments in Tissue Culture Bud Production and Subsequent Bud Growth for Loblolly Pine (<i>Pinus taeda</i> L.). |
| 2:44 | 83. SMITH, MICHAEL H. (University of Georgia). Levels of Biochemical Polymorphisms in Turtles (Chelonia: Reptilia). | 4:56 | 92. MEHRA-PALTA, ASHA, AND R. L. MOTT (North Carolina State University). <i>In vitro</i> Induced Organogenesis on Intact Embryos and Excised Embryo Parts of Loblolly Pine (<i>Pinus taeda</i> L.). |
| 2:57 | 84. LARY, J. M., R. D. HOOD, W. T. SCOTT, A. M. GEARHART, AND PAULETTE M. MOLAY (University of Alabama). Effects of Actinomycin D on Skeletal Abnormalities in Mice Heterozygous for the Brachyury (T) Gene. | | |

PARASITOLOGY, SESSION II

Room 4

Presiding: *Dr. B. J. Bogitsh*, Vanderbilt University

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| 2:57 | 93. LIU, YUIN HWA, AND A. B. WEATHERSBY (University of Georgia). Stability and Permeability of <i>Culex pipiens</i> haemolymph and Its Effect on Susceptibility to <i>Plasmodium gallinaceum</i> . | | mosporidia: Leucocytozoidae): Effect of Fnuclation, Pinealectomization and Caponization on the Periodicity of Gametocytes. |
| 3:10 | 94. GORE, T. C., AND G. P. NOBLET (Clemson University). <i>Leucocytozoon smithi</i> (Hae- | 3:23 | 95. BOOKER, KATHERINE A., AND W. H. YONGUI, JR. (Virginia Polytechnic Institute and State University). An Intra- |

- erythrocytic Parasitemia of *Cytotoddia* (= *Toddia bufonis* Franca) in *Natrix sipedon*.
- 3:36 96. KUTZMAN, R. S., AND J. F. ROBERTS (North Carolina State University). Induced Resistance of *Crithidia fasciculata* (Kinetoplastida: Trypanosomatidae) to Carbonyl cyanide m-chlorophenylhydrazone, an Uncoupler of Oxidative Phosphorylation.
- 3:49 97. BURGESS, D. E., D. A. DALLSANDRO, AND W. L. HANSON (University of Georgia). The Effect of BCG on Acute Infections of *Trypanosoma (Schizotrypanum) cruzi* (Zoomastigophorasida: Kinetoplastorida: Trypanosomatidae) in Mice.
- 4:02 98. HAZEN, T. C., G. W. ESCH, AND MARK RAKER (Wake Forest University). Light and Electron Microscope Studies on Lesions Associated with Red-Sore Disease in Largemouth Bass.
- 4:15 99. BOGITSH, B. J., AND O. S. CARTER (Vanderbilt University). Ultrastructure of the Esophageal Granules of *Schistosoma mansoni* (Trematoda).
- 4:28 100. MCCALL, JOHN W. (University of Georgia). *Litomosoides carinii* Infections in the Mongolian Jird (*Meriones unguiculatus*): Comparison of Ocular, Oral, and Subcutaneous Routes of Inoculation.
- 4:41 101. LOCKETT, EDWARD, AND J. A. BUTTS (University of North Carolina, Charlotte). Haptoglobin Levels in *Mesocricetus auratus* (Mammalia: Rodentia: Cricetidae) During Infection With *Dipetalonema viteae* (Nematoda: Spirurata: Dipetalonematidae).
- 4:54 102. ROBERSON, EDWARD L. (University of Georgia). Efficacy of Thienium Closylate-Piperazine Phosphate Combination Against Immature and Mature Stages of *Ancylostoma braziliense* (Nematoda: Strongylida) in Weaned Pups.
- 5:07 103. TILLMAN, P. G., AND J. H. OLIVER, JR. (Georgia Southern College). Morphology, Histology, and Gametogenesis in *Ornithodoros parkeri* (Acari: Ixodoidea).

ANIMAL PHYSIOLOGY, SESSION II

Room 5

Presiding: *Dr. Gerald C. Llewellyn*, Virginia Commonwealth University

- 1:26 104. COPELAND, R. J., D. I. PAV, AND J. M. PAV (East Tennessee State University and Hospital of St. Raphael, New Haven). Visual Representation of Skeletal System; Historical Study.
- 1:39 105. SANDERS, G. E., J. T. SUMMERSGILL, R. E. DANIEL, AND D. O. ABBOT (Murray State University). Effects of Delta-9-Tetrahydrocannabinol on *Tetrahymena pyriformis* GL ATCC # 30006.
- 1:52 106. SCHULTZ, T. W., AND A. M. JUNGREIS (University of Tennessee, Knoxville). The Goblet Cell Cavity Matrix: Its Role in the Short Circuit Decay Profile of the Larval Lepidopteran Midgut.
- 2:05 107. KRIEGER, K. A., AND W. D. BURBANCK (Queens College and Emory University). LAP and MDH Isozyme Patterns in Sixteen Southern Pleurocerid Snail Populations.
- 2:18 108. SILER, T. T., AND L. P. STRATTON (Furman University). Changes in Isozyme Pattern and Comparative Thermal Stabilities of Lactate Dehydrogenase in Heat-Acclimated *Lepomis macrochirus*.
- 2:31 109. SOUTHGATE, MICHAEL, AND J. A. SNYDER (Furman University). A Comparative Study of the Antibacterial Activity of Two Lysozyme Isozymes of *Rana pipiens*.
- 2:44 110. CHAPPELL, CYNTHIA, AND MARION WELLS (Middle Tennessee State University). Thrombocyte Specificity in Two Strains of *Gallus domesticus*.
- 2:57 BREAK
- 3:10 111. KEITH, WILLIAM B. (University of Mississippi). Observations on the Role of Thyroid Hormones on the *In Vitro* Conversion of Radioactive 17β -Estradiol to 2-Hydroxy-estrone by Hamster Liver Homogenates.
- 3:23 112. ROBINSON, L. M., AND W. B. KEITH (University of Mississippi). The Effects of Thyroid Inhibition on Ovarian Function and on the Concentration of Estradiol- 17β in Reproductive and Pituitary Tissues of the Golden Hamster.
- 3:36 113. HOWARD, B. P., AND W. B. KEITH (University of Mississippi). Specific Binding of Radioactively Labelled Cortisol by Guinea Pig Thymic Preparations: Relationship to Glucocorticoid Resistance.
- 3:49 114. CAHILL, SANDRA, MARTIN GOEHLE, AND GERALD LLEWELLYN (Virginia Commonwealth University). Differential Response by Sex, of the Mongolian Gerbil, *Meriones unguiculatus*, to Varying Concentrations of Mixed Aflatoxins.
- 4:02 115. THOMEN, ELLEN, AND G. C. LLEWELLYN (Virginia Commonwealth University). The Effects of Copper Acetate and Mixed Aflatoxins on Male Syrian Hamsters.
- 4:15 116. PETRALIA, CYNTHIA, AND DAVID STASZAK (Georgia College). Chilling as an Environmental Stress Factor upon the Embryological Development of *Mus musculus* L., C57B1/6J Strain.
- 4:28 117. HUEY, BARRY, AND L. P. STRATTON (Furman University). Alkali Denaturation of Rodent Hemoglobins.

RECOGNITION AND PROTECTION OF NATURAL AREAS OF THE SOUTHEASTERN UNITED STATES

Room 6

Invited Papers sponsored by the Association of Southeastern Biologists in cooperation with The Nature Conservancy, Southeastern Chapter of the Ecological Society of America, and Southeastern Section of the Botanical Society of America. Coordinated by:

William H. Martin, Eastern Kentucky University

Robert K. Peet, The University of North Carolina, Chapel Hill

James F. Matthews, The University of North Carolina, Charlotte

Preserving Natural Diversity

- 1:30 118. CHIPLEY, ROBERT (The Nature Conservancy). What Are Natural Areas?
1:45 119. PEET, ROBERT (University of North Carolina, Chapel Hill). Strategies For the Preservation of Natural Diversity.

Identification and Evaluation of Natural Areas

- 2:05 120. WAGGONER, GARY (National Park Service). The National Natural Landmarks Program.
2:20 121. MCCOLLUM, JERRY (Georgia Department of Natural Resources). Natural Areas Evaluation in Georgia.
2:35 122. RADFORD, ALBERT, AND R. DAVID WHETSTONE (University of North Carolina, Chapel Hill). The Development of a Classification System for Natural Ecosystems.
3:00 123. MILLER, FRANK (Mississippi State University). Habitat-Vegetation Classification by Remote Sensing.
3:20 124. ELEUTERIUS, LIONEL (Gulf Coast Research Laboratories). Inventory and Classification of Wetlands.
3:30 BREAK

Protection and Management of Natural Areas

- 3:45 125. MCCALL, TIM (The Nature Conservancy). Essential Components of Stewardship Plans.
4:00 126. RASKIN, DANIEL (The Nature Conservancy). Legal Aspects of Land Protection.
4:15 127. DESELM, HAL R. (University of Tennessee). Managing Natural Areas — A Case for Determining Objectives.
4:30 128. MASSEY, J. R., AND JAMES MATTHEWS (University of North Carolina, Chapel Hill, and University of North Carolina, Charlotte). Species Biology as a Component of Management Plans.
4:45 129. GOODWIN, L. M., JR. (Weymouth Woods — Sandhills Nature Preserve). People Problems and Public Relations in Natural Areas.

Utilization of Natural Areas

- 5:00 130. MARTIN, WILLIAM H. (Eastern Kentucky University). Permanent Documentation in Natural Areas.
5:15 131. COOPER, ARTHUR W. (North Carolina State University). Natural Areas in Public Policy and Decisions.

AQUATIC ECOLOGY, SESSION II

Room 7

Presiding: *Dr. A. S. Tombes*, Clemson University

- 1:26 132. BURRIS, J. W., AND C. M. COOPER (University of Mississippi). Limnological Studies in a Southern Flood Control Reservoir.
1:39 133. HALL, G. B., AND G. M. SIMMONS, JR. (Virginia Polytechnic Institute and State University). The Succession of the Phytoplankton Community and Primary Productivity in a New Reservoir, Lake Anna, Virginia.
1:52 134. KAUFMAN, LAURENCE H. (Virginia Polytechnic Institute and State University). Plankton Dynamics of the Mississippi River, the Big Black River and Two Oxbow Lakes in a Record Flood Year (1972-73).
2:05 135. SCHUSTER, GUENTER A. (University of Tennessee). A Previously Unreported Gland and Associated Structure Found in the Genus *Hydropsyche*. (Hydropsychidae: Trichoptera).
2:18 136. SCHUSTER, G. A., AND D. A. EINER (University of Tennessee). A preliminary Report on the Study of the Larval Taxonomy of the Genus *Hydropsyche* in Eastern North America. (Hydropsychidae: Trichoptera).
2:31 137. COOPER, CHARLES M. (University of Mississippi and United States Department of Agriculture — Sedimentation Laboratory). A Survey of the Diptera (Insecta) of Grenada Reservoir, Mississippi.

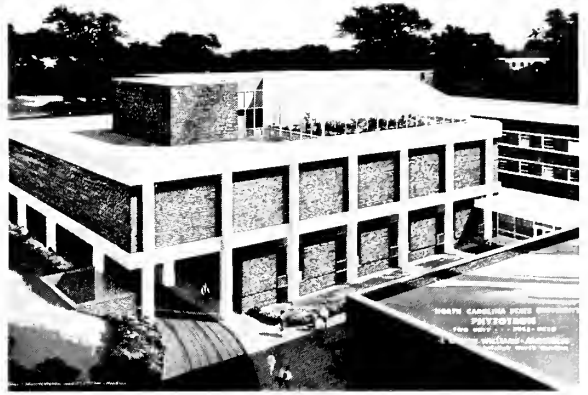
- 2:44 138. TARTER, D. C., C. K. LILLY, AND DIANA L. ASHLEY (Marshall University). Ecological Life History and the pH Tolerance of a Pond Sialid, *Sialis itasca* Ross, from West Virginia (Insecta: Megaloptera).
- 2:57 139. SIGMON, C. F., AND B. R. INGRAM (Clemson University). Effects of Heated Effluent on the Distribution and Abundance of Benthic Insects in a South Carolina Reservoir.
- 3:10 BREAK
- 3:23 140. KENNEDY, J. H., AND E. F. BENFIELD (Virginia Polytechnic Institute and State University). Summer Drift of Macroinvertebrates in a Large Warm Water River.
- 3:36 141. SMOCK, L. A., AND M. S. SHUMAN (University of North Carolina, Chapel Hill). Influence of Organism Size, Species and Sediment on Metal Accumulation by Benthic Macroinvertebrates.
- 3:49 142. ROOSENBERG, W. H., R. M. BLOCK, AND J. C. RHODERICK (University of Maryland, Chesapeake Biological Laboratory). The Influence of Chlorine Produced Oxidants on Larval Stages of the Soft Shell Clam *Mya arenaria*.
- 4:02 143. MCGINNISS, M. J., A. L. BUIKEMA, JR., AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Temperature Effects on the Acute Toxicity of Two Simulated Effluents to *Daphnia pulex* (Cladocera).
- 4:15 144. KNAUER, G. W., AND A. L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). ATP Levels of *Daphnia pulex* (Cladocera) Following Simulated Entrainment.
- 4:28 145. NEWBERN, LINDA A., AND A. L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). Effects of Simulated Entrainment on the Metabolism of *Daphnia pulex* (Cladocera).
- 4:41 146. TOMBES, A. S., A. R. ABERNATHY, AND D. M. WELCH (Clemson University). The Relationship Between Rainfall and Nematodes in Finished Water.
- 4:54 147. CURRY, MARY G. (VTN Louisiana, Inc.). Ecology of the Leech *Placobdella montifer* Moore (Hirudinea: Glossiphoniidae): Part I.

PHYTOTRONICS

Room 8

Presiding: *Dr. David T. Patterson*, Southern Weed Science Laboratory
United States Department of Agriculture

- 2:05 148. OSMOND, D. L., AND C. D. RAPER, JR. (North Carolina State University). Balanced Shoot and Root Functions: Photosynthate Production and Nitrogen Uptake.
- 2:18 149. HESKETH, J. D., AND A. TERAMURA (United States Department of Agriculture — Agriculture Research Center, Mississippi State University, and Duke University). Aspects of Plant Growth Modeling: Leaf Aging and Branching Behavior.
- 2:31 150. THOMAS, JUDITH F. (North Carolina State University). Influence of Day/Night Temperature on Morphology and Reproductive Development of *Glycine max* (L.) Merrill.
- 2:44 151. PATTERSON, D. T., MARY M. PEET, J. A. BUNCE, AND P. J. KRAMER (Duke University). The Effect of Size at Flowering on Vegetative Growth and Seed Yield of Soybean (*Glycine max*).
- 2:57 152. PEET, MARY M., D. T. PATTERSON, AND J. A. BUNCE (Duke University). The Effect of Increasing Soybean Density in Controlled Environments on Their Production and Variability.
- 3:10 153. BUNCE, J. A., N. SIONIT, MARY M. PEET, AND D. T. PATTERSON (Duke University). Effect of Water Stress at Various Stages of Development on Soybean Yield in Phytotron and Field Environments.
- 3:23 154. MASTERS, MICHAEL A. (Duke University). Photosynthesis Response to Varying Leaf Water Potentials in Four Arctic and Alpine Species of *Saxifraga* (Saxifragaceae).
- 3:36 155. FLINT, ELIZABETH P. (Duke University). Phytotron Study of Growth Rates in Diploid and Tetraploid Chromosomal Races of *Epilobium angustifolium* (Onagraceae).
- 3:49 156. UNDERWOOD, HERBERT (North Carolina State University). Photoperiodic Time Measurement in the Male Lizard *Anolis carolinensis*.
- 4:02 157. HORST, E. K., AND R. L. LOWER (North Carolina State University). A Phytotron Study of the Effects of Photoperiod and Temperature on Flowering and Growth Response in *Cucumis sativus* L. and *Cucumis hardwickii*.
- 4:15 158. BURIEL, J. F. (Duke University). Comparative Studies of Loblolly Pine Grown in Chamber, Greenhouse, and Field Environments.



The Southeastern Plant Environment Laboratories are regional facilities available to all biologists but especially to those located in the Southeastern U.S. SEPEL consists of two phytotrons, one at North Carolina State University and one at Duke University. The facilities contain temperature-controlled glass houses, artificially-lighted plant growth chambers of three sizes, seed germinators and supporting laboratories as well as gas-tight controlled-environment air pollution chambers with associated monitoring instrumentation. Consequently SEPEL provides a wide range of controlled conditions so researchers can investigate simultaneously a number of environmental variables.

A staff of refrigeration and electronics technicians insures reliability of the facilities. A staff of Phytotron assistants provide daily care of the biological material. Thus investigators need appear only at crucial periods during the course of the study, e.g. to set up the experiment, take interim data and at final harvest.

Members of the Association of Southeastern Biologists are invited to visit the Phytotron units of SEPEL. Staff members will be available to discuss the facilities and to explain operational procedures.

FRIDAY MORNING — APRIL 15

CHROMOSOME STRUCTURE AND FUNCTION, SESSION I (Invited Papers)

Room 3

Arranged by: *Margaret Y. Menzel*, Florida State University

Presiding: *Dr. Priscilla S. Rushton*, Memphis State

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|------|------|--|-------|------|---|
| 8:00 | 159. | ASHLEY, TERRY (Duke University). Chromosomal Associations in Some Eucaryotic Nuclei. | 9:44 | 161. | LUCCHESI, JOHN C. (University of North Carolina, Chapel Hill). The Regulation of X Chromosome Activity in <i>Drosophila</i> . |
| 8:39 | 160. | GERSTEL, D. U., J. A. BURNS, AND L. G. BURK (North Carolina State University). A Case of Cytoplasmic Male Sterility in <i>Nicotiana tabacum</i> and Its Relatives. | 10:23 | 162. | GRILL, RITODA, F. E., GINIROSO, AND J. W. DAY (Oak Ridge National Laboratory). Studies of Recombination in <i>Drosophila melanogaster</i> . |
| 9:18 | | BREAK | | | |

PLANT SYSTEMATICS, SESSION I

Room 4

Presiding: *Dr. J. M. Stucky*, North Carolina State University

- 8:00 163. REMBERT, DAVID H., JR. (University of South Carolina). *Indigofera* (Papilionaceae) — An Historical Review.
- 8:13 164. NELSON, J. B., AND J. E. FAIREY, III (Clemson University). Misapplication of the Name *Stachys nuttallii* (Lamiaceae for an Unnamed Southeastern Species.
- 8:26 165. HATLEY, JANET R. (North Carolina University). Analysis of Variation in *Shortia galacifolia*.
- 8:39 166. MURPHY, JAMES C. (North Carolina State University). Weedy Amaranths of the Southeastern U.S.: Some Taxonomic Problems.
- 8:52 167. FAIREY, JOHN E., III (Clemson University). *Cuscuta japonica* Choisy (Convolvulaceae) Collected Again in North America.
- 9:05 168. FANTZ, PAUL R. (University of Florida). Notes on the Endangered Florida Endemic, *Clitoria fragrans* Small (Fabaceae).
- 9:18 169. MUSSELMAN, L. J., AND W. F. MANN, JR. (Old Dominion University, and Southern Forest Experiment Station). Parasitism and Haustorial Structure of *Ximenia americana* L. (Olacaceae).
- 9:31 170. RICH, STEVEN D. (Old Dominion University). Anatomy and Ultrastructure of the Primary Haustorium of Witchweed (*Striga asiatica*) (Scrophulariaceae).
- 9:44 171. MANN, W. F., JR., AND L. J. MUSSELMAN (Southern Forest Experiment Station, and Old Dominion University). Screening of Native Root Parasites in the Scrophulariaceae as Pathogens of Commercial Timber Species in the Southeastern United States.
- 9:57 172. MOHLENBROCK, ROBERT H. (Southern Illinois University). Progress in the Flora of Illinois.
- 10:10 173. HEINEKE, THOMAS (Southern Illinois University). Flora of Cedar Lake Reservoir, Jackson County, Illinois.
- 10:23 174. SHEA, ANDREA B. (University of Tennessee). Analysis of the Botanical Remains from an Archaeological Site in the Normandy Reservoir, Coffee County, Tennessee.
- 10:36 175. NELSON, PAUL W. (Southern Illinois University). A Floristic Model of the St. Francois Mountains in the Missouri Ozarks.
- 10:49 176. MOHLENBROCK, ROBERT H. (Southern Illinois University). Woody Plants of the Francis Marion National Forest.

CRYPTOGAMIC BOTANY, SESSION I

Room 5

Presiding: *Dr. David A. Breil*, Longwood College

- 8:26 177. WHITFORD, L. A. (North Carolina State University). Are There Any Rare Freshwater Algae?
- 8:39 178. KOCH, ARTHUR R., JR. (University of North Alabama). Floristic and Ecological Investigations of Algal Communities on Sandstone Cliffs in East-Central and Southeastern Ohio.
- 8:52 179. HOWARD, R. VINCE (Virginia Polytechnic Institute and State University). *Nemalionopsis* Distribution and Classification (Algae: Rhodophyta).
- 9:05 180. BREIL, DAVID A. (Longwood College). Bryophytes of Virginia Piedmont Floodplains.
- 9:18 181. ZEHR, DOUGLAS (Southern Illinois University). Phenology of Selected Bryophytes in Southern Illinois.
- 9:31 182. COLLIER, PAULA A. (University of Tennessee). The Sexual Life Cycle of Three Species of the Funariaceae in Tissue Culture.
- 9:44 183. RENZAGLIA, KAREN (Southern Illinois University). A Comparative Study of Gametophyte Structure and Development in the Anthocerotales.
- 9:57 184. SCHERTLER, MARLEEN (Southern Illinois University). Development of the Archegonium and the Embryo in the Leafy Hepatic *Lophocolea heterophylla* (Schrad.) Dumort.
- 10:10 185. GRIFFIN, DANA, III (University of Florida). Observations on the Moss Genus *Lciomela*.
- 10:23 186. WHITTLER, DEAN P. (Vanderbilt University). *Lycopodium* Gametophytes in Axenic Culture.
- 10:36 187. CARPENTLER, I. W., JR. (Appalachian State University). Report of a Five Year Old Colony of *Equisetum arvense* L. Growing through Asphalt Pavement.

PLANT ECOLOGY, SESSION II

Room 6

Presiding: *Dr. Linda M. Stroud*, North Carolina State University

- 8:00 188. CONN, JEFFERY S. (North Carolina State University). Relation of *Erythrina flabelliformis* (Fabaceae) to Rock Outcrops in Southern Arizona: Water Relations Studies.
- 8:13 189. HALL, A. B., AND UDO BLUM (North Carolina State University). The Effects of Varying Nutrient and Density Levels on Allelopathy of *Helianthus annuus* L. Var. "Russian Mammoth" (Asteraceae) on *Amaranthus retroflexus* L. (Amaranthaceae).
- 8:26 190. SMITH, GARY, AND UDO BLUM (North Carolina State University). The Effect of Chronic Ozone Exposure on the Biomass, Total Nonstructural Carbohydrates, and Starch Content of Ladino Clover (Fabaceae).
- 8:39 191. SHERROD, CASEY, JR., AND K. W. McLEOD (Savannah River Ecology Laboratory). The Effect of Thermal Effluents on the Germination and Growth of Water Tupelo and Baldcypress under Laboratory Conditions.
- 8:52 192. COLOSI, JOE (North Carolina State University). Reproductive Phenology of *Iva imbricata* and *Uniola paniculata*.
- 9:05 193. BLUM, UDO (North Carolina State University). Photosynthesis and Respiration of *Spartina alterniflora* Loisel. (Poaceae) in North Carolina Salt Marshes: Model Validation.
- 9:18 194. GIURGEVICH, JOHN R. (University of Georgia). Net Productivity of *Juncus roemerianus* Scheele and *Spartina alterniflora* Loisel. Estimated from CO₂ Uptake.
- 9:31 195. BASKIN, J. M., AND CAROL C. BASKIN (University of Kentucky). Cedar Glades in the Former Big Barren Region of Kentucky.
- 9:44 196. FLAGG, RAYMOND O. (Carolina Biological Supply Company). Extinction Rate for Angiosperms.
- 9:57 197. HOMOYA, MICHAEL (Southern Illinois University). Some Aspects of the Life History of *Isotria medeoloides*, an Endangered Orchid Species.
- 10:10 198. MCCORD, R. A., AND E. E. C. CLEBSCH (University of Tennessee, Knoxville). The Application of r- and K-Selection to Herbaceous Plants.
- 10:23 199. PLUMMER, GAYTHER L. (University of Georgia). *Franklinia alatamaha* (Theaceae).
- 10:36 200. SHARITZ, REBECCA R., AND SUSAN A. WINFRIEDER (Savannah River Ecology Laboratory). Studies of Genetic Variation in *Typha* (Typhaceae).
- 10:49 201. WINSTEAD, JOE E. (Western Kentucky University). Cell Length and Wood Specific Gravity as Ecotypic Characters in *Acer negundo* L. (Aceraceae).

AQUATIC ECOLOGY, SESSION III

Room 7

Presiding: *Dr. Frank J. Schwartz*, Institute of Marine Sciences
University of North Carolina

- 8:00 202. POTTER, W. A., K. L. DICKSON, J. F. STAUFFER, JR., AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University and University of Maryland). Entrainment Studies at the Appalachian Power Company's Generating Station at Glen Lyn, Virginia.
- 8:13 203. POTTER, W. A., K. L. DICKSON, J. CAIRNS, JR., AND J. R. STAUFFER, JR. (Virginia Polytechnic Institute and State University and University of Maryland). Impingement Studies at the Appalachian Power Company's Generating Station at Glen Lyn, Virginia.
- 8:26 204. WILLIAMS, ANN H. (University of North Carolina, Chapel Hill). The Role of Three-Spot Damsel Fish (Pomacentridae) in Community Structure.
- 8:39 205. LARRICK, S. R., D. S. CHERRY, K. L. DICKSON, AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Effect of Temperature on the Chlorine Avoidance Behavior of the Golden Shiner.
- 8:52 206. BERNET, C. K., C. M. COOPER, Y. J. MCGAHA (University of Mississippi and United States Department of Agriculture Sedimentation Laboratory). A Study of Fishes Impinged at the Allen Steam Plant from August 1974 Through February 1976.
- 9:05 207. HOOPER, R. C., AND C. B. COBURN, JR. (Tennessee Technological University). The Study of Fish Diversity in Relation to Stream Order in Blackburn Fork.
- 9:18 208. BULOW, F. J., C. S. COBB, AND H. R. WADDLE (Tennessee Technological University). Effect of *Posthodiplostomum minimum* on the growth, condition and liver RNA-DNA Ratio of *Lepomis macrochirus*.
- 9:31 209. PERSCHACKER, P. W., AND F. J. SCHWARTZ (Institute of Marine Sciences, University of North Carolina). Composition and Biomass of Demersal Fishes Associated with Silty-Clay and Sandy Foam Estuarine Substrates.

- 9:44 210. COBURN, C. B., JR. (Tennessee Technological University). Variations to be Considered in Using Microhematocrits as a Tool for Sexing Bluegill (*Lepomis macrochirus*) from Natural Populations.
- 9:57 211. SWIGERT, JAMES, AND E. L. MORGAN (Tennessee Technological University). Mortality of Bluegills, *Lepomis macrochirus*, Exposed to Successive Doses of Copper and Zinc.
- 10:10 212. SATTERFIELD, JAMES D. (Georgia State University). The Effect of Stream Channelization on Populations of *Fundulus stelleri* (Pisces: Cyprinodontidae).
- 10:23 213. KNEIB, RONALD T. (University of North Carolina, Chapel Hill). Diet and Growth of the Killifish, *Fundulus heteroclitus* (Pisces: Cyprinodontidae), from a North Carolina Salt Marsh.
- 10:36 214. STANFORD, R. M., AND F. J. SCHWARTZ (Institute of Marine Sciences, University of North Carolina). Feeding Behavior of Wild and Laboratory Held Pinfish *Lagodon rhomboides* (Pisces: Sparidae).
- 10:49 215. ABELL, P. R., D. T. BURTON, AND C. J. MOORE (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). Time Course of Thermal Acclimation in Atlantic Silverside (*Menidia*) Exposed to Cyclic Temperatures.

ANIMAL ECOLOGY

Room 8

Presiding: *Dr. Whitfield Gibbons*, Savannah River Ecology Laboratory

- 8:26 216. ANDERSON, G. E., AND J. B. GENTRY (Savannah River Ecology Laboratory). Trace Metal Distribution in Plants and Arthropods on a Coal Fly-ash Substrate.
- 8:39 217. GENTRY, J. B., AND J. M. DUNBAR (Savannah River Ecology Laboratory). Foraging territories of the Florida Harvester Ant, *Pogonomyrmex badius* (Hymenoptera: Formicidae).
- 8:52 218. SPOONER, JOHN D. (University of South Carolina). Evolutionary Trends in Acoustic Signaling of Phaneropterine Katydid (Orthoptera: Tettigoniidae).
- 9:05 219. HACKNEY, OEGA P., AND COURTNEY T. HACKNEY (Mississippi State University). Periodic Regression Analysis of Ecological Data.
- 9:18 220. PLATANIA, STEVE, AND B. A. SANDERS (Towson State University and United States Forest Service). Habitats of the Bog Turtle, *Clemmys mullenbergi*, in the Southern Part of Its Range.
- 9:31 221. BRISBIN, I. L., JR., AND P. R. WILLIAMS, JR. (Savannah River Ecology Laboratory and University of Georgia). Development and Characterization of a Feral Strain of Bantam Chickens as a Possible Tool for Ecological Studies in Southeastern Environments.
- 9:44 222. FENDLEY, T. T., AND I. L. BRISBIN, JR. (Savannah River Ecology Laboratory). Growth Curve Analyses: Investigation of a New Tool for Studying the Effects of Environmental Stress Upon Wildlife Populations.
- 9:57 223. FIERSTINE, MARIANNE S., AND M. J. VARGO (Iowa State University and Savannah River Ecology Laboratory). Uptake and Elimination of Radiocesium by American Coots (Rallidae) Inhabiting a Reactor Cooling Reservoir.
- 10:10 224. LEE, BARBARA B., AND D. S. LEE (North Carolina State Museum of Natural History). Daily Activity Patterns of Central Florida Anhingas.
- 10:23 225. POTTER, ELOISE F. (Carolina Bird Club). Seasonal Fluctuations in the Frequency of Water-bathing by Small Land Birds.
- 10:36 226. MARSH, CHRIS (North Carolina State Museum of Natural History). The Influence of Weather on Autumn Shorebird Migration in Piedmont, North Carolina.
- 10:49 227. BROWNE, MICOU M., AND D. S. LEE (North Carolina State Museum of Natural History). The Manatee in North Carolina.

INVERTEBRATE ZOOLOGY

Room 9

Presiding: *Dr. Arthur L. Buikema, Jr.*, Virginia Polytechnic Institute and State University

- 8:00 228. HENEBRY, MICHAEL S. (Virginia Polytechnic Institute and State University). Factors Affecting Protozoan Colonization of Artificial Substrates in the Laboratory.
- 8:13 229. YONGUE, WILLIAM H., JR. (Virginia Polytechnic Institute and State University). Notes on *Strombomonas vepei* n. sp. (Protozoa: Euglenidae) from a Soft Water Appalachian Pond.

- 8:26 230. HONIG, R. A., M. J. MCGINNISS, A. L. BUIKEMA, JR., AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Interaction of Temperature and Toxicants on the Growth Rates of *Chilomonas paramecium* (Flagellata) Populations.
- 8:39 231. NELSON, DIANE R. (East Tennessee State University). Fungal Parasites of New Zealand Tardigrades (Phylum: Tardigrada).
- 8:52 232. JENNER, CHARLES E. (University of North Carolina, Chapel Hill). *Solemya velum*, a Burrow-Dwelling Bivalve Mollusk.
- 9:05 233. FULLER, S. L. H., AND J. W. RICHARDSON (Academy of Natural Sciences of Philadelphia). Amensalistic Competition Between *Corbicula manilensis* (Philippi), the Asiatic Clam (Corbiculidae), and Fresh-Water Mussels (Unionidae) in the Savannah River of Georgia and South Carolina (Mollusca: Bivalvia).
- 9:18 234. VIDRINE, M. F., AND D. J. BEREZA (University of Southwestern Louisiana, and Academy of Natural Sciences of Philadelphia). Preliminary Lists of Species from Recent Collections of Fresh-Water Mussels (Bivalvia: Unionacea) in Three Southwestern Louisiana River Drainages.
- 9:31 235. DUNDEE, DEE S. (University of New Orleans). Behavior of Introduced Molluscs.
- 9:44 236. JENNER, MARTHA G. (University of North Carolina, Chapel Hill). Pseudotandry (False Maleness) in Female *Ilyanassa obsoleta* (Gastropoda: Prosobranchia).
- 9:57 237. SHIRLEY, T. C., AND ANN M. FINDLEY (Louisiana State University). Circadian Rhythm of Oxygen Consumption in the Marsh Periwinkle, *Littorina irrorata* (Gastropoda).
- 10:10 238. TURNER, HUGH M. (Louisiana State University). Phylogenetic Relationship of Three Genera of Southeastern Louisiana Freshwater Limpets (Pulmonata: Ancyliidae) as Suggested by Septum Formation and Other Aspects of Anatomy.
- 10:23 240. SHABICA, STEPHEN V. (Coastal Research Laboratory, United States National Park Service). Cold-Adapted Metabolism and Slow Growth Rates of the Antarctic Limpet *Patinigera polaris* in Relation to Its Evolutionary History.
- 10:36 241. VIDRINE, MALCOLM F. (University of Southwestern Louisiana). New Host Records for Two Water Mites (Acarina: Unionicolidae).
- 10:49 242. ROBERTS, E. A., AND R. V. DIMOCK, JR. (Wake Forest University). Chemically Mediated Reversal of Phototaxis in a Symbiotic Water Mite (Acarina: Unionicolidae).
- 11:02 243. SHELLY, ROWLAND M. (North Carolina State Museum of Natural History). New Xystodesmid Milliped Genera from Piedmont North and South Carolina (Polydesmida).
- 11:15 244. FILKA, MARIANNE, AND R. M. SHELLY (North Carolina State Museum of Natural History). The Kings-Crowders Mountain Region: A Milliped "Cluster" Area in North Carolina (Diplopoda).
- 11:28 245. SHELLY, ROWLAND M. (North Carolina State Museum of Natural History). Towards a Resolution of the *Sigmoria-Sigiria* Enigma (Diplopoda: Polydesmida: Xystodesmida).
- 11:41 246. NELSON, CHARLES H. (University of Tennessee, Chattanooga). Re-Examination of Phyletic Relationships Within the Family Pteronarcidae (Insecta: Plecoptera).

FRIDAY AFTERNOON — APRIL 15

CHROMOSOME STRUCTURE AND FUNCTION, SESSION II (Invited Papers)

Room 3

Arranged by and Presiding: *Dr. Margaret Y. Menzel*, Florida State University

- 1:00 247. MCKNIGHT, S. L., AND O. L. MILLER, JR. (University of Virginia). Ultrastructure of Chromatin During Transcription and Replication.
- 1:39 248. HUTCHINSON, CLYDE A. (University of North Carolina, Chapel Hill). The Chromosome of Bacteriophage ϕ X 174.
- 2:18 249. SOLARI, ALBERTO (Duke University). The Organization and Behavior of the Sex Chromosomes.
- 2:57 BREAK
- 3:23 250. MOSES, M. I., AND S. J. COUNCE (Duke University). The Synaptonemal Complex and Mammalian Meiosis.
- 4:02 251. WISE, DWAYNE, AND G. K. RICKARDS (Duke University). Behavior of an Interchange Quadrivalent in Living Cells of *Melanoplus differentialis* (Orthoptera: Acrididae).

PLANT SYSTEMATICS, SESSION II

Room 4

Presiding: *Dr. Shirley Tucker*, Louisiana State University

- 1:13 252. WELLS, ELIZABETH F. (University of North Carolina, Chapel Hill). The Taxonomy of *Heuchera* (Saxifragaceae) East of the Rockies. 3:10
1:26 253. NESOM, GUY L. (University of North Carolina, Chapel Hill). The "Achene-Complex" and Related Structures in the Compositae. 3:23 261. BELL, C. RITCHIE (University of North Carolina, Chapel Hill). Umbellet Number and Pollination Efficiency in *Daucus carota* L. (Apiaceae).
1:39 254. VAN HORN, GENE S. (University of Tennessee, Chattanooga). A Preliminary Analysis of Phylogenetic Relationships of the Ranunculaceae. 3:36 262. LINDSEY, ANNE H. (University of North Carolina, Chapel Hill). Promiscuous Pollination in *Thaspium barbinode* and *Zizia trifoliata* (Apiaceae).
1:52 255. FLORY, W. S. (Wake Forest University). The Distribution and Chromosome Numbers and Types of Various Species and Taxa of *Hymenocallis*. 3:49 263. SOBEL, KATHY C. (University of North Carolina, Chapel Hill). Reproductive Biology of the *Ranunculus abortivus* Complex: (Ranunculaceae).
2:05 256. PARKS, CLIFFORD R. (University of North Carolina, Chapel Hill). Compatibility Studies in the Genus *Camellia* (Theaceae). 4:02 264. OTTE, DEBORAH S. (University of North Carolina, Chapel Hill). Pollination in *Hexastylis arifolia* (Michx.) Small and *H. minor* (Ashe) Blomquist (Aristolochiaceae).
2:18 257. KEELEY, STERLING C., AND SAMUEL B. JONES (University of Georgia). Implications of External Pollen Morphology for the Taxonomy of the West Indian Vernonias. 4:15 265. TREIBER, MIKLOS (University of North Carolina, Chapel Hill). Plant Sex in the *Arisaema triphyllum* Complex *Sensu* Huttleston (Araceae).
2:31 258. HARRIS, C. S., L. J. MUSSELMAN, W. F. MANN, JR. (Old Dominion University, and Southern Forest Experiment Station). Taxonomic Studies of the Genus *Agalinus* Raf. (Scrophulariaceae) in the Southeastern United States. 4:28 266. FARENCE, D. R., JR. (University of South Carolina). Ovule development, megasporogenesis and megagametogenesis, in *Ludwigia alternifolia* L. (Onagraceae).
2:44 259. BIERNER, M. W., W. M. DENNIS, AND B. E. WOFFORD (University of Tennessee). Flavonoid Chemistry, Chromosome Number and Phylogenetic Relationships of *Helenium chihuahuensis* (Asteraceae). 4:41 267. TUCKER, SHIRLEY (Louisiana State University). Comparative Floral Development in *Peperomia* (Piperaceae) and *Saururus* (Saururaceae).
2:57 260. JOHNSON, L. K., AND B. B. SMITH (York College of Pennsylvania). Early Ovule Development, Megasporogenesis, and Megametogenesis in *Solidago graminifolia* (L.) 4:54 268. FANTZ, PAUL R. (University of Florida). The First Occurrence of Chasmocleistogamy in *Clitoria mariana* L. (Fabaceae).
5:04 269. GWYNN, THOMAS M., III (Old Dominion University). Floral and Seed Biology of *Seymeria cassioides* (J. F. Gmel.) Blake (Scrophulariaceae).

CRYPTOGAMIC BOTANY, SESSION II

Room 5

Presiding: *Dr. Lafayette Frederick*, Howard University

- 1:26 270. ELLIOTT, L. P. (Western Kentucky University). Flies as a Vector in the Spread of Staphylococcal Mastitis. 2:18 274. SIMONS, RAY, AND LAFAYETTE FREDERICK (Fernbank Science Center and Howard University). Some Interesting and Infrequently Encountered Slime Molds from Georgia (Myxomycetes).
1:39 271. DYKSTRA, MICHAEL J. (University of Florida). An Ultrastructural Examination of *Schizoplasmodiopsis* (Protostelia). 2:31 275. ZATTAU, W. C., AND C. J. UMPHRETT (Clemson University). Topographic Features of Some Chytrids From a Sphagnum Bog.
1:52 272. FREDERICK, LAFAYETTE, I. L. ROTH, AND RAY SIMONS (Howard University and University of Georgia). Variations in Operculum Structure in Sporophores of the Acellular Slime Molds (Myxomycetes). 2:44 276. MARTIN, W. WALLACE (Randolph-Macon College). Observations on New Fungal Parasites of Insect Eggs Producing Appressorial Complexes.
2:05 273. KELLER, H. W., AND T. E. BROOKS (Wright State University and Southeast Missouri State University). A New Corticolous Genus and Species in the Myxomycetes. 2:57 277. DANIELS, W. H., AND C. E. BLAND (East Carolina University). The Comparative

- Physiology and Chemical Control of Selected Strains of the Marine Fungus *Lagenidium callinectes* Couch (Lagenidiales).
- 3:10 278. BLAND, C. E., AND T. M. CHARLES (East Carolina University). A Comparative Taxonomic Evaluation of Seven Marine Isolates of the Genus *Lagenidium* (Lagenidiales).
- 3:23 279. LUNNEY, CAROL Z., AND C. E. BLAND (East Carolina University). A Comparative Electron Microscope Study of Vesicle Morphology in Zoospores of Certain Fresh Water and Marine Oomycetes.
- 3:36 280. THARP, T. P., AND C. E. BLAND (East Carolina University). Fine Structure of Swimming and Encysting Spores of *Haliphthoros milfordensis* (Lagenidiales).
- 3:49 281. DAY, AGNES A., AND W. LENA AUSTIN (Howard University). Brightfield, Phase-Contrast and SEM Studies of Spore Wall Topography in Homothallic Species of *Gelasinospora* (Sordariaceae).
- 4:02 282. SAMUELSON, DON A. (University of Florida). Morphology and Fine Structure of the Operculate Ascus (suborder Pezizineae).
- 4:15 283. WASHINGTON, BETTY J., AND LAFAYETTE FREDERICK (Atlanta University and Howard University). Ultrastructural Studies on Galls of Red Cedar Induced by *Gymnosporangium juniperi-virginianae* (Basidiomycetes).
- 4:28 284. DOTSON, D. W., AND D. T. JENKINS (University of Alabama, Birmingham). Dedicaryotization of *Psilocybe cubensis*.
- 4:41 285. JENKINS, DAVID T. (University of Alabama, Birmingham). A Preliminary Study of Section *Vaginatae*, Genus *Amanita* (Basidiomycetes) in North America.
- 4:54 286. ANDREWS, KAREN E., AND D. T. JENKINS (University of Alabama, Birmingham). A Nutritional Study of Taxa Within the Genus *Amanita*.

PLANT ECOLOGY, SESSION III

Room 6

Presiding: *Dr. George S. Ramseur*, University of the South

- 1:00 287. STALTER, RICHARD (St. John's University). The Plant Communities of St. Phillips Island, Beaufort County, South Carolina.
- 1:13 288. MILLER, GERALD J. (Decatur, Georgia). The Floristics and Vegetation Patterns of Sea Island, Georgia.
- 1:26 289. MASHBURN, SUSAN J., AND REBECCA R. SHARITZ (Savannah River Ecology Laboratory). Seasonal Changes in the Vegetation of Two Carolina Bays.
- 1:39 290. DAY, F. P., JR., CLAIRE V. DABEL, AND LOUISE ERSKINE (Old Dominion University and Randolph Macon Women's College). Dismal Swamp Plant Community Structure.
- 1:52 291. LEWIS, KENNETH P. (University of Alabama, Huntsville). Vegetative Reproduction and Structure of Communities of *Justicia americana* (L.) Vahl.
- 2:05 292. HINKLE, ROSS, AND H. R. DESELM (University of Tennessee). The Vegetation of Cumberland Gap National Historical Park.
- 2:18 293. MALTER, JEFFERY L. (University of Tennessee). Citico Creek Nature Study Area, Cherokee National Forest: Floristics and Politics.
- 2:31 294. RAMSEUR, GEORGE S. (University of the South). Vegetation Analysis of an Experimental Watershed on the Cumberland Plateau.
- 2:44 295. MACDONALD, MARY ELLEN, AND D. T. JENKINS (University of Alabama, Birmingham). A Preliminary Survey of Plant Communities Found at the Childersburg Field Experiment Station.
- 2:57 296. LOWMAN, MARGARET (Duke University). Phenological Phenomena and Growth Patterns of Sixteen Northern Hardwoods.
- 3:10 297. KILKUS, P. A., AND G. T. WEAVER (Southern Illinois University, Carbondale). Cover-Typing a Proposed Research Natural Area With an In Depth Approach to Method Evaluation.
- 3:23 298. COLEMAN, JAMES M. (University of Florida). Upland Vegetation of Northeast Mississippi.
- 3:36 299. DELAPP, JOHN A. (North Carolina State University). The High Elevation Red Oak Community of the Southern Appalachians.
- 3:49 300. WENTWORTH, THOMAS R. (North Carolina State University). Vegetation of the Thompson River Gorge of the Southern Blue Ridge Mountains.
- 4:02 301. KLIMAS, C. V., AND P. A. ROBERTSON (Southern Illinois University). Structure and Soil Moisture Relationships of a *Quercus prinus* (Fagaceae) Stand in Southern Illinois.
- 4:15 302. WARE, STEWART, RIDGE DEWITT, AND SUSAN GIASCOCK (College of William and Mary). Hardwood Forests of Virginia's Central Coastal Plain.
- 4:28 303. COLOSI, JOE, E. D. SENECA, C. L. CAMPBELL, W. W. WOODHOUSE, JR., AND S. W. BROOME (North Carolina State University). Dune Stabilization with *Iva imbricata*.
- 4:41 304. PORCHER, RICHARD D. (The Citadel). The History and Pattern of Land Use of Hob-

- caw Forest, Winyah Bay, Georgetown County, South Carolina.
- 4:54 305. WHIPPLE, S. A., AND DAVID WHITE (Louisiana State University and Tulane University). The Effects of Fire on Two Louisiana Marshes.
- 5:07 306. WILSON, E. JEAN (University of North Carolina, Chapel Hill). A Floristic Study of The "Savannahs" on Pine Plantations in the Croatan National Forest.

PLANT PHYSIOLOGY

Room 8

Presiding: *Dr. Walter W. Heck*, United States Department of Agriculture, Agriculture Research Service, North Carolina State University

- 1:39 307. DUKE, S. O., G. H. EGLEY, AND B. J. REGER (United States Department of Agriculture). Seed Hydration and Secondary Dormancy in *Rumex crispus* L.
- 1:52 308. CREECH, B. J., D. D. BOYETTE, AND P. P. SEHGAL (East Carolina University). Study of Mustard Root Hairs.
- 2:05 309. HOKE, G. D., JR., W. V. DASHEK, J. C. CHANCEY, JR., AND G. C. LEWELLYN (Virginia Commonwealth University). The Response of Lily Pollen to Aflatoxin B₁ in Media Containing and Lacking Phosphate.
- 2:18 310. LAWSON, VERNA R., GLENDA KNOX, AND BRENDA KNOX (Alcorn State University). Interaction of Chloramphenicol and Cycloheximide With IAA, GA₃, and Red Light (660 nm) in the Growth of Excised Coleoptile Segments of *Triticum vulgare* cv Arthur.
- 2:31 311. LAWSON, VERNA R., AND GLENDA D. KNOX (Alcorn State University). Interaction of Griseofulvin and Rifampicin With IAA, GA₃, and Red Light (660 nm) in the Growth of Apical Coleoptile Segments of *Triticum vulgare* cv Arthur.
- 2:44 312. ADAIR, OLIVIA V., J. H. GREENE, III, AND MARGARET MILLER (University of South Alabama). The Effects of Gibberillic Acid on a Marine Diatom, *Cyclotella*.
- 2:57 313. GREENE, J. H., III, OLIVIA V. ADAIR, AND MARGARET MILLER (University of South Alabama). The Response of *Selenastrum bibrainum* to Varying Concentrations of Gibberillic Acid.
- 3:10 314. PARRONDO, R. T., AND J. G. GOSSELINK (Louisiana State University). Effects of Salinity on the Rate of Rubidium Uptake by Several Species of Marsh Grasses.
- 3:23 315. PHILBLCK, ROBERT B. (United States Department of Agriculture — Agriculture Research Service, North Carolina State University). A Plant Exposure System For Atmospheric Pollution Research.
- 3:36 316. TAYLOR, G. E., JR. (Agnes Scott College). Physiological Factors Affecting Leaf Susceptibility to Sulfur Dioxide.
- 3:49 317. DUNNING, JOHN A. (United States Department of Agriculture — Agriculture Research Service, North Carolina State University). Relative Humidity Affects the Response of Oats Exposed to Sulfur Dioxide.
- 4:02 318. JOHNSTON, BILL, AND A. S. HEAGLE (North Carolina State University). The Effects of Low Doses of Ozone on the Subsequent Sensitivity of Soybean to Injury by High Ozone Doses.

ICHTHYOLOGY AND HERPETOLOGY

Room 9

Presiding: *Dr. Richard C. Bruce*, Western Carolina University

- 1:00 319. DOUGLAS, NEIL H., AND J. L. HARRIS (Northeast Louisiana University). Occurrence of the Chub Genus *Nocomis* (Cyprinidae) in the Ouachita River Drainage, West-Central Arkansas.
- 1:13 320. MOORE, C. J., J. H. HIXSON, AND D. T. BURTON (Academy of Natural Sciences of Philadelphia, Benedict Estuarine Research Laboratory). Abundance and Seasonal Occurrence of Shore Zone Fishes in Central Chesapeake Bay.
- 1:26 321. MAURAKIS, E. G., AND W. S. WOOLCOTT (Virginia Electric and Power Company, and University of Richmond). Seasonal Distributional Patterns of Fishes in the James River, Virginia (Osteichthyes).
- 1:39 322. POWELL, J. C. (George Mason University). The Diel Distribution and Relative Abundance of Fish Species in a Freshwater Tidal Creek.
- 1:52 323. HOCUTT, C. H., R. F. DENONCOURT, AND J. R. STAUFFER, JR. (Appalachian Environ-

- mental Laboratory, University of Maryland), An Inventory of the Fishes of Gauley River, West Virginia.
- 2:05 324. OUTTEN, L. M. (Mars Hill College). Comparative Studies of Cyprinid Fishes in the Southeast.
- 2:18 325. ELLIS, E. G., AND G. H. CLEMMER (Mississippi State University). Habitat Selection of *Pimephales notatus* and *P. vigilax* (Cyprinidae) in a Laboratory Stream.
- 2:31 326. LOOS, J. J. (Academy of Natural Sciences of Philadelphia). Comparative Early Life Histories of Representatives of the Cyprinid subgenera *Hydrophlox* and *Notropis*.
- 2:44 327. ROSS, S. W., AND D. E. FAST (Institute of Marine Sciences, University of North Carolina). New Records of Tropical Fishes Collected on Reefs in Onslow Bay, North Carolina.
- 2:57 328. SCHWARTZ, FRANK J. (Institute of Marine Sciences, University of North Carolina). Effects of Sharksucker, *Echeneis naucrates*, Disk on Scaled and Scaleless Fishes and Sea Turtles.
- 3:10 329. FLIPPO, G. M., AND K. R. MARION (University of Alabama, Birmingham). The Fence Lizard (*Sceloporus undulatus*) in Alabama: A Study in r-Selection.
- 3:23 330. FUNDERBURG, J. B. (North Carolina State Museum of Natural History). Comments on a Unique *Pseudacris* Complex (Amphibia: Hylidae) in Virginia.
- 3:36 331. DODD, C. K., JR., AND M. T. CHRISTENSEN (National Museum of Natural History and Mississippi State University). Percent Assimilation and Feeding Behavior of the Oklahoma Salamander, *Eurycea tynerensis*.
- 3:49 332. WALSTON, L. L., AND C. D. WILDER (Murray State University). A Study of the Cave Salamander (*Eurycea lucifuga*) in Trigg County, Kentucky.
- 4:02 333. BRASWELL, ALVIN L. (North Carolina State University and North Carolina State Museum of Natural History). Geographic Variation in *Elaphe obsoleta* (Say) (Reptilia, Squamata, Colubridae) in North Carolina.
- 4:15 334. GREENE, JUDITH L., AND J. WHITFIELD GIBBONS (Savannah River Ecology Laboratory). Considerations of Growth Processes and Body Size in Aquatic Turtles (Chelonia: Reptilia).
- 4:28 335. COX, W. A., AND K. R. MARION (University of Alabama, Birmingham). Winter Reproduction and Multiple Clutches in a Spring-Dwelling Population of *Sternotherus minor minor* (Reptilia: Chelonia: Kinosternidae).
- 4:41 336. HALLA, B. F., G. J. TAYLOR, AND S. A. DAWSON (Maryland Wildlife Administration). Range Determination of the Bog Turtle in Maryland.
- 4:54 337. GIBBONS, J. W., AND D. H. NELSON (Savannah River Ecology Laboratory). The Evolutionary Significance of Delayed Emergence from the Nest by Hatching Turtles (Chelonia: Reptilia).

Abstracts of Papers Presented at the 38th Annual Meeting of the Association of Southeastern Biologists

The number in parenthesis at the top of each abstract refers to the number of that paper in the program.

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Time Course of Thermal Acclimation in Atlantic Silverside (*Menidia menidia*) Exposed to Cyclic Temperatures

PHILIP R. ABELL, DENNIS T. BURTON AND
CHARLES J. MOORE

*Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory*

Many studies have addressed the time course of thermal acclimation of fish at constant temperatures, however, much less is known about the time course of acclimation to cyclic temperatures, particularly to low cyclic temperatures. This study was undertaken to determine the time course of thermal acclimation in Atlantic silverside (*Menidia menidia*) exposed to several fluctuating low temperatures. Adult fish were acclimated for a minimum of two weeks to 15C. One group was then taken from 15C to 5C over a 10-day period (1°/day) and held at 5C for 21 days. Three groups were exposed once every 24 hours for 31 days to different fluctuating temperature cycles. The time of the descending phase (15C to 5C) for each group was 1) 1.5 hr, 2) 11 hr and 3) 22.5 hr; the ascending phase (5C to 15C) was 1.5 hr for all groups. Upper limit critical thermal maxima (CTM) were used to assess thermal acclimation after exposure to the cycles for various periods of time up to 31 days. All CTM measurements were made at maximum phase (15C). The CTM of all cyclic groups decreased significantly between 5 and 10 days when compared to the 15C acclimated controls. The CTM of all cyclic groups were significantly higher than those of fish held continuously for 21 days at 5C. This study indicates that Atlantic silverside exposed to cyclic low temperatures adjust to intermediate temperature(s) between the minimum and maximum rather than toward the maximum as has been suggested for fish exposed to cyclic elevated temperatures.

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The Effects of Gibberillic Acid on a Marine Diatom, *Cyclotella*

OLIVIA V. ADAIR, JOHN H. GREENE III, AND
MARGARET MILLER

University of South Alabama

An investigation was made to determine the effects on the growth rate of a marine diatom, *Cyclotella*, when gibberillic acid was introduced to laboratory cultures. The cultures were exposed to five different concentrations of gibberillic acid, a growth substance, ranging from 5ppm to 35ppm. Cell count, turbidity readings, and chlorophyll concentration were the parameters used to determine the effects on the growth curve of *Cyclotella*.

(89)

Observations on Fusiform Rust (*Cronartium fusiforme*) in Axenic Culture and Dual Culture with Loblolly or Slash Pine

H. V. AMERSON, R. L. MOTT, E. B. COWLING AND
W. R. JACOBI

North Carolina State University

Tissue cultures of the pine host are being used to study the rust-host interaction at the cellular level. Fungal hyphae within the original host explant at the time of subculture apparently do not grow into either the surrounding medium or into callus that develops on the explant. Studies to determine the cause(s) of this failure are in progress. The attempted establishment of axenic cultures of fusiform rust from excised telial columns appears more successful than efforts involving gall tissue. Two morphologically different forms have been isolated from telia. One form grows as a white mycelium producing colonies up to 1 cm in diameter, whereas the other form produces a small orange stroma and is termed pseudohyphal. Virulence tests to establish the identity of these fungi are currently in progress. Additionally, virulence testing, light and electron microscopy are being employed to study the nuclear condition of these suspected isolates of *Cronartium fusiforme*.

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Trace Metal Distribution in Plants and Arthropods on a Coal Fly-ash Substrate

GILBERT E. ANDERSON AND JOHN B. GENTRY
Savannah River Ecology Laboratory

Increased release of trace metals to the environment poses a threat to human health and the environment. It is of paramount importance that the behavior of such elements in the various ecosystems be understood. With such an objective in mind trophic relationships of selected trace metals were investigated in a terrestrial ecosystem occupying an island composed of coal fly-ash. Using atomic absorption spectrophotometry individual plants and invertebrates were analyzed for Cd, Cr, Cu, Pb and Zn. Mean elemental concentrations at different trophic levels are presented as well as statistical distributions of each metal.

(286)

A Nutritional Study of Taxa Within the Genus *Amanita*

KAREN E. ANDREWS AND DAVID T. JENKINS
University of Alabama, Birmingham

A preliminary nutritional study of five species of the genus *Amanita* was undertaken. A yeast-nitrogen base

medium was employed to which dextrose, mannose, galactose, xylose, lactose, sucrose, and cellulose was added in concentrations of 1% and 3%. Separately, the organisms were grown on a water agar medium to which ammonium sulfate and various amino acids, at concentrations of 1% and 3%, were added. Comparison of growth was based primarily upon the morphological variations in colony diameter, texture, and color and the microscopical variations in hyphal structures, diameter, and septation.

(75)

The Staining Characteristics of a Family of Gallocyanin-Heavy Metal Dyes

ARTHUR L. APLEGATE

St. Andrews Presbyterian College

The gallocyanin-chrome alum stain has been shown to have specificity for nucleic acids. In an attempt to improve the specificity of the stain and increase the weight of the metal nucleus, the following metals were complexed with gallocyanin: 1) copper 2) cerium 3) cadmium 4) lead. A 0.5% solution of gallocyanin-copper sulfate in 70% chloroethanol and 0.5% gallocyanin-cadmium sulfate in the same solvent give virtually no non-specific staining. The staining time was four hours. A variety of tissues and fixatives were tested and control tissues were extracted with 10% perchloric acid.

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Chromosomal Associations in Some Eucaryotic Nuclei

TERRY ASHLEY

Duke University

There is fragmentary evidence for a specific arrangement of both homologous and non-homologous chromosomes in somatic nuclei from fertilization onward. Such order would contribute greatly to an understanding of the central cytogenetic problem of how homologous chromosomes "find" each other at meiotic prophase. The concepts and data supporting specificity of arrangement in nuclei remains controversial. Can such associations between homologous, or certain non-homologous chromosomes be convincingly demonstrated? If such associations exist, are they transient or persistent in nature? What can be postulated about the mechanisms responsible for these associations? Are these mechanisms universal among eucaryotes? These questions will be addressed by examining recent observations from a variety of organisms. Cytological evidence from *Ornithogalum virens*, a Liliaceous plant with $n = 3$, suggests associations between both homologous and non-homologous chromosomes. Observations on associations between telomeres and the nuclear membrane in several eucaryotes will be presented and discussed as one possible recognition mechanism. — Supported by NIH grant GM23712-01.

(82)

Linkage and Selection Analysis of Biochemical Variants of *Peromyscus maniculatus* (Rodentia)

RAMONE BACCUS

University of Georgia

Starch-gel electrophoresis was used to analyze nine biochemical variants over four deer mouse populations

collected over a 5,000 ft. altitudinal gradient in Colorado. Lod-score test statistics for linkage analysis were generated from pair-wise comparisons of all nine systems (loci), using mother-offspring combinations. Three pairings (ADH—SDH, ADH—GOT-1, and SDH—EST-4) reflected positive lod-scores, providing preliminary evidence for chromosomal linkage between these Mendelizing sets. All other pairings either reflected definite evidence of non-linkage ($P < 0.01$), or contained insufficient information (variability) to make satisfactory determinations. Independent selection component analysis of mother-offspring combinations plus adult male-female contingents were also conducted on ADH and GOT-1, chosen because of sufficient polymorphism and a maximum of two major alleles per locus. Resultant fitness estimates indicate GOT-1 is under strong prezygotic selection, while ADH appears neutral. These results appear to support Franklin and Lewontin's (1970) contention that linkage groups augment heterozygosity measures for a given cohort. Is linkage a spurious inflation of measured heterozygosity?

(78)

The Utility of Bacteriophage Lambda to Study the Transcription of Isoleucine-Valine (ILV) Operons of *Escherichia Coli* K-12

RICKY BAJAJ AND ARTHUR L. WILLIAMS

Alabama State University

This study was undertaken to isolate specialized transducing phages carrying a series of fragments of the isoleucine-valine (*ilv*) operons. Strain KS302 (deleted for the lambda attachment site, att λ) was used to insert bacteriophage lambda into the *ilv* gene cluster. Several different phage lines were isolated carrying bacterial DNA from the counterclockwise side and the clockwise side of the insertion. Preliminary DNA-RNA hybridization experiments suggested that the *ilv* DNA carried by these phages can be useful in studying the regulation of gene activities in *E. coli* K-12.

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Cedar Glades in the Former Big Barren Region of Kentucky

JERRY M. BASKIN AND CAROL C. BASKIN

University of Kentucky

A checklist of the herbaceous vascular plants occurring on cedar glades in the former Big Barren Region of Kentucky has been prepared. One hundred and forty nine taxa, representing 41 families, were collected on cedar glades in Warren, Simpson, Logan and Hart Counties. Species collected included some that were characteristic of the former Big Barren grassland, some that are characteristic of tall grass prairies, some that are characteristic of cedar glades in southeastern United States, and a number of common weeds. Only one cedar glade endemic (*Leavenworthia torulosa* Gray) was found on glades in the former Big Barren Region.

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Umbellet Number of Pollination Efficiency
in *Daucus carota* L. (Apiaceae)

C. RITCHIE BELL

University of North Carolina, Chapel Hill

Pollination efficiency (as indicated by percentage fruit set) was calculated for 2873 individual umbellets from 339 specifically modified umbels and 50 unmodified control umbels of 30 plants of *Daucus carota* in a single spontaneous population of those plants near Ralchigh, N.C. Average fruit set for each treatment was as follows: controls 67%; umbels reduced to only a single umbellet 75%; umbels reduced to 5 contiguous umbellets 56%; umbels of 5 non-contiguous umbellets 70%; umbels modified to 10 contiguous umbellets 75%; and for umbels composed of 10 non-contiguous umbellets 68%. Average fruit set, and thus presumed pollination efficiency in these "promiscuous" plants, varied more within treatments, and on individual plants, than between treatments. These quantitative data further indicate the minor role currently played by inflorescence size, shape and compactness in the attraction of pollinators, in pollination effectiveness, and, presumably, in the evolutionary maintenance of inflorescence size in *Daucus carota*.

(76)

Effects of paraquat on rejoining of x-ray
induced chromosome aberrations

SANDRA BELL

University of Tennessee, Knoxville

The herbicide paraquat has been shown to inhibit DNA synthesis in root cells of the broadbean *Vicia faba*. It does not, however, cause an increase in chromatid aberrations in *Vicia* although reports in the literature indicate an increase in aberrations in onion and barley. The current study investigates the rejoining of x-ray induced chromosome breaks in the presence of paraquat. When a split dose of x-rays is administered to *Vicia faba* cells in the G₁ phase of the cell cycle with paraquat treatment between the doses the number of 2-hit chromosome aberrations produced is additive. This indicates that paraquat does not influence rejoining of broken chromosomes, which in the past has been shown to be dependent upon protein synthesis. However, in the presence of paraquat, an increase in aberrations is found in cells that were in either S or G₂ periods of the cell cycle when irradiated.

(53)

Leaf Pack Processing in a Pastureland Stream

ERNEST F. BENFIELD

Virginia Polytechnic Institute and State University

Processing of American Sycamore leaf packs in a pastureland stream was examined by placing leaf pack analogues in the stream, and sampling over a 161-day period. Using an exponential decay model in which percent weight remaining was regressed on time, a processing coefficient of -0.0057 was obtained. The influence of macroinvertebrates on the processing of leaf packs was found to differ somewhat from the situation reported for woodland streams. In woodland streams, macroinvertebrate 'shredders' have been shown to be very important in the fragmentation of whole leaves

which is the initial step in the processing detrital material by stream consumers. Shredders were not important in this pastureland stream and fragmentation of whole leaves was mainly a function of microbial decomposition and mechanical breakage. It is speculated that the absence of shredders in the stream is linked to the absence of a functional leaf processing continuum due to the dominance of sycamore leaf input.

(80)

A Temperature Sensitive Modification of the
Cell-2 Phenotype in *Drosophila melanogaster*

D. B. BENNER

East Tennessee State University

The dominant fourth-chromosome wing vein mutant Cell-2 (*CE*²) produces reduction of the ocelli, loss of the ocellar and scutellar bristles, convergence of the longitudinal third and fourth wing veins, and homozygous lethality. This study determined that flies reared at 18C have more normal wing vein phenotypes than those reared at 25C, but they show no change in homozygous survival nor changes in the bristles and ocelli. When pupae are transferred to 18C at 6 hr after the formation of the puparium at 25C the wing vein pattern is nearly normal. Flies transferred 18 hr after puparium formation show the mutant pattern. The *Ce*² effect on the wing vein pattern is determined no later than 18 hr after puparium formation which is 98 hr before the wing vein pattern is visible.

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A Comparative Taxonomic Evaluation of
Seven Marine Isolates of the Genus *Lagenidium*

CHARLES E. BLAND AND THOMAS M. CHARLES

East Carolina University

Seven isolates, from widely divergent geographic areas and different hosts, of the genus *Lagenidium*, that were thought originally to be *L. callinectes*, were examined critically and compared morphologically and physiologically. Preliminary results indicate that although all isolates bear a superficial morphological resemblance to *L. callinectes* as described by Couch (1942), there are differences between the new isolates and *L. callinectes* which make it difficult to include them in that species. In fact, differences among the seven isolates regarding response to various hosts, growth rate, temperature and salinity ranges, and fungicide tolerances indicate that three subgroups exist within the isolates themselves. Whether these differences justify descriptions of new varieties and/or species is debatable and will be discussed.

(77)

Development of the Sexual Cycle in
Neurospora tetrasperma

SARA N. BENNETT

Georgia Southern College

H. BRANCH HOWE, JR.

University of Georgia

Lawns of wild type *Neurospora tetrasperma*, mating type A, grown on corn meal agar on depression slides

were fertilized at 24, 36, 48, 72 or 84 hr. Scoring was carried out at 100× with a phase contrast microscope. The formation of additional protoperithecia subsequent to fertilization was drastically reduced compared to unfertilized controls. The greatest reduction in protoperithecial formation occurred when fertilization was at 24 hr (96.6%) or at 36 hr (95.6%). The percentage of protoperithecia which developed into perithecia was highest when the lawns were fertilized at 24 hr. Fertility had declined by 36.7% at 36 hr, 68.3% at 48 hr, 91.8% at 60 hr and 96.6% at 72 hr. No perithecia were produced from protoperithecia located in the experimental areas of lawns fertilized at 84 hr. Individual protoperithecia remained fertile for only a short period of time. Almost all protoperithecia failed to develop into perithecia if they were fertilized after they were 36-42 hr old.

(206)

A Study of Fishes Impinged at the Allen Steam Plant from August 1974 Through February 1976

CHRISTOPHER K. BERNET, C. M. COOPER,¹
AND Y. J. MCGAHA
University of Mississippi

Fishes impinged against water-intake retainer screens at the Allen Steam Plant, Memphis, Tennessee, were studied from August 1974 through February 1976. Fishes captured by the screens during a 24-hour period each week were sampled. Fish counts were made at 6:00 a.m. and 6:00 p.m. each quarter year to ascertain differences in night and daytime catch rates. Thirty-nine species entered the total catch with individuals of four species, *Polyodon spathula* (Walbaum), *Dorosoma cepedianum* (Lesueur), *Dorosoma petenense* (Gunther), and *Aplodinotus grunniens* Rafinesque, collected in large numbers. Observations on the remarkable growth rate of very young paddlefish, *P. spathula*, were made in June 1975. Mass mortality of threadfin shad, *D. petenense*, occurred during January 1976 when water temperatures varied between 4.4 and 5.6C. The number of fishes collected during each test period was directly influenced by the number of water-intake circulators in operation. Population density, average size, and species diversity of fishes varied with seasons.—¹Currently employed as a post-doctorate research fellow, U.S.D.A. Sedimentation Laboratory, Oxford, Ms. 38655.

(259)

Flavonoid Chemistry, Chromosome Number and Phylogenetic Relationships of *Helenium chihuahuensis* (Asteraceae)

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B. EUGENE WOFFORD
University of Tennessee, Knoxville

Five populations of *Helenium chihuahuensis* Bierner were examined for flavonoid content, chromosome number and morphological characteristics. Thirteen flavonoid compounds were detected of which eleven were at least partially identified, and the chromosome number was determined to be $n = 15$. *Helenium chihuahuensis* was then compared to *H. arizonicum* ($n = 15$), *H. laciniatum* ($n = 13$) and *H. mexicanum* ($n = 13$) by

constructing Wagner Networks both excluding and including flavonoid data. Whereas *H. chihuahuensis* previously was believed to be most closely related to *H. mexicanum*, the Wagner Network constructed by utilizing morphological, cytological and chemical data indicated that *H. chihuahuensis* is most closely related to *H. arizonicum*, then to *H. mexicanum* and finally to *H. laciniatum*.

(17)

Physiological Response of White Perch (*Morone americana*) to Chlorine

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Chesapeake Biological Laboratory*

White perch were exposed to chlorine for two hours at a concentration of 1.3 mg/l chlorine produced oxidant (CPO). Fish were sampled at 30 min intervals up to 120 min (the time at which 100% mortality occurred). Disequilibrium of fish was not observed until at least 100 min after exposure to chlorine. Prior to this time, all fish appeared healthy when sampled. Blood pH decreased from 7.5 in the control group to 7.0 after 30 min exposure to CPO. No further decrease of pH was observed even after the occurrence of death. Compensation for lowered pH was indicated by elevated hematocrit (106%) and increased gill carbonic anhydrase activity (76%). Elevated levels of methemoglobin were also observed in those fish exposed to chlorine. It is postulated that hemoglobin is oxidized to methemoglobin when chlorine comes in contact with the gill surface. Methemoglobin formation produces an increase of blood CO₂ lowering blood pH until loss of blood buffering capacity causes eventual death.—*This research was supported by the State of Maryland Department of Natural Resources, Power Plant Siting Program under contract number 25-75-04.*

(193)

Photosynthesis and respiration of *Spartina alterniflora* Loisel (Poaceae) in North Carolina salt marshes: Model validation

UDO BLUM
North Carolina State University

In situ ecosystem gas exchange measurements were taken monthly during low tide for short, medium, and tall height forms of *Spartina alterniflora* in three salt marshes near Southport, North Carolina. Measurements began in June 1974 and ended September 1975. Multiple regression analysis was used to obtain empirical relationships between gas exchange values and the physical and biotic variables measured. Models for gross ecosystem photosynthesis, net ecosystem photosynthesis, net photosynthesis of aboveground standing crop, ecosystem respiration, and respiration of aboveground standing crop were developed. Subsequently, net primary productivity of aboveground standing crop for 1975 was calculated from model data. Harvest estimates of net primary productivity of aboveground standing crop for 1975 will be compared with the estimates obtained from model data.

(99)

Ultrastructure of the Esophageal Granules
of *Schistosoma mansoni* (Trematoda)

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Vanderbilt University

The posterior portion of the esophageal gland of *Schistosoma mansoni* synthesizes a granule that is highly structured internally. Each granule consists of arrays of membrane-bound tubules enclosed by a membrane. Cytochemical tests indicate that the granules are not reactive for cytochrome c-oxidase but do react for macromolecular carbohydrates. It is believed that the granules are synthesized in the Golgi complex and are secreted at the base of the luminal amplifications of the esophagus. Colchicine treatment results in an accumulation of granules in the cyton region. Their physiological function is still undetermined, but it is hypothesized that they are involved with early stages of digestion of host red blood cells. — Supported, in part, by a grant from the Edna McConnell Clark Foundation (275-0041).

(95)

An Extraerythrocytic Parasitemia of Cytotoddia
(= *Toddia bufonis* Franca) in *Natrix*
sipedon sipedon

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Virginia Polytechnic Institute and State University

During a period from the middle of July to the middle of September 1976 *Cytotoddia* was followed in six *Natrix* from Northern Michigan by means of blood smears stained with Giemsa. Five snakes (four ♀ and one ♂) had a natural infection and one snake (♂) had a mechanical infection obtained by injecting intraperitoneally an aliquot of infected blood in a normal saline solution. From differential counts of one thousand cells per slide the development of the parasitemia is individually variable and no pattern is apparent. Preliminary evidence seems to indicate however that the incidence of infection reaches a higher level in younger snakes than in older ones. After the artificial infection developed in three weeks the percentage of infection ranged from 14% to 21% and remained at that level through the study period. It is thought that this parasitemia is related to the normal erythropoietic process and depending on the stages of the blood cycle the cytotoddia is found in erythrocytes or polychromatic cells.

(60)

Taxonomy and Biology of *Orconectes transfuga*
in the Rogue River System, Oregon
(Decapoda: Cambaridae)

RAYMOND WILLIAM BOUCHARD
University of North Alabama

Orconectes transfuga was described on the basis of specimens from three localities in the Rouge River system, east of Grants Pass, Jackson County, Oregon. No member of the family Cambaridae is native to streams west of the Continental Divide in the United States. It

is unknown how or when *O. transfuga* gained access to the Rogue River system. The great similarity in color patterns between *O. transfuga* and the predominantly Ozarkian crayfish *O. n. neglectus* prompted an examination of the two species. On the basis of morphological comparisons and identification of commensal ostracods, *O. transfuga* was determined to be an introduced species and a subjective junior synonym of *O. n. neglectus*. The Oregon population of *O. neglectus* is common and well established in the Rogue River system and has replaced the native *Pacifastacus leniusculus klamathensis* in most habitats. *Orconectes neglectus* ranges primarily from a low diversion dam east of Gold Hill downstream at least as far as the mouth of the Illinois River.

(74)

Morphology of the Mandible in Holarctic
Crayfishes (Decapoda: Astacidae and
Cambaridae): Ecological and
Phylogenetic Implications

RAYMOND WILLIAM BOUCHARD
University of North Alabama

The masticatory surfaces of the mandibles in the Holarctic crayfish genera (*Astacus*, *Austropotamobius*, *Pacifastacus*, *Barbicambarus*, *Cambarus*, *Fallicambarus*, *Faxonella*, *Hobbsseus*, *Orconectes*, *Procambarus*, *Troglocambarus*, *Cambarellus* and *Cambaroides*) reveal both morphological similarities among phylogenetically related species and also modifications which may be correlated with feeding efficiencies. The masticatory surface consists of incisor and molar ridges, the latter comprising discrete cephalic and caudal regions. One likely aspect of the mandible which may be correlated with a particular feeding efficiency in some species is the blade-like incisor region. Similarities in the mandible indicative of phylogenetic homogeneity among certain genera and subgenera agree with previous assessments based upon secondary sexual characteristics. One important difference, however, suggests that the troglobitic *Procambarus* (*Remotiocambarus*) *pecki* has closer affinities with members of the genus *Cambarus* than with those of *Procambarus*. Based on morphological differences, the western North American crayfishes of the genus *Pacifastacus* are divided into the subgenera *Pacifastacus* and *Hobbsastacus*.

(58)

Threatened and Recently Extinct Crayfishes of the
Western United States (Decapoda: Astacidae
and Cambaridae)

RAYMOND WILLIAM BOUCHARD
University of North Alabama

A preliminary study was made of the distribution, habitat and rarity of three western United States crayfishes — *Orconectes deanae* in New Mexico, *Pacifastacus fortis* and *P. nigrescens* in California. *Orconectes deanae* has a limited range in the South Canadian River system of San Miguel and Quay counties, New Mexico, where it presently coexists with the introduced *O. rusticus*. Because of the limited range of *O. deanae* and a lack

of knowledge concerning its interaction with *O. rusticus*, *O. deanae* is recommended for listing as a threatened species as outlined by the Endangered Species Act of 1973. *Pacifastacus fortis* is known from tributaries of the Pit River in Shasta County, California, and was determined to be a threatened species due to its limited range and presence of the aggressive cambarid *O. virilis* in the immediate area. *Pacifastacus nigrescens* is considered as being probably extinct because of urbanization and introductions of *P. I. leniusculus* in the San Francisco area.

(49)

Macro-organic Drift in the Yadkin River, a North Carolina Piedmont Stream

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Duke Power Company

Organic drift ($> 471\mu$) in the Yadkin River was sampled monthly near the site of the proposed 3840 MWe Perkins Nuclear Station, from September 1974 through November 1975. Detritus was the main component of the drift (99.8% by wet weight), with detrital density averaging $480\text{g}/100\text{m}^3$ and total detrital load ranging from 300 to 4,600 metric tons per month. The invertebrate component was approximately 80% aquatic and 20% aerial or terrestrial by number, and 84% aquatic and 16% aerial or terrestrial by wet weight. Numerically dominant invertebrates were *Rheotanytarsus* spp, *Polypedilum* spp, *Orthocladius* spp, *Cricotopus* spp, *Chaoborus punctipennis*, Oligochaeta, *Hydropsyche* spp, *Stenonema* spp, and adult Diptera. Total macroinvertebrate density averaged 460 organisms/ 100m^3 . Monthly estimates of total numbers drifting past the site ranged from 0.2 to 3.8 billion aquatic and from 0.006 to 1.3 billion aerial or terrestrial. Monthly estimates of total biomass drifting past the site ranged from 70 to 11,600 kg aquatic and from 10 to 1,320 kg aerial or terrestrial.

(33)

Nitrogen Cycling in an Alluvial Swamp Forest

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East Carolina University

Fluxes of nitrogen were measured in an alluvial swamp forest on the Tar River near Grimesland, North Carolina. Pathways measured were litterfall, throughfall, stemflow, and inputs from rainfall. The litterfall has been analyzed for total nitrogen which totals about $5\text{ gm}^{-2}\text{ yr}^{-1}$. Water samples were analyzed for NH_4^+ , NO_3^- , and organic nitrogen. Annual fluxes for throughfall and stemflow will be presented. Fertilization experiments were conducted by adding NO_3^- and NH_4^+ to the overlying water and monitoring their rates of disappearance in the presence and absence of soil. NO_3^- was found to disappear rapidly, decreasing from 2-11 ppm to background levels within 10 days. Disappearance rates of NO_3^- in the absence of soil were significantly lower. Under both conditions NH_4^+ was found to have a lower disappearance rate than NO_3^- . Analysis of exchangeable NH_4^+N in soil was 113 ppm in July and 183 ppm in October. Total soil nitrogen averaged 1.8% dry weight.

(18)

Effect of Salinity on Toxicity and Tissue Accumulation of Cadmium in the Sailfin Molly, *Poecilia latipinna* (Poeciliidae)

DAVID P. BRANNON AND LAURENCE G. TATE
University of South Alabama

Forty eight hour LC_{50} values for cadmium exposure were determined at salinities ranging from 2‰ to 35‰. LC_{50} values ranged from 4 to 19 ppm with fish being more susceptible to cadmium at lower salinities. In addition an experiment on sub-acute, long term exposure, at a constant salinity, to cadmium was conducted. Tissue cadmium levels were measured by atomic absorption spectrophotometry. Tissues analyzed were gill, gut, liver, and muscle.

(333)

Geographic Variation in *Elaphe obsoleta* (Say) (Reptilia, Squamata, Colubridae) in North Carolina

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*North Carolina State University and
N.C. State Museum of Natural History*

456 *Elaphe obsoleta*, representative of the phenotypic variation occurring across the state, were examined. Specimens from certain areas differed significantly from those in others areas in the following characters: the number of ventrals, caudals, scale rows (at the neck, midbody, and near the vent), scale rows smooth at midbody, body blotches, and relative tail length. Specimens from the Mountains averaged more fused lateral neck blotches. Divided anal plates occurred in all the females examined, but in only 91% of the males. Coastal Plain males had the highest percentage of entire anal plates. Males and females showed independent geographic variation in the number of ventrals and scale rows near the vent. Based on the pattern and color of adults, four "types" were recognized. The distribution of these "types" correlated closely with major vegetation zones. Man's alterations of the environment have probably shifted the selective pressures on this species.

(180)

Bryophytes of Virginia Piedmont Floodplains

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Longwood College

Bryophytes were collected from two densely wooded tributary floodplains of differing drainage basins (James River and Roanoke River) of south central Virginia. Dominant trees of these forests include river birch (*Betula nigra*), bitternut hickory (*Carya cordiformis*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), and pin oak (*Quercus palustris*). Collections were made from four microhabitats including 1) soils, 2) logs, 3) trees and 4) soil at the margins of the rivers and sloughs. Mosses found on the soil include *Mnium cuspidatum*, *Brachythecium oxycladon*, and *Leptodictyum riparium*. A pleurocarpous moss, *Leskea polycarpa*, blanketed most of the moist decorticated logs. Trees exhibited the greatest diversity (18 spp) of bryophytes. The most common of these are *Anomodon attenuatus*,

Leskea gracilescens, *Clasmatodon parvulus* and *Frullania inflata*. Thallose liverworts such as *Anthoceros laevis* ssp. *carolinianus*, *Riccia sullivantii* and *Fossombronina foveolata* are temporary colonizers of river banks in the spring and fall. Flooding and drought apparently restrict the number of bryophytes in piedmont floodplains.

(221)

Development and Characterization of a Feral Strain of Bantam Chickens as a Possible Tool for Ecological Studies in Southeastern Environments

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AND
PEYTON R. WILLIAMS, JR.
University of Georgia

A strain of feral bantam chickens has been established by allowing free-choice mating amongst red junglefowl and pedigreed bantams of several varieties in a free-ranging barnyard habitat for a period of three years. Surviving birds were removed from the barnyard and released into a hardwood swamp-forest habitat bordering a farm plantation near Milledgeville, Georgia, and after three more years, nine birds were trapped from this area to serve as the foundation stock of the feral bantam strain which has now been propagated by a program of free-choice mating in the laboratory for six more generations. Characterizations of the changes in frequencies of various color, comb and plumage phenotypes during this process, may provide insight into some of the selective forces faced by such birds in the feral state. Correlative behavioral studies and the use of these birds for making controlled releases in selected southeastern habitats for purposes of assessing pollutant uptake and cycling are discussed.

(227)

The Manatee in North Carolina

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North Carolina State Museum of Natural History

Although the historic distribution of the West Indian (Florida) manatee, *Trichechus manatus*, is not well documented, it is generally accepted that some individuals regularly migrated north to coastal North Carolina during the summer. This "population" was apparently decimated by coastal residents, and few records have come from the Carolinas during this century. Consequently, the species, considered Endangered by the federal government, was believed extirpated from the northern portion of its summer range. During the summers of 1975 and 1976, in a cooperative program with the U.S. Fish and Wildlife Service, we attempted to gather information on the current status of the animal in North Carolina. Approximately 250 posters were distributed along the southern coast of the state, watermen and other coastal residents were interviewed, and newspapers and other media were used to solicit sight reports from the public. Information received indicates that manatees still occur in North Carolina waters from June to early October, although no estimate of numbers can be made at this time. Pooling of recent and historical records shows cluster areas of occurrence. Aerial surveys of potential foraging habitat, and the recent reported increase of certain exotic aquatic plants, suggest that

coastal North Carolina could support a substantial population of manatees in summer.

(208)

Effect of *Posthodiplostomum minimum* on the Growth, Condition and Liver RNA-DNA Ratio of *Lepomis macrochirus*

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Tennessee Technological University

Samples of over 300 bluegills were collected from a middle Tennessee lake during a 12-month cycle in order to study the effects of the strigeoid trematode, *Posthodiplostomum minimum*, on the growth, condition and RNA-DNA ratio of the bluegill, *Lepomis macrochirus*. Coefficient of condition (K_{TL}) and immediate or short-term growth rate (as indicated by RNA-DNA ratio) decreased with increased rates of infestation. Long-term growth rate (as indicated by the scale method), however, showed little apparent affect.

(153)

Effect of Water Stress at Various Stages of Development on Soybean Yield in Phytotron and Field Environments

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Duke University

Effects of water stress at flowering, pod development, and pod filling on final yield of soybeans were studied in potted plants outdoors and in chambers. In chambers stress was developed by withholding water until leaf water potentials reached about -23 bars (4-6 days). Plants outdoors were watered only once a day and reached about -30 bars each afternoon of the seven day stress periods. In both environments seed yield was most severely reduced by stress during pod filling, and least by stress during flowering. Decreased average weight per seed caused much of the yield reduction during pod filling. The numbers of seeds per pod and pods per plant were decreased by stress during pod filling in plants outdoors, but not in chambers, and resulted in more severe yield reduction outdoors. Stress at earlier stages reduced seed yield mainly by decreasing the number of pods per plant.

(97)

The Effect of BCG on Acute Infections of *Trypanosoma (Schizotrypanum) cruzi* (Zoomastigophorasida: Kinetoplastorida: Trypanosomatidae) in Mice

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University of Georgia

The immunotherapeutic effect of BCG in the suppression of neoplasia in mice is well documented (Hawrylko and Mackaness, *J. of the Nat. Can. Inst.*, 51, 5: 1677, 1973). This has stimulated considerable interest in the use of BCG to protect experimental animals against a number of parasites including *T. cruzi*. The latter studies have led to conflicting results (c.f., Ortiz-Ortiz et al., *J. Immunol.* 114: 1424, 1975; Kuhn, et al., *Int. J.*

Parasitol. 5: 557, 1975). In the present studies mice were inoculated with 10⁶ BCG intravenously or subcutaneously and challenged subsequently with a Brazil strain of *T. cruzi* 10 or 21 days later. In these experiments significantly lower mean parasitemias were seen in some BCG-sensitized groups. Cumulative mortality studies showed little or no difference in deaths. Additional studies are underway to determine the effect of mouse strains as well as antigen-adjuvant sensitization in the enhancement of resistance in mice to acute *T. cruzi* infections.—*This research was supported in part by NIH TRNG Grant 5 T01 A100315-08.*

(158)

Comparative Studies of Loblolly Pine Grown in Chamber, Greenhouse and Field Environments

JOE F. BUREL
Duke University

One year old loblolly pine seedlings were grown over two seasons (1974 and 1975) in three different kinds of environments at the Duke University Phytotron, to determine the effects of various levels of environmental control on growth. Identically potted seedlings were set out into chamber (controlled watering, light, temperature and humidity), greenhouse (controlled watering, temperature and humidity) and field (controlled watering) environments. Measurements taken during and at the end of the study periods included root, stem and needle dry weights, height and needle and flush numbers. Differences in total dry weight existed both within growth environments and between seasons. For 1974 (chamber and greenhouse day-night temperatures of 30C/26C) plants ranked in the order of descending total dry weight were field, chamber and greenhouse. This ranking was maintained for both shoot and root dry weights. In 1975, (chamber and greenhouse day-night temperatures of 26C/20C) the order of ranking was chamber, greenhouse and field. Chamber and field showed a significant difference in their total dry weights as well as in their shoot dry weights.

(132)

Limnological Studies in a Southern Flood Control Reservoir

JOHN W. BURRIS AND CHARLES M. COOPER¹
University of Mississippi

Limnological investigations of Grenada Reservoir, Mississippi were made from January, 1973 through March, 1976. The reservoir (40 km²) was subject to extreme fluctuations in water level and turbidity. Secchi readings ranged from five cm in winter to 163 cm in late summer. Virtually no encroachment by submergent or emergent macrophytes occurred. Planktonic and benthic cycles observed were compared with physico-chemical data. Plankton populations ranged from less than 100 organisms/liter in August, 1975 to 650,000/l in January, 1976. One hundred seven genera of plankton were identified of which the predominant genus was *Melosira* (Chrysophyta). Benthos populations experienced summer minima and winter maxima reflecting emergence cycles of aquatic insect stages. Of the 39 genera and 41 species of macrofauna identified, the majority were Tubificidae (Oligochaeta) and Chironomidae (Diptera).—¹*Currently employed as a post-doctorate research fellow with the U.S.D.A. Sedimentation Laboratory, Oxford, Mississippi.*

(114)

Differential Response By Sex, Of The Mongolian Gerbil, *Meriones unguiculatus*, To Varying Concentrations Of Mixed Aflatoxins

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Virginia Commonwealth University

The aflatoxins are known to be potent toxins as well as carcinogens. In this study, Mongolian gerbils were used to determine the acute toxic effects of varying concentrations of aflatoxin on each sex of adult animals. Animals were housed in special plastic cages and fed ground meal *ad libitum*. Mixed aflatoxins containing B₁, B₂, G₁, and G₂, were administered intraperitoneally using dimethyl sulfoxide as the carrier. The following data were collected: mortality, change in body weight, food consumed, water consumed and physical activity as measured on a photoelectric cell system. At sacrifice or death, gross and histopathological changes were noted following weight measurements made on body organs. The following organs were evaluated: liver, kidney, lungs, and adrenal glands. From these data, comparisons were made between the controls and test animals to determine the toxic and lethal response by sex.

(51)

An Evaluation of the Practice of Using Application Factors to Predict Sublethal Levels of Toxicants

WILLIAM F. CALHOUN AND KENNETH L. DICKSON
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Application factors have frequently been used by aquatic biologists to predict "safe concentrations" of toxicants from acute toxicity data. Ideally an application factor is the ratio of the "safe concentration" to the acutely lethal concentration (usually the LC₅₀). In the absence of an experimentally derived safe concentration, frequently it is assumed that the safe to lethal ratio is constant for related groups of chemicals and between aquatic species. By statistically analyzing the basic toxicological data in technical publications which utilize these concepts, it was possible to demonstrate that the application factors are frequently used improperly and thereby provide an incorrect estimate of sublethal toxicant concentrations.

(37)

Nutrients, Hydrogen Sulfide, and Dry Matter Production of *Spartina alterniflora* in Three Salt Marshes

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Above-ground standing crop of *Spartina alterniflora* and concentrations of ammonium ion, phosphate, and hydrogen sulfide in the interstitial water of marsh sediments were measured in study areas in three salt marshes in the vicinity of Morehead City, N.C. Study plots were located in representative stands of short S.

alterniflora and adjacent levee or edge stands of tall *Spartina*. Interstitial water was sampled at depths of 5, 15, and 35 cm. Maximum standing crop values observed during September ranged from 200 gm dry wt/sq m in short stands of the Causeway marsh to 1180 gm dry wt/sq m in the levee stand of a marsh which receives secondary sewage effluent. Ammonia and phosphate in all marshes showed winter maxima and lowest concentrations in summer. On most occasions, both ammonium and phosphate concentrations were higher in the deeper sediments. Hydrogen sulfide concentrations were lowest during the winter and highest in September and October. The observed differences between ammonium and phosphate concentrations in short and tall stands in the three marshes do not seem great enough to explain the differences in maximum standing crop. Hydrogen sulfide toxicity, however, may be important in limiting the growth of *Spartina alterniflora*.

(187)

Report of a Five Year Old Colony of *Equisetum Arvense* L. Growing through Asphalt Pavement

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Appalachian State University

In the spring of 1971 shoots of *Equisetum arvense* L. were observed emerging from asphalt pavement in Boone, North Carolina. In the following five years this colony has grown, and by the spring of 1976 it covered an area of approximately three square meters. Both sterile and fertile stems have been produced annually since 1972. Colonies of *E. arvense* have been observed in several other locations along highways in Watauga County where creek sand has been used by the highway department during periods of snow and ice. The highway mixes calcium chloride salts with the sand before spreading it over the roads. It is the author's opinion that the sand used to formulate the asphalt contained spores, gametophytes, or vegetative parts of sporophytes, which withstood the high temperatures produced by the paving process.

(79)

Regulation of the Isoleucine and Valine (ILV) Biosynthetic Enzymes in a Valine-Resistant Mutant of *Escherichia Coli* K-12

CALEB CARTER, ANN C. WILLIAMS,
AND ARTHUR L. WILLIAMS
Alabama State University

Recently, a valine-resistant mutant was isolated that acquired azaleucine-resistance simultaneously. This study was undertaken to examine the enzyme levels in this mutant under repressed and derepressed conditions. It was found that the isoleucine-valine biosynthetic enzymes were derepressed in this mutant when grown under repressed conditions. Furthermore, the differential rate of synthesis indicated that these enzymes were made at an elevated level under repressed conditions as compared to the parental strain. Additional parameters will be discussed in regards to the overall regulation of the isoleucine-valine operons of *E. coli* K-12.

(59)

Geographic Variation in the Form I Male Gonopod of the Dwarf Crayfish, *Cambarellus Puer* (Crustacea: Decapoda)

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Memphis State University

Geographic variation in the gonopod of the dwarf crayfish, *Cambarellus puer*, was studied. Computations were based on eight morphologic measurements from 140 form I male specimens from 20 localities. Analyses were conducted using univariate and multivariate statistical techniques on scaled data. A matrix of correlation among seven scaled characters was computed and the first three principal components extracted, which accounted for 85.7% (component I = 41.9%, II = 26.2%, III = 17.6%) of the variation in the character set. Three-dimensional projection of localities onto principal components show that most populations are similar with respect to the gonopod. Projections on components I, II, and III were analyzed with respect to eleven environmental variables. Correlations between environmental variables and the principal components in *C. puer* appear low, substantiating the idea that the gonopod is little affected by ecological variables.

(110)

Thrombocyte Specificity in two Strains of *Gallus Domesticus*

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Middle Tennessee State University

Antisera produced in rabbits against chicken thrombocytes from bursectomized and intact New Hampshire Red chickens were cross reacted with thrombocytes from White Leghorn chickens. Differences between thrombocytes were measured by cytotoxicity. There was little response in the White Leghorn thrombocytes to the antisera at four and five weeks after hatch. At six through eight weeks after hatch the response of White Leghorn thrombocytes increased. These data suggest a difference between thrombocyte cell surfaces from bursectomized and intact White Leghorn chickens as well as a difference in White Leghorn and New Hampshire thrombocytes.

(118)

What Are Natural Areas?

ROBERT CHIPLEY
The Nature Conservancy
(No abstract received)

(31)

Nitrogen and Phosphorus as Possible Limiting Factors in Lichen Growth

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Nitrogen and phosphorus were applied to two species of *Cladonia*, *Cladonia subtenuis* and *Cladonia leporina*, to determine if the supplies of these elements were limiting lichen growth rates. Fertilizers were hand broad-

casted, in solid form, onto 1 m² plots. Application rates were 7 g/m² of nitrogen and 1 g/m² of phosphorus. Both species of lichens showed increased growth when treated with nitrogen or phosphorus in two types of ecosystems, an abandoned field and a *Pinus palustris* stand.

(44)

Indices for Organic Carbon Partitioning in Aufwuchs Communities

JAMES R. CLARK, JOHN H. RODGERS, JR.,
KENNETH L. DICKSON AND JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University

Nontaxonomic indices based on biological information can be derived to aid in water quality assessment. In addition to Weber's autotrophic index, ratios such as chlorophyll *a*/ATP (Functional Trophic Index) and ATP/ash free dry wt (Viability Index) can be computed to evaluate changes in perturbed Aufwuchs communities. By estimating organic carbon from each of these methods, the ratios allow relative partitioning of an aufwuchs community into autotrophic and heterotrophic components or viable and nonviable organic carbon. Samples from glass slides in artificial streams treated with chlorine, copper, dichromate, sucrose, dextrose or phosphate were used to evaluate the efficacy of these indices. Relative changes in the autotrophic-heterotrophic or viable components of the aufwuchs communities are best explained by a combination of techniques.

(12)

Effects of Acclimation Time on Larval Flounder (*Paralichthys* sp.) Oxygen Consumption

LINDA C. CLEMENTS AND DONALD E. HOSS
*National Marine Fisheries Service,
Beaufort, North Carolina*

Reliable metabolic rates of poikilotherms depend on complete acclimation of the organism to the test temperature. The time for complete acclimation to a new temperature was measured as a function of the rate of oxygen consumption of larval *Paralichthys dentatus* (summer flounder) and *P. lethostigma* (southern flounder). Larvae (35 mg mean wet wt) caught and held at environmental temperatures (10 to 12C) were exposed to constant temperatures ($\pm 0.2C$) at 10C and 15C from 1-4 days, and then their oxygen consumption was measured using a differential respirometer. Applying a multiple linear regression model to the oxygen consumption rate as a function of acclimation temperature and number of days acclimation, there was no significant effect of day (partial F test). It appears that acclimation of these larval fish occurs in less than one day, and thus longer acclimation times over the range of temperature change tested would be unnecessary.

(210)

Variations to Be Considered in Using Microhematocrits as a Tool for Sexing Bluegill (*Lepomis macrochirus*) from Natural Population

C. B. COBURN, JR.
Tennessee Technological University

Some authors have advocated the use of hematocrit (het) for sexing various species of fish. Unfortunately

most of these based their conclusions on data gathered from fishes collected at one time with the fishes' het being influenced by prevailing factors at that time. This study was conducted on bluegills collected from different types of lakes and streams over several seasons. In addition to sex, hets are influenced by seasons, gonadal growth and development, and condition factors. Thirty to 40% of bluegills can be sexed by het during two periods of the year, dependent on habitat conditions. Generally the male has higher het in "summer" months whereas the female has higher het in "winter" months.

(298)

Upland Vegetation of Northeast Mississippi

JAMES M. COLEMAN
University of Florida

Vegetation characteristics in relation to environmental factors were studied in the uplands of western Tishomingo and part of eastern Prentiss County, Mississippi. Importance values of the major species were arrayed on an environmental gradient of cumulative radiation. White oak (*Quercus alba*) is dominant in the mesic and intermediate portions of the gradient. Southern red oak (*Quercus falcata*) and shortleaf pine (*Pinus echinata*) intergrade with white oak in the xeric portion of the gradient. Understory vegetation is also arrayed on the gradient to demonstrate successional trends. Beech (*Fagus grandifolia*) will most likely be dominant in the mesic portion of the gradient. White oak, black oak (*Quercus velutina*) and hickories (*Carya* spp.) will dominate intermediate sites and white oak, southern red oak and post oak (*Quercus stellata*) will dominate on xeric sites. Various causal and historical factors are also discussed.

(182)

The Sexual Life Cycle of Three Species of the Funariaceae in Tissue Culture

PAULA A. COLLIER
University of Tennessee

Three species of the Funariaceae (*Physcomitrella patens*, *Physcomitrium pyriforme*, and *Funaria hygrometrica*) have been cultured under sterile conditions on Knops inorganic medium (liquid and agar) to determine the minimum time necessary for completion of the sexual life cycle. Data is presented to document the following: 1) spore germination time; 2) gametophore production time; 3) conditions and time necessary for production of gametangia; 4) time needed for sporophyte maturation. The critical factor for induction of gametangia in all three species is cold temperature (13C).

(192)

Reproductive Phenology of *Iva imbricata* and *Uniola paniculata*

JOE COLOSI
North Carolina State University

The floral and seed development of two coastal fore-dune dominants, *Iva imbricata* and *Uniola paniculata*, were monitored throughout the 1976 growing season in Atlantic coast populations from Cape Henry, Virginia to Ft. Pierce, Florida. In *Uniola paniculata*, floral development proceeds clinally from south to north. In

mid-June, when floral primordia are beginning to differentiate at the northern end of the species' range, floral culms have attained nearly full length (60 cm) and are beginning anthesis at the southern end. The approximately one month developmental difference between the northern and southern ends of the range is maintained through seed maturation. No trends in floral or seed development were found for *Iva imbricata*: Capitula dry earlier in southern populations than in northern populations, however. The phenology pattern will be used in relating seed germination response to provenance in these two species.

(303)

Dune Stabilization with *Iva imbricata*

JOE COLOSI, E. D. SENECA, C. L. CAMPBELL,
W. W. WOODHOUSE JR., AND S. W. BROOME
North Carolina State University

Experiments were conducted with *Iva imbricata*, a dominant shrub of Southeastern U.S. coastal dunes, to investigate its role in dune stabilization. Three types of cuttings were set out in several habitats of three North Carolina locations during the springs of 1975 and 1976. Survival after one year was greatest in the sand flat habitat (63%) and lowest in blowout areas on the back side of the foredune (0%) at Ocracole Island, North Carolina. Rooted stems taken from foredune plants survived better in all habitats than did unrooted stems. Woody stems survived much better than soft (new growth) stems. Rooted cuttings in peat pots were more subject to desiccation due to wind erosion than were unpotted stems. However, the peat pot cuttings that survived sand removal often had higher survival, and were invariably more robust at the end of the growing season, than were the unpotted stems.

(188)

Relation of *Erythrina flabelliformis* (Fabaceae) to Rock Outcrops in Southern Arizona: Water Relations Studies

JEFFERY S. CONN
North Carolina State University

Erythrina flabelliformis Kearney, a drought-deciduous mesophyte, occurs at its northernmost limit of distribution in a seemingly xeric habitat: the lower south-facing hillsides of isolated mountain ranges in Southern Arizona. There, it almost always grows in cracks or next to rock outcrops. In investigating the species' relationship to outcrops, particular attention was given to soil water near outcrops and water absorption capabilities of *E. flabelliformis* and *Happlopappus larcifolius*, a co-occurring species inhabiting both rocky and non-rocky areas. Soil moisture studies made near and away from outcrops at the Molino Basin study site, Santa Catalina Mountains, Arizona were inconclusive due to problems in calibrating Bouyoucos blocks to measure water potential in rocky soils. Study of pre-dawn xylem tension and leaf osmotic pressure show that *E. flabelliformis* is much less capable of extracting soil moisture than *H. larcifolius*. Thus, *E. flabelliformis* is probably restricted to rock outcrops due to the greater amount of moisture found there.

(131)

Natural Areas in Public Policy and Decisions

ARTHUR W. COOPER
North Carolina State University

(No abstract received)

(137)

A Survey of the Diptera (Insecta) of Grenada Reservoir, Mississippi

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The Diptera of Grenada Reservoir (40 km²) were studied during benthic investigations from January, 1973 through August, 1975. Samples were collected monthly with Ekman dredges, and over 3500 slides were prepared for identification. Twelve genera and 13 species of Diptera were identified with aquatic stages of *Chaoborus punctipennis* (Say), *Coelotanypus tricolor* (Loew), and *Chironomus attenuatus* (Walker) constituting over 99 percent of all Diptera collected. Diptera were well distributed in the reservoir and constituted the single most important component of the macrobenthos. Certain species were ubiquitous in habitat while others were restricted by depth or other factors. Changes in temperature, dissolved oxygen, and water level appeared to control insect migrations and emergence. Populations showed mid-winter highs and mid-summer lows with some species having up to four generations per year.

(64)

Comparative Activity Patterns and Movements of Shelta Cave Crayfishes

JOHN E. COOPER AND MARTHA R. COOPER
North Carolina State Museum of Natural History

Undisturbed activities, responses to baits and disturbance, and movements related to water levels were compared among three troglomorphic crayfishes inhabiting Shelta Cave, Alabama, over a two-year period of mark-recapture studies. During stable low-water periods most individuals of the smallest and rarest species, an undescribed form, were moving about prior to baiting or other disturbance. By contrast, many individuals of the largest, most abundant species, *Orconectes australis*, were lying quiescent, either in the open or under cover, while the third species, *Cambarus jonesi*, was seldom observed. All three were attracted to baits, but the robust *C. jonesi* reacted most immediately and aggressively to disturbance, while the small, fragile species became less evident as disturbance increased. Both *O. australis* and *C. jonesi* exhibited ability to resist drying in the cave atmosphere, and appeared capable of overland movement when necessary. As water levels rose in winter they made extensive horizontal movements. The small species, by contrast, appeared very susceptible to drying when out of water. It responded to rising water by retreating vertically in crevices in the floor to reach a permanent sub-floor reservoir, remaining there until the water had crested and started to recede the following spring or summer.

(104)

Visual Representation of Skeletal System:
Historical Study

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Hospital of St. Raphael, New Haven

Purpose of this paper is to elucidate a didactic problem in presentation of anatomical discoveries. We chose one organ system that was depicted throughout the ages by both anatomists and artists, the skeletal system, and traced its illustration and description from medieval illuminations to modern times. During our research, which included study and comparison of manuscripts, some rare book editions, and many standard old and new textbooks, we found interesting anachronisms, progressions and regressions both in anatomy as a science and in technique of illustration.

(335)

Winter Reproduction and Multiple Clutches in a
Spring-dwelling Population of *Sternothaerus*
minor minor (Reptilia: Chelonia: Kinosternidae)

WILLIAM A. COX AND KEN R. MARION
University of Alabama, Birmingham

Monthly samples of *Sternothaerus minor minor* were obtained from Millpond Spring, Jackson County, Florida, from June 1974 to June 1975. Females were examined for oviducal eggs, yolked ovarian follicles and corpora lutea (CL). Vitellogenesis begins in late August and continues to mid-June. The first clutch reaches ovulatory size (15.5-17.5 mm diameter) by mid-October. Oviducal eggs are present from November through June, but are absent from July until November. There is a correlation between the presence of oviducal eggs and large (5.5-7.5 mm diameter) CL. Regression of the CL follows oviposition and, with subsequent clutches, distinct size classes of regressing CL (1.5-5.4 mm diameter) are found. As many as three definite size classes of CL were found, indicating that multiple clutches occur in *S. m. minor* in these habitats. Winter reproduction in this species appears to be an adaptation to climatological factors, utilizing the most favorable combinations of temperature and precipitation.—*This work was supported by a Graduate School grant, University of Alabama, Birmingham.*

(308)

Study of Mustard Root Hairs

BUFORD J. CREECH, DOUGLAS D. BOYETTE AND
PREM P. SEHGAL
East Carolina University

One day old, dark-grown mustard seedlings were treated for 18 hours with unbuffered and buffered solutions of naphthalene acetic acid [NAA] (10^{-7} - 10^{-9} M), calcium nitrate (1.27 mM) and boric acid (1.62 mM). The growth of root hairs was measured indirectly. Under standard conditions, the seedlings were stained with toluidine blue, washed with water and destained with formalin-acetic-alcohol. Optical density measurements at 640 nm of the destained dye were taken as indication of growth in surface area of root hairs. Low concentration of NAA promotes and high concentration inhibits

root hair growth. Boric acid promotes growth if root hairs are present and inhibits if root hairs are absent on seedlings at the time of treatment. Calcium nitrate promotes root hair growth in seedlings both with and without root hairs. Other results with NAA, $\text{Ca}(\text{NO}_3)_2 \cdot 4 \text{H}_2\text{O}$ and H_3BO_3 taken alone and in combination on root hairs will be discussed.

(90)

Tissue Culture Studies on a Salt Marsh Aster:
Callus Initiation and Growth

W. W. CURE AND R. L. MOTT
North Carolina State University

Callus tissue has been induced from excised petiole segments of a native North Carolina salt marsh species of aster, *Aster tenuifolius* L., on a chemically defined medium. Maximum fresh weight increase occurred on a medium composed of the inorganic constituents of Murashige and Skoog, 3% sucrose, 2 mg/l NAA and 0.5 mg/l kinetin. Root or shoot regeneration has not yet been observed from these cultures. Effects of added NaCl on the callus growth and fresh weight increase of this halophytic species will be discussed and related to salt stress resistance.

(147)

Ecology of the Leech *Placobdella montifera*
Moore (Hirudinea: Glossiphoniidae): Part I

MARY G. CURRY
VTN Louisiana, Inc.

Placobdella montifera Moore is a relatively uncommon freshwater leech known from Canada, the northeastern one-fourth of the United States and Louisiana. Very little is known about the species, especially its life history and ecological requirements. A total of 100 adults was collected from 30 habitats in 10 western Louisiana parishes. In most of these areas, the species was not uncommon. Seven habitats were monitored physico-chemically for 6 months. Parameters included: pH, 5.5-8.1; total alkalinity, 8.0-296.0 ppm; temperature, 10.5-28.5°C; specific conductance, 40-700 micromhos/cm; color, 40-280 PCU; free carbon dioxide, 5.0-25.0 ppm; dissolved oxygen, 0.1-10.0 ppm; sodium, 3.2-50.0 ppm; potassium, 1.2-48.0 ppm. Leeches were collected free-living, from a turtle, and from the mantle cavities of several species of clams. Brooding individuals, carrying from 12 to more than 50 young, were found free-living and in clams. No seasonal correlations were made with either the clam relationships or reproductive behavior.—*Generous contributions of Malcolm F. Vidrine are gratefully acknowledged.*

(48)

Distribution and Abundance of Macroinvertebrates in the Yadkin River, a North Carolina
Piedmont Stream

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Duke Power Company

This study describes the distribution and abundance of benthic macroinvertebrates in the Yadkin River in the vicinity of Duke Power Company's proposed Perkins Nuclear Station. Oligochaeta and Chironomidae dom-

inated the benthos at all stations. Spatial differences in number of taxa collected and faunal composition were related to substrate type and organic carbon content. Shore stations, with negligible current, fine silt-sand substrate (mean particle size, $\phi = 3.62 \pm 0.92$ S.D.) and relatively high sediment carbon content (mean percent carbon, dry, = 0.658 ± 0.51 S.D.), contained the largest number of taxa (86). The shore community had an annual macroinvertebrate mean density of 876 ± 714 S.D., dominated by Oligochaeta. Midstream stations, with a current averaging 0.6 m/s, coarse sand substrate (mean particle size, $\phi = 0.16 \pm 0.79$ S.D.) and low sediment carbon content (mean percent carbon, dry, = 0.061 ± 0.024 S.D.), contained a lower number of taxa (44), predominantly Chironomidae, and had an annual macroinvertebrate mean density of 543 ± 366 S.D.

(277)

The Comparative Physiology and Chemical Control of Selected Strains of the Marine Fungus *Lagenidium callinectes* Couch

WILLIAM HENRY DANIELS AND CHARLES E. BLAND
East Carolina University

The fungus *Lagenidium callinectes* Couch, is a marine, holocarpic, biflagellate, phycomycete. First described by Couch (1942) as a parasite of the ova and early larval stages of the blue crab *Callinectes sapidus*, other strains of *Lagenidium* have recently been isolated and identified as parasites (pathogens) of other marine crustacea. To facilitate control of *Lagenidium* in the mariculture of crustacea and as an aid to taxonomic studies, *in vitro* physiological and fungicidal control tests were conducted. First performed were physiological tests including salinity, temperature, and cation replacement responses. Differing growth rates and sporulation levels were noted for some strains. Secondly, various chemicals reported to have fungitoxic potential were tested for the control of *L. callinectes*. Those showing possible value in fungal control and warranting further testing were Surflan, Terrazole, Formalin, Furanace, and Betadine.

(281)

Brightfield, Phase-contrast and SEM Studies of Spore Wall Topography in Homothallic Species of *Gelasinospora* (Sordariaceae)

AGNES A. DAY AND W. LENA AUSTIN
College of Medicine, Howard University

Features at the light microscope level reveal that ascospores of *G. calospora* and *G. tetrasperma* are ovate to rounded with a surface showing numerous pit-like depressions. When these spores were treated with varying concentrations of sodium hypochlorite and studied by brightfield and phase-contrast microscopy it was apparent in *G. calospora* that the primary wall becomes swollen and will expand away from the body of the spore. *G. tetrasperma* ascospores when subjected to this treatment show no discernible morphological alterations. SEM studies of ascospores of the species presently under investigation confirmed light microscopic observations

in addition to revealing the fact that there is an absence of a germinal pore space or germinal pore in the primary wall of *Gelasinospora* ascospores.

(290)

Dismal Swamp Plant Community Structure

FRANK P. DAY, JR., CLAIRE V. DABEL, AND
LOUISE ERSKINE
Old Dominion University
and Randolph Macon Women's College

The Dismal Swamp vegetation is a heterogeneous mixture of communities ranging from typical cypress (*Taxodium distichum*) — gum (*Nyssa* spp.) stands to untypical mixed oak (*Quercus* spp.) stands. Severe human disturbances have resulted in the decline of typical swamp vegetation and an increase in importance of other vegetation types. This paper examines structural features of four important Dismal Swamp community types. The Atlantic white cedar (*Chamaecyparis thyoides*) stand was characterized by a large standing crop of woody litter (50,147 kg/ha), as the cedar are dying out, high basal area (55 m²/ha), and a small root mass (889 g/m², does not include main root stocks). The cypress-gum community had the highest above ground biomass (345,000 kg/ha) and was also characterized by a large standing crop of woody litter (45,388 kg/ha). The red maple (*Acer rubrum*) — gum and mixed oak communities were very similar structurally.

(2)

Parasites of Fishes from Lake Hyco, North Carolina

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North Carolina State University

Preliminary studies indicate a difference in both incidence and number of parasites in various species of fishes from Lake Hyco and surrounding streams in Person and Caswell Counties, North Carolina. Particular interest is given to the genus (*Mazocraooides* in two populations of the gizzard shad, *Dorosoma cepedianum*.

(299)

The High Elevation Red Oak Community of the Southern Appalachians

JOHN A. DELAPP
North Carolina State University

Large stands of northern red oak (*Quercus rubra* var. *borealis* (Michx. f.) Farwell) occur on various broad ridges above 1350 m (4400 ft) in the Southern Appalachians. The variation of composition and structure within this community-type is described, based on quantitative data gathered in six different regions of western North Carolina. Through the analysis of quadrat samples of the vegetation with ordination techniques, the major compositional gradients and their relations to measured environmental gradients are characterized.

(127)

Managing Natural Areas — A Case for Determining Objectives

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Many public agencies and private groups manage natural and semi-natural areas. The objectives are various depending upon the dominant internal or external political or scientific forces impinging on the decision makers. Special natural areas obtained for preservation of one or a few biologic species are at least initially to be managed for that (or those) objective(s). Enough information of impact of management possibilities and their consequences on the species is not always known to make correct decisions.

(331)

Percent assimilation and feeding behavior of the Oklahoma salamander, *Eurycea tynnerensis*

C. KENNETH DODD, JR. AND MICHAEL T. CHRISTIANSEN
*National Museum of Natural History and
Mississippi State University*

Ten *Eurycea tynnerensis* (33.8 ± 3.7 mm SVL) from Mayes County, Oklahoma, were tested for percent assimilation (percent of organic material removed from the food during passage through the gut). Salamanders were acclimated at 14C for two weeks prior to testing and feces were collected for one month. On a diet of tubifex worms, the mean of percent assimilation was 63.1 ± 15.0 . While feeding, three postures were observed: (1) resting, during which the back was curved and relaxed, (2) feeding, during which the snout was alternately moved back and forth against the substrate, and (3) swallowing, during which the back was straight and rigid. Prey was captured by a snap and suck movement. It appeared as though salamanders may employ both active search and ambush techniques to secure prey.

(284)

Dedikaryotization of *Psilocybe cubensis*

DAVID W. DOTSON AND DAVID T. JENKINS
University of Alabama, Birmingham

Monokaryotic mycelia was recovered from treated, dikaryotic mycelia of *Psilocybe cubensis*. This uninucleate phase was reestablished by growing dikaryotic mycelia in a basal medium to which cholic acid was added. The presence of this bile acid induced abnormal clamp formation. As a result monokaryotic hyphae of both nuclear types was produced. Subsequently, an attempt was made to reestablish the dikaryotic phase by crossing the monokaryotic isolates.

(319)

Occurrence of the Chub Genus *Nocomis* (Cyprinidae) in the Ouachita River Drainage, West-Central Arkansas

NEIL H. DOUGLAS, AND JOHN L. HARRIS
Northeast Louisiana University

Collections of fishes in the Ouachita River drainage during recent years have revealed the presence of a

previously unreported genus to the ichthyofauna of this system. Specimens of the Chub Genus *Nocomis*, belonging to the *biguttatus* species group, have been collected from the headwaters of this drainage, specifically the Little Missouri River and the South Fork of the Ouachita River, Montgomery County, in west-central Arkansas. The *biguttatus* group, *Nocomis biguttatus*, *Nocomis asper*, and *Nocomis effusus* (Lachner and Jenkins, 1971), are known to inhabit the upper Mississippi, Great Lakes, Ohio, Cumberland, Missouri, White, Red, and Arkansas drainages. Two species occur in Arkansas. *Nocomis biguttatus* is found chiefly in the White River drainage of northern Arkansas whereas *Nocomis asper* inhabits the Ozark uplands of the Arkansas River drainage. The recent discovery firmly establishes the genus *Nocomis* in the Ouachita River system, a major drainage of the lower Mississippi Valley.

(307)

Seed Hydration and Secondary Dormancy in *Rumex crispus* L.

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*Southern Weed Science Laboratory,
Agricultural Research Service,
U.S. Department of Agriculture*
B. J. REGER
*R. B. Russell Research Center,
Agricultural Research Service,
U.S. Department of Agriculture*

Dark-imbibed seeds of curly dock (*Rumex crispus* L.) did not germinate at 15C. However, they germinated at 25C after exposure to a low irradiance red light treatment, if preceded by a dark imbibition period at 15C. Dark-incubation at 15C for 3-4 days induced maximal germination responses to the subsequent red light/25C treatment. After dark-incubation at 15C for 10-14 days the seeds became secondarily dormant. If, after the onset of secondary dormancy, the seeds were desiccated for 4-7 days at 15C and then rehydrated in the dark at 15C, a new pattern of changing sensitivity to the red light/25C treatment was observed. Maximal light 25C stimulated germination was reduced and occurred about 1 week after rehydration. Germination kinetics data suggest that osmotically produced hydration levels which reduce germination by 50% play no direct role in primary phytochrome reactions or secondary dormancy induction. However, desiccation and subsequent rehydration can break secondary dormancy, reinitiating the course of events which lead to secondary dormancy.

(235)

Behavior of Introduced Molluscs

DEE S. DUNDEE
University of New Orleans

Slugs are frequently active at times which, to the human observer, appear to be unfavorable for such activity. In effort to clarify parameters allowing slugs favorable activity periods, measurements of various factors have been made. The results have been analyzed by computer.

(317)

Relative Humidity Affects the Response of Oat to Sulfur Dioxide

JOHN A. DUNNING

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Agricultural Research Service,
North Carolina State University

Experiments were conducted to determine the affect of relative humidity (RH) on the response of 2 oat varieties to sulfur dioxide (SO₂). Plants were grown in controlled environment facilities at a day/night temperature of 26/22C. In the first experiment growth humidity (GH) was held constant (55-60%) and exposure humidity (EH) was varied across four humidity levels (40, 55, 70 and 85%). In the second experiment four GH (40, 52, 64 and 76%) and two EH (55 and 80%) were used. Plants were exposed four times to each of four concentrations of SO₂ (0, 40, 80 and 160 ppm) for 3 hr each time when plants were 5-6 wk old. Plants were harvested 7 wk from seed. Injury increased and top dry weight decreased with increasing EH. Root dry weight decreased with increasing EH except between 55 and 70% in the first experiment. Plants grown at 76% RH had less injury and greater weight than those grown at the lower humidities.

(271)

An Ultrastructural Examination of *Schizoplasmodiopsis* (Protostelia)

MICHAEL J. DYKSTRA
University of Florida

Spores, cysts and trophic stages of the four known species of the genus *Schizoplasmodiopsis* were examined by transmission electron microscopy. Spores of *S. micropunctata* and *S. vulgare* had electron-dense protrusions of the fibrillar wall. The spore walls of *S. pseudoendospora* and *S. reticulata* were of a uniform construction throughout, though *S. reticulata* had irregular thickenings of the wall which were seen as reticulate markings with the light microscope. Cysts had fibrillar walls devoid of ornamentation. The trophic stages of the four species differed from the dormant stages in regard to two major cytoplasmic features. Spores and cysts had electron-opaque bodies ranging in size from 0.25um to 0.37um which were coated with ribosomes while trophic stages never had them. Mitochondria of the dormant phases were coated with ribosomes, while the active phases had mitochondrial membranes which were free of ribosomes.

(40)

Growth Rates of *Corbicula manilensis* in the Clinch River, Tennessee

KENNETH W. EAGLESON AND ERIC L. MORGAN
Tennessee Technological University

A one year growth study initiated in November, 1975 has been completed on *Corbicula manilensis* in the Clinch River and two small tributaries near Oak Ridge, Tennessee. One tributary, Grassy Creek, served as a reference stream, receiving no agricultural, industrial or municipal discharges. A second tributary, Bear Creek, did receive considerable runoff from multiple sources, including industrial and land use management runoff

from forestry activities. At all sites, replicate holding chambers containing 21 clams each, were positioned immediately above the bottom and filled with substrate typical of the individual site. Clams were divided into three size classes having seven members per class contained in each chamber. Growth rates will be discussed in light of physical and chemical water quality parameters and the specific ecological setting. A comparison of growth rates between size classes will also be made.

(124)

Inventory and Classification of Wetlands

LIONEL ELEUTERIUS
Gulf Coast Research Laboratories

(No abstract received)

(35)

The Sulfur Cycle in a Coastal Wetland Ecosystem

JOSEPH B. ELKINS, JR. AND MARK M. BRINSON
East Carolina University

Portions of the sulfur cycle were studied in an alluvial swamp forest located on the Tar River 3.2 km north of Grimesland, North Carolina. Measurements included input of sulfur in precipitation, amount cycled from the canopy to the forest floor as litterfall, stemflow, and throughfall, and the concentration in the standing water and soil interstitial water. The exchange of sulfate between the overlying water and the soil was measured during a 5 day period using ³⁵SO₄ as a tracer. During autumn, activity in the overlying water layer of the biotic system (not formalin treated) was reduced within 24 hr to 25% of maximum in unfiltered samples and 22% in filtered samples. The activity in the abiotic system (formalin treated) was reduced after 24 hr to 45% of the maximum activity in the unfiltered samples and 38% in the filtered samples. Steady-state levels of activity were approached within one day in both systems. Major sinks of sulfur accumulation were diffusion to the soil and immobilization by decomposing leaves.

(270)

Flies as a Vector in the Spread of Staphylococcal Mastitis

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Western Kentucky University

Coagulase-negative *Staphylococcus* strains survived and most appeared to multiply in the digestive tract of flies. The organism was also isolated from the flies' vomit and fecal specks and survived in the dead flies. Since staphylococci are wide spread in the barn and in flies it appears that flies are vectors in the spread of staphylococcal bovine mastitis.

(325)

Habitat Selection of *Pimephales Notatus* and *P. Vigilax* (Cyprinidae) in a Laboratory Stream

ERIN G. ELLIS AND GLENN H. CLEMMER
Mississippi State University

The bluntnose minnow, *Pimephales notatus* (Rafinesque) and the bullhead minnow, *P. vigilax* (Baird and

Girard), are common minnows found in streams, rivers, and small lakes throughout much of eastern North America. *P. notatus* is reported primarily from smaller, clear streams and pools with various bottom types. *P. vigilax* is generally found in sluggish waters of larger ditches, pools and inland streams and appears to have more tolerance for turbidity and silt. Both species were tested in an artificial stream where current, bottom type, and water depth could be manipulated. When tested alone, *P. notatus* selected more for faster current and sand bottom. *P. vigilax*, alone, selected more for depth and gravel. Together, the two species chose the deepest area but an intermediate current and sand bottom. *P. notatus* chose sand significantly, but *P. vigilax* did not make a significant choice. The choices seem to reflect a preference for a specific type of substrate and to a lesser degree, for a specific range of depth and current, as the laboratory choices closely simulated the habitat the fishes occupy in nature.

(1)

The Life Cycle of *Eimeria utahensis*
(Protozoa: Eimeriidae)

JOHN V. ERNST

USDA, ARS, Regional Parasite Research Laboratory,
Auburn, Alabama

AND

BILL CHOBOTAR

Andrews University

Sporulated oocysts of *Eimeria utahensis* Ernst, Hammond, and Chobotar, 1968, were inoculated into coccidia-free kangaroo rats, *Dipodomys ordii*. The prepatent period was 9-10 days, and patent period was abnormally prolonged, up to 70 days. The endogenous life cycle was restricted to the small intestine and consisted of four asexual generations of schizonts and the micro- and macrogamonts. The schizonts were in epithelial cells in the distal half of the villi. Young gamonts initially were in epithelial cells of the crypts. Shortly after infection, however, the infected cells were displaced into the lamina propria, where the sexual stages matured. Mature microgamonts were approximately twice the size of mature macrogamonts. Only one type of wall-forming body was present in the macrogamonts.

(3)

Parasite Population Dynamics in Hatchery
Rainbow Trout (*Salmo gairdneri* Richardson)

HERMAN EURE

Wake Forest University

During the past several months trout have been collected from different locations within a hatchery complex for parasitological examination. Preliminary results show that trout caught in the hatchery stream harbor at least one species of nematode and two species of tapeworms. Trout caught in the hatchery lake, however, have been completely free of intestinal helminth parasites regardless of the location within the lake. Fish

reared in the hatchery lake are fed on a diet of Purina trout chow exclusively, while trout in the stream feed naturally with occasional supplements of trout chow. We postulate that the absence of invertebrate fauna from the diets of the lake trout precludes their having any intestinal parasites while those fish in the stream are selecting items from a natural food chain which includes infected invertebrates. Thus it appears that artificial feeding of hatchery rainbow trout may be performing the same function as anthelmintic drugs, namely, the exclusive parasites from the intestine of these fish.

(167)

Cuscuta japonica Choisy (Convolvulaceae)
Collected Again in North America

JOHN E. FAIREY, III

Clemson University

In October 1971, two collections of a robust dodder were made on the Clemson University Campus (*Leach 154, Fairey & Sawyer F526, CLEMS*). A large stand of *Pueraria* was the primary host, but the parasite was also observed on *Acer negundo* L., *Ligustium sinense* Lour., and *Phytolacca americana* L. Specimens were forwarded to Kek Botanic Gardens for positive determination where Bernard Verdcourt identified the plants as *Cuscuta japonica* Choisy. According to Yuncker (*Torreya* 44:34-35, 1944), the first report of this Asiatic species from either of the Americas was from San Antonio, Texas, in 1941 where it was found on kudzu in a greenhouse. In 1943, Erdman West collected specimens near Quincy, Florida, again on *Pueraria*. These collections from Clemson represent the third report of this unusual species in the New World and the first report from South Carolina. Duplicates of this collection (*Fairey & Sawyer F526*) will be distributed through the SABC Distribution of Southeastern Plants.

(268)

The First Occurrence of Chasmocleistogamy in
Clitoria mariana L. (Fabaceae)

PAUL R. FANTZ

University of Florida

Clitoria mariana is distributed in Southeast Asia and the Eastern United States (New Jersey to Florida, west to eastern Texas). Cleistogamous flowers and chasmodichogamous plants are known from the American variety, but absent from the Asian variety. Cleistogamy and chasmodichogamy occur in both the typical form and the pubescent form of Florida. Each inflorescence usually bears a pair of flowers, either both chasmogamous or both cleistogamous. Cleistogamous flowers are easily distinguished from chasmogamous flowers by the lack of petals and minute calyx. A specimen in the Carter herbarium (PH), collected Aug. 1, 1906, from Culley's, Lancaster County, Pennsylvania, has the rare occurrence of chasmocleistogamy. One flower of the inflorescence pair is chasmogamous, whereas the other flower is cleistogamous. The only other occurrence of chasmocleistogamy in the genus was found in a specimen of *C. guianensis* from Minas Gerais, Brazil (*Irwin 2384, US 2324452*).

(168)

Notes on the Endangered Florida Endemic,
Clitoria fragrans Small (Fabaceae)

PAUL R. FANTZ
University of Florida

Clitoria fragrans is an endemic of regrowth, sand scrubs of Polk and Highland Counties, Florida. The species is easily distinguished from *Clitoria mariana* by its narrow leaves, glaucous stems and fruits, smaller flowers, and longer-stalked, smaller fruits. The plants flower during May-June, although the exact period for a population in a given year usually lasts less than a week. Cleistogamous flowers are produced over longer periods. Small deposited the type specimen at the New York Botanical Garden although Gleason was unable to locate the type in 1945. An isotype (NY) was selected as the lectotype. Small's type locality data ("Sandhills near Desoto City") were ambiguous; however, the sandhills position has been fixed. Present populations, including the type locality, are scarce, often low in numbers of individuals, and threatened by the rapid advancement of citrus groves and condominium-recreational complexes.

(266)

Ovule Development, Megasporogenesis, and
Megagametogenesis in *Ludwigia alternifolia* L.

DALE R. FARENCE JR.
University of South Carolina

Ovules of *Ludwigia alternifolia* L., fixed in FPA₅₀, (formalin, propionic acid and ethanol 50%), and pre-treated with lactic acid at 60C for 24 hr were immersed in the Herr Clearing Fluid (phenol, clove oil, chloral hydrate, lactic acid 85% and xylene, 2:2:2:1 by weight). The bitegmic, crassinucellate ovule attains its final anatropous position prior to the initiation of meiosis I. It produces a linear tetrad of megaspores, the micropylar member of which becomes functional. Frequently concurrent growth is exhibited by other tetrad members, most notably the chalazal megaspore. The functional megaspore gives rise to a 4-nucleate megagametophyte of the *Oenothera* type.

(222)

Growth Curve Analyses: Investigation of a New
Tool For Studying the Effects of Environmental
Stress Upon Wildlife Populations

TIMOTHY T. FENDLEY AND I. LEHR BRISBIN, JR.
Savannah River Ecology Laboratory

Recent advances in the development of mathematical procedures for the qualitative and quantitative analyses of sigmoid growth curves have provided a new tool for assessing the impacts of environmental contaminants upon populations of game birds and possibly other forms of wildlife. Because derived sigmoid growth parameters are usually based upon mathematical fits to a relatively large number of data points for each individual, they should be relatively free from biases introduced by random measurement errors. Such growth parameters,

moreover, can also provide an integrative assessment of the health or condition of an animal over its entire period of growth and development. The use of growth curve analytical techniques is illustrated with data for laboratory-reared wood ducks (*Aix sponsa*) hatched from eggs laid by birds inhabiting a swamp delta contaminated with nuclear reactor effluents, principally radiocesium. Only sex, regardless of habitat contamination, affected the growth curve asymptotes, those of males being greater than those of females.

(223)

Uptake and Elimination of Radiocesium by
American Coots (Rallidae) Inhabiting a
Reactor Cooling Reservoir

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Iowa State University
MICHAEL J. VARGO
Savannah River Ecology Laboratory

The uptake and elimination of radiocesium were studied in American Coots (*Fulica americana*) wintering on the Par Pond reactor cooling reservoir system of the U. S. ERDA Savannah River Plant. Determinations were made of the times required for individual birds to reach equilibrium concentrations, after being confined to portions of contaminated reservoir habitat. Birds were then moved to a pen located in uncontaminated habitat in order to determine the rate of their radiocesium elimination. This information, together with field studies of radiocesium concentrations in free-living birds, is needed to assess any possible hazards to human health which might result from eating contaminated waterfowl.

(244)

The Kings-Crowders Mountain Region: A
Milliped "Cluster" Area in North Carolina
(Diplopoda)

MARIANNE FILKA AND ROWLAND M. SHELLEY
North Carolina State University and
North Carolina State Museum

The 1975 Symposium on Endangered and Threatened Biota of North Carolina disclosed several "cluster" areas with more than one species of concern to the state. Subsequent investigations in the Kings-Crowders Mountain region of Cleveland and Gaston Counties have revealed a unique diplopod fauna that warrants similar attention. Of twenty species collected, four xystodesmids and one callipodid are of particular interest. The north-eastern range limit and only authentic North Carolina records of *Pachydesmus crassicutis incurtus* Chamberlin are in this area. *Deltotaria lea* Hoffman and an undescribed xystodesmid genus are concentrated here, but are also known from single males collected near Lincolnton. The callipodid, *Delophon* sp., has been encountered here, over 100 miles east of previously reported localities. Finally, *Boraria stricta* (Brölemann) reaches its eastern range limit in the area. Because of this unique milliped fauna, we believe that the Kings-Crowders Mountain region should be recognized as another "cluster" area in North Carolina.

(61)

Distribution of the subgenus *Pennides* of the
crawfish genus *Procambarus* in Mississippi
(Decapoda, Cambaridae)

J. F. FITZPATRICK, JR.
University of South Alabama

The subgenus *Pennides* of the crawfish genus *Procambarus* is represented in Mississippi by 7 taxa, some of which are undescribed. Members of this subgenus occur everywhere in the state except the fluvial plain of the Delta. The distributions are perfectly complementary, no known cases of sympatry existing. Two, *P. lagniappe* Black and *P. lylei* Fitzpatrick and Hobbs, have very restricted distributions. *P. penni* Hobbs and *P. clemmeri* Hobbs are sibling species, and all records of the former from east of the Pearl River should be referred to the latter. The most widespread taxon, extending in all drainages from the southwest corner of the state to the Tennessee drainage in the northeast, is an undescribed subspecies of *P. vioscai* Penn. Analysis of the distribution patterns reveals much about the invasion of the central Gulf Coastal Plain by members of this subgenus. — *Supported in part by the University Research Committee.*

(196)

Extinction Rate for Angiosperms

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The Smithsonian's listing two years ago of about 10% of the vascular plants of the United States as endangered or threatened with extinction implies impending national disaster. This is reinforced locally by botanists in several states who want the list extended. Reports of an increased vertebrate extinction rate for the world seem to have nurtured general fear that flowering plants are suffering comparably everywhere. Our view of expansion of the human population and the emotional aspects of man's encroachment on wildlife are such that we may have difficulty keeping our minds open to the implications of the fact that the angiosperm extinction rate has been declining in the contiguous United States since the formation of the Forest Service. While we should stay alert to potential dangers to American flora, we should also recognize the advancements achieved, perhaps serendipitously, for plants in the areas of management and preservation.

(155)

Phytotron Study of Growth Rates in Diploid and
Tetraploid Chromosomal Races of *Epilobium*
angustifolium (Onagraceae)

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Duke University

Twelve clones each of two chromosomal races of *Epilobium angustifolium* from the Beartooth Mountains (Wyoming) were grown from field-collected rootstocks under common conditions in the Phytotron. Each clone was chromosomally identified as diploid ($n = 18$) or tetraploid ($n = 36$) through meiotic squashes of phytotron-grown material. Each clone was represented by four replicates. Measurements of the plants at 20, 40

and 65 days after planting indicated that diploids put out leaves significantly earlier and reached maximum leaf length and shoot height faster than tetraploids, although the initial weight of the diploid rootstocks was lower. Diploid plants also flowered significantly earlier than tetraploids. Ecological significance of these physiological differences is discussed in relation to the prevalence of diploids at higher, and tetraploids at lower elevations in the field study site.

(329)

The Fence Lizard (*Sceloporus undulatus*) in
Alabama: A Study in r-Selection

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University of Alabama in Birmingham

A field study of a population of *Sceloporus undulatus* in central Alabama revealed demographic characteristics closely associated with an r-selected life history strategy. When compared to available data for *S. undulatus* in more northern parts of its range, the Alabama population has higher reproductive potential and growth rates and a lower survivorship. Specifically, females of the Alabama population lay up to four clutches of eggs per year. The growth of hatchlings is extremely rapid, with some individuals reaching snout-vent lengths of greater than 60 mm by October. All individuals reach sexual maturity in less than a year. However, less than 5% of the young hatched apparently survive to reproductive maturity. The potential selective pressures contributing to the above life history parameters are discussed.

(255)

The Distribution, Chromosome Numbers and
Types of Various Species and Taxa of
Hymenocallis

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Wake Forest University

A review of all known chromosome numbers in *Hymenocallis* species is presented. This includes new counts of 114 accessions from 200 taxa (about 48 species) collected in the southwestern United States, Mexico and the West Indies. Numbers are reported for the first time for 31 species, and in addition 6 hybrids, and 14 accessions not yet identified and named. Chromosome number origin and evolution in *Hymenocallis* are considered, and taxonomic implications of the results are considered.

(4)

The Occurrence and Distribution of Intestinal
Flagellates in Anura of South Carolina
(Zoomastigophorea)

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AND
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University of South Carolina

This study examines the occurrence and distribution of the intestinal flagellates present in the frogs and toads of South Carolina. A total of 427 frogs and toads rep-

resenting seven genera and twenty species were collected from twenty different collection sites throughout the state from March 1971 until September 1976. Each of the four physiographic regions of the state (Mountain, Piedmont, Sandhills, and Coastal Plain) are represented by collection sites. Thirteen species of intestinal flagellates were identified: *Chilomastix canllcryi*, *Hexamitus intestinalis*, *Karotomorpha swezyi*, *Monocercomonas batrachorum*, *Monocercomonoides melolonthae*, *Octomastix batrachorum*, *Octomitus neglecta*, *Retortamonas dobelli*, *Trepomonas agilis*, *Trinitus parvus*, *Tritrichomonas augusta*, *Tritrichomonas batrachorum*, *Urophagus intestinalis*. The ecological distribution and host-parasite relationships of these parasites are discussed. The morphological descriptions of the intestinal flagellates are based on specimens impregnated with the silver-protein (Protargol) technique.

(65)

Observations on the Natural History of the Black Creek Crayfish, *Procambarus pictus* (Decapoda: Cambaridae)

RICHARD FRANZ
Florida State Museum

The Black Creek crayfish, *Procambarus (Ortmanniicus) pictus* Hobbs, is endemic to the Black Creek drainage in northeast Florida. Data gathered from a monthly survey of one creek suggest that the species is annual. Females with eggs (or young) were found from April to September and measured 22 to 30 mm C.L. (46 to 68 mm T.L.). The number of eggs per female ranged from 100 to 146 ($\bar{X} = 127.8$). Form 1 males were observed from November through September, reaching a peak in July. Form 1 males ranged in size from 20 to 28 mm C.L. (45 to 72 mm T.L.). Copulation was observed in both the stream and holding buckets during the spring and summer months. Recruitment of young into the population occurred primarily during the summer months.

(63)

Geologic and Geographic Distribution of Florida's Troglotic Crayfishes

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DAVID S. LEE
North Carolina State Museum of Natural History
BRIAN HOUHA
University of Florida

The current knowledge of Florida's troglotic crayfish fauna is reviewed and interpretations of distributional patterns are presented. These crayfishes are restricted to certain geologic formations having light to non-existent clastic overburdens. Areas with moderate to heavy accumulations over the carbonate rocks lack these crayfishes. The Crystal River Formation, a group of highly soluble Eocene limestones, is the most important geological element influencing distributions of most Florida cave-dwelling crayfishes. Members of the *Procambarus lucifugus* complex, *Troglocambarus maclanei*, *Procambarus acherontis* (?), and *Cambarus cryptodytes* are apparently confined to this formation. *Procambarus pallidus* occurs primarily in the Crystal River Formation, although 2 sites may be in the Suwanee Limestone. The remaining species are confined to still other limestones

(*Procambarus milleri* in Miami oolite, *Procambarus horsti* and *Procambarus orcinus* in St. Marks Formation).

(272)

Variations in Operculum Structure in Sporophores of the Acellular Slime Molds (Myxomycetes)

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University of Georgia
RAY SIMONS
Fernbank Science Center

Sporophores of some species of myxomycetes are characterized by the development of a well-defined operculum that separates circumscissilely when the sporophore matures. *Metatrichia vesparium*, *Trichia crateriformis*, some species of *Licea*, and *Craterium* are myxomycetes that have operculate sporophores. Previously, the structure of the operculum has been considered to be similar to that of its associated peridium. Scanning electron microscope studies have revealed a distinctly different operculum-peridium structure for some operculate slime molds. Sporophores of *Licea kleistobolus* and *L. parasitica* have non-cellular opercula with pitted or perforated surfaces. *Craterium minutum* has a non-cellular operculum that consists of a closely packed stroma of spherical operculum that consists of a closely packed stroma of spherical lime granules. The operculum of *Metatrichia vesparium* sporangia is like the peridium in being smooth and non-cellular. Sporangia of *Trichia crateriformis* possess the most distinctive type of operculum. It is cellular in structure and consists of a one-cell-thick layer of spore-like units. Its associated peridium is non-cellular.

(233)

Amensalistic Competition between *Corbicula manilensis* (Philippi), the Asiatic Clam (Corbiculidae), and Fresh-Water Mussels (Unionidae) in the Savannah River of Georgia and South Carolina (Mollusca: Bivalvia)

SAMUEL L. H. FULLER AND JAY W. RICHARDSON
Academy of Natural Sciences of Philadelphia

Previous reports (e.g., Fuller and Imlay, 1976, *The ASB Bulletin*, 23:60) have suggested that *Corbicula manilensis* is especially successful in habitats (1) that have been disturbed by man and (2) whose native benthos, especially fresh-water mussels, has been in some degree eliminated. Unfortunately, we have evidence that the (more agile) Asiatic Clam can compete actively against mussels, even in undisturbed areas. During recent surveillance of the Savannah River macroinvertebrate community, we noticed unusually large numbers of uprooted mussels and often found a unionid, about to be dislodged, surrounded by these clams, including individuals burrowing beneath the mussel. Displacement of mussels was more common on firmer substrates, which presumably offer *C. manilensis* added purchase. This competition conforms to Odum's (1959, *Fundamentals of Ecology*) concept of amensalism and possibly explains reports (e.g., Gardner *et al.*, 1976, *The Nautilus*, 90:117-125) of negative correlation between numbers of mussels and of Asiatic Clams. An uprooted mussel probably will become a dead mussel.

(330)

Comments on a Unique *Pseudacris* Complex
(Amphibia: Hylidae) in Virginia

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North Carolina State Museum of Natural History

Field studies of breeding populations of *Pseudacris* in the Mattaponi drainage, east-central Virginia, revealed the presence of three sympatric forms: *P. brimleyi*, *P. triseriata feriorum*, and a form indistinguishable from *P. t. kalmi*. These observations support the contention, based on parallel studies of other species groups in the area, that this drainage is a tension zone between northern and southern herpetofaunal elements. Investigations of micro-habitat selection revealed that *P. brimleyi* calls exclusively from within clumps of emergent grasses in water 3-5 feet deep, while *P. t. feriorum* typically selects calling sites in densely vegetated, shallow water. The two species will breed simultaneously in the same pond if both types of micro-habitat are present. The "*kalmi*" form, which has not previously been reported from south or west of Chesapeake Bay, was encountered at several localities, always in deeper water not frequented by *P. t. feriorum*. Elsewhere in their ranges where these two subspecies are in contact intergradation occurs. The apparent maintenance of genetic integrity by the two forms in the Mattaponi drainage suggests a re-evaluation of the *P. triseriata* complex.

(217)

Foraging Territories of the Florida Harvester Ant,
Pogonomyrmex badius (Hymenoptera:
Formicidae)

JOHN B. GENTRY

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and

JAMES M. DUNBAR

Michigan State University

The Florida harvester ant is an important granivore (seed-eater) in the old-field ecosystem of the southeastern United States. Colonies are distributed in a highly regular spatial pattern which, despite seasonal nest relocations, remains constant from year to year. These data, along with information on foraging patterns, indicated that the ants have adopted a foraging strategy which allows for more efficient utilization of available food resources. To build on this knowledge, a study was designed to determine foraging territories of individual colonies. Foraging workers from 10 adjacent colonies were individually marked and observed during daily foraging periods. Each colony had a well defined foraging territory with very little overlap with neighboring colonies. There was no evidence of aggressive defense of the territories. Comparisons are made between foraging territories before and after nest relocation.

(160)

A Case of Cytoplasmic Male Sterility in *Nicotiana
tabacum* and Its Restoration

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North Carolina State University at Raleigh

Cytoplasmic male sterility often occurs in *Nicotiana* when the chromosomes of one species are introduced

into the cytoplasm of another. F₁ hybrids between *N. tomentosiformis* and *N. otophora* show complete pollen abortion if *N. tomentosiformis* is used as the female parent; the reciprocal cross is male fertile. In hybrid derivatives from *N. repanda* and *N. tabaeum* anthers are abortive following replacement of the chromosomes of *N. repanda* by the genome of *N. tabaeum* in *N. repanda* cytoplasm. Introduction of a very short centric fragment derived from *N. repanda* restores normal morphology and high pollen fertility. This satellited fragment is attached to the nucleolus in pachytene and diplotene cells (constitution 24_{II} + f) and furthermore, seems to be the only chromosome involved in nucleolar organization in meiotic cells; the nucleolus organizing capacity of *N. tabaeum* chromosomes is suppressed ("amphiplasty"). Thus, a plant with *N. repanda* cytoplasm is male sterile if the nucleolus is formed by *N. tabaeum* organizers but fertile if an organizer from *N. repanda* is active. Whether this relationship is causal or coincidental needs to be studied by analyzing the location of other restorer genes. There exist several suitable male sterile lines combining alien cytoplasm with *N. tabaeum* nuclei and the search for restorers is underway in a number of laboratories. (Incidentally, K. Tsunewaki, Jap. J. Genet. 49:425-433, 1974, noted that all the satellited chromosomes so far tested in the Triticeae carry restorer genes. Other restorers, however, were found on unsatellited chromosomes). Whether nucleoli and/or their ribosomal RNA may have specific functions in anther development is a subject for further inquiry.

(337)

The Evolutionary Significance of Delayed
Emergence from the Nest by Hatchling Turtles
(Chelonia: Reptilia)

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Delayed emergence from the nest is geographically and phylogenetically widespread among turtles. In North America, this phenomenon is usually manifested as overwintering in the nest as hatchlings or advanced embryos. As a result hatchlings enter the aquatic habitat in the spring rather than in the fall as generally expected. Field data on almost 400 hatchlings of five species from the climatically-mild environment of South Carolina reveal that overwintering typifies several species of aquatic turtles indigenous to the southeastern U.S. Emergence times were not correlated with rainfall. We therefore reject conventional explanations of the "cold climate" and "dry weather trap" hypotheses proposed by others to account for the emergence of hatchlings in the spring. We submit evidence that delayed emergence is a strategy of species living in environments in which high unpredictability and uncertainty prevail for hatchlings emerging immediately upon hatching.

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Net Productivity of *Juncus roemerianus* Scheele
and *Spartina alterniflora* Loisel. Estimated From
CO₂ Uptake

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University of Georgia

The net, above-ground productivity of *J. roemerianus* and the short and tall forms of *S. alterniflora* was calculated from data gathered by gas exchange techniques.

Daily rates of CO₂ fixation (mg CO₂ dm⁻² leaf area day⁻¹) under ambient conditions were measured on *in situ*, intact plants in the marshes at The University of Georgia Marine Institute on Sapelo Island, Georgia. These rates were converted to a marsh area basis using leaf area indices measured in the same marshes. Corrections for night respiratory losses were applied and root:shoot ratios were used to estimate the final net productivity values. Above-ground, net productivity values calculated for short *S. alterniflora* agreed well with harvest values in the literature. Values calculated for *J. roemerianus* and tall *S. alterniflora* were higher than literature harvest values. Reasons for these differences are discussed.

(129)

People Problems and Public Relations in Natural Areas

L. M. GOODWIN, JR.

Weymouth Woods—Sandhills Nature Preserve

(No abstract received)

(94)

Leucocytozoon smithi (Haemosporidia: Leucocytozoidae): Effect of Enucleation, Pinealectomization and Caponization on the Periodicity of Gametocytes

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Gametocytes of *Leucocytozoon smithi* in both peripheral and cardiac blood of domestic turkeys undergo a circadian change in numbers (Noblet and Noblet, 1976). Peak parasitemias of birds exposed to either natural or reverse photoperiods coincide with the midpoint of the light period while low parasitemias occur during the dark phase (Noblet and Noblet, in press). To further elucidate factors which might influence the circadian pattern, turkey hosts were either enucleated, pinealectomized, enucleated plus pinealectomized, or caponized. Approximately 4 weeks after the surgery was completed, peripheral parasitemias of 6 turkeys in each of the 4 experimental groups and of 6 control turkeys were determined every 2 hours during a 36-hr time period. Results indicated no significant difference in cyclic changes in gametocyte numbers between experimental and control turkeys. Additional parameters under investigation are temperature and feeding activity.

(23)

Plasma Testosterone and Estrogen Levels in the Gulf Killifish, *Fundulus grandis* (Pisces: Cyprinodontidae)

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University of Alabama, Birmingham

Plasma testosterone or estrogen levels were determined in male or female Gulf killifish by radioimmunoassay. Plasma samples were taken during the day from 6 different groups (400, 0800, 1600, 2000 or 2400 hr). Plasma from several fish were pooled to provide sample sizes of 100ul. The plasma testosterone levels (4.5 ± 1.2 ng/ml) for male Gulf killifish caught in October (preparatory period) are in the range previously re-

ported for immature or castrated Rainbow trout, *Salmo gairdneri*. No evidence of a daily rhythm of plasma gonadal steroids was observed. The plasma estrogen levels (764 ± 104 pg/ml) for female killifish caught in October, are considerably lower than reported for the Rainbow trout (4.4 ng/ml). However, the values obtained from the Gulf killifish are in accordance with ranges reported for non-reproductively active reptiles, birds and mammals (50-1200 pg/ml).

(313)

The Response of *Selenastrum bibrainum* to Varying Concentrations of Gibberillic Acid

JOHN H. GREENE III, OEVIA V. ADAIR,
AND MARGARET MILLER
University of South Alabama

The effects of five different concentrations of gibberillic acid, a plant hormone, on a unicellular green alga, *Selenastrum bibrainum*, were noted in laboratory cultures. Two techniques were employed to determine the growth curves. First, the individual cells were counted using a hemacytometer and second, by measuring the turbidity of the solution in a Spectronic 20. Gibberillic acid stimulated the rate of growth at all five concentrations tested by shortening the lag and log periods of the growth cycle. Maximum growth was noted at 20 ppm. There was no observed change in cell size as a result of hormonal activity in contrast to reports by other workers using other green algal species.

(334)

Considerations of Growth Processes and Body Size of Aquatic Turtles

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Savannah River Ecology Laboratory

Numerous ecological studies have been concerned with growth rates and body size of aquatic turtles. Explanatory models have been proposed by some authors and the evolutionary and ecological significance have been discussed. The present study involves the examination of long- and short-term growth rates of freshwater turtles from South Carolina populations. Because of the relatively long period of study (9 years) and the large sample sizes (N > 1000) several aspects of growth and sizes are addressed.

(9)

A Comparison of the Life Histories of Three Digenetic Trematodes (Trematoda: Opisthorchiida: Cryptogonimidae)

GEORGE J. GREER AND KENNETH C. CORKUM
Louisiana State University

Three adult cryptogonimid trematodes were found in largemouth bass, *Micropterus salmoides*, taken from False River, Point Coupee Parish, Louisiana. Distinct site preferences were shown by the adult worms in the intestine. Incidence of infection in the snail host, *Cincinnati peracuta*, varied considerably between the three species and correlated well with the differences noted in the incidence and intensity of adult infections. Cercarial emergence of two species from snails maintained under natural conditions occurred exclusively during the

day. Metacercariae of all three species were recovered from the body muscles of a variety of sunfishes, *Lepomis* spp. Egg production by adults began several days after metacercariae were fed to bass.

(162)

Studies of Recombination in the
Drosophila Oocyte

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*Oak Ridge National Laboratory and *Hope College*

The temperature sensitive period for increasing recombination as well as the relation of this period to premeiotic S and to synaptonemal complex formation have now been defined through the use of a synchronous oocyte sample. Females developing at a control temperature of 25C produce the first oocyte in each of their 30-40 ovarioles close to pupation at 132 hr. These oocytes represent a synchronous sample which can be followed cytologically because each occupies the posterior-most position in the ovariole and which can be recovered for genetic analysis because they are the first eggs to be laid. Labeling studies show that DNA replication in these oocytes begins at ~132 hr and continues for 30 hr. Increases in recombination, induced by a 12 hr treatment at 35C, are confined to virtually the same period. In euchromatin the pattern of heat-induced increases resembles those produced by the "interchromosomal effect" but in the heterochromatin of chromosome 2 where heat has its maximal effect, the "interchromosomal effect" is absent. Electron micrographs and electron micrograph autoradiographs demonstrate that synaptonemal complex formation begins less than 6 hr after DNA replication and heat response are initiated, implying that homologues are suitably paired for recombination during premeiotic S. — *Research supported by Energy Research and Development Administration under contract with Union Carbide Corporation.*

(185)

Observations on the moss genus *Leiomeles*

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University of Florida

The bartramiaceous genus *Leiomeles* is fairly well circumscribed by the absence of whorled subperichaetial branches and the immersed, non-plicate capsule. *Leiomeles* shares several morphological features with *Anacolia*, and certain species of the two genera may be mutually confused; however, if other characters such as number of cell layers composing the leaf lamina and position of leaf papillae are considered, the problem of identification is minimized. The two genera may not be distinguished, as Brotherus suggested, on the basis of a dioicous versus synoicous condition. While all known species of *Anacolia* are dioicous, the situation in *Leiomeles* is quite variable. Even the supposedly synoicous species, *L. bartramioides*, if regarded in a broad taxonomic sense, includes dioicous forms. The use of the deciduous leaf character to distinguish species of *Leiomeles* requires much further study. Though given considerable weight in some cases (e.g., *L. deciduifolia* Herz.), the extent of deciduousness within and between populations varies considerably and may be environmentally related—most collections examined in this study with deciduous leaves came from exposed rock surfaces. One species, *L. setifolia*, occupies an uncertain position in the genus. Hooker, in the tradition of

the day, placed it in *Gymnostomum*, based on the lack of a peristome. Mitten assigned it to his Subsection *Leiomeles*, Section *Eubartramia*; however, he mistakenly equated it with *Bartramia intertexta*, a species belonging to the genus *Anacolia*. Paris' combination, *Anacolia setifolia*, was rejected by Flowers who reassigned the species to *Leiomeles*. Within the genus *Leiomeles* this species is unique. The capsules are exerted on an elongated seta. The basal portion of the leaf is devoid of papillae, and a hyaline border extends along the basal margins somewhat reminiscent of the condition in *Tortella*. To retain *L. setifolia* in its present taxonomic position will require a modification of our present concept of *Leiomeles*.

(16)

Effects of Continuous Chlorination on White
Perch (*Morone americana*) and Atlantic
Menhaden (*Brevoortia tyrannus*) at
Two Temperatures

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AND

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Continuous flow bioassays for 96 hours showed menhaden to be more sensitive than white perch to chlorine produced oxidants (CPO) at 15C but not at 25C. The LC50 for menhaden was 0.18 mg/l and 0.15 mg/l CPO at 15C and 25C respectively, while the LC50 for white perch was 0.21 mg/l and 0.15 mg/l CPO at 15C and 25C respectively. During these bioassays 100% mortality was observed at higher CPO concentrations, while at lower concentrations no mortality was observed. Mortality at the higher concentrations occurred within the first 24-48 hr. A concurrent evaluation of various blood and gill physiological parameters revealed an ability of the fish to tolerate the lower CPO concentrations. Hence, chlorine produced oxidants appear to produce a threshold response rather than a gradient response for menhaden and white perch. — *This research was supported by the State of Maryland Department of Natural Resources, Power Plant Siting Program under contract number 25-75-04.*

(269)

Floral and Seed Biology of *Seymeria cassioides*
(J. F. Gmel.) Blake (Scrophulariaceae)

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Seymeria cassioides is a host specific hemiparasite which may kill or damage young pines under conditions of water stress. The small yellow flowers are visited by various Hymenoptera, Coleoptera, and Diptera. The anthers of the genus *Seymeria* are unique among the Scrophulariaceae in that they have apical dehiscence. The flower is apparently adapted for pollination by Hymenopterans which cause the flower to bend, sprinkling pollen on the floral visitor. Other insects may visit the flowers and forage for nectar, however, these floral visitors apparently do not activate the pollination mech-

anism. Seeds were recovered and numbers of seeds per unit of soil and soil depth were determined.

(36)

Changes in Soil Salinity of a Mississippi Tidal Marsh

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Soil salinity (i.e. the salinity of the free soil water) was examined at 11 stations along a transect on a Mississippi tidal marsh dominated by *Juncus roemerianus* and *Spartina cynosuroides*. Changes in soil salinity were reflected in salinity changes of the nearby surface water. Soil salinity was usually higher, varying between 2.5 and 15.8 ‰ between February 1975 and January 1976, while the salinity of the nearby surface water varied between 0 and 11.5 ‰. Following a long period of high salinity in the bay and sound, the soil salinity increased up to 16.8 ‰ maximum in October 1976. Soil salinity increased as the distance of the sampling station from the flood water increased. The higher soil salinities did not seem to affect any of the marsh plant species and marsh plant zonation did not appear to be due to soil salinity.

(219)

Periodic Regression Analysis of Ecological Data

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Periodic regression analysis is a technique for analyzing data which vary periodically over time. Many ecological parameters exhibit this characteristic and lend themselves to this type of analysis. The advantage of periodic regression analysis lies in the ability to test hypotheses concerning relative amplitudes and phases of fitted curves. These hypotheses may be of interest in predicting or testing periodic phenomena. An application of periodic regression analysis to an ecological problem is included.

(189)

The Effects of Varying Nutrient and Density Levels on Allelopathy of *Helianthus annuus* L. var. "Russian Mammoth" (Asteraceae) on *Amaranthus retroflexus* L. (Amaranthaceae)

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Helianthus annuus L. var. "Russian Mammoth" (sunflower) plants were grown under different nutrient levels (complete, 1/2, 1/4, 1/8, 1/16 strength Hoagland's solution) and at different densities (1, 3, 6, 12 plants per pot) under both greenhouse and field conditions. The plants were harvested after six weeks, freeze-dried and dry weights were determined. Phenols were determined as percent chlorogenic acid equivalents. Plant weight decreased significantly with decreasing nutrient levels and increasing density. Percent phenol content increased significantly with decreasing nutrient levels but no clear

trend of percent phenol content was evident with changing densities. Two levels (2.5 grams/pot) of ground sunflower debris from each of the nutrient levels (combining the various densities under each nutrient level) were added to pots containing *Amaranthus retroflexus* L. (pigweed) seeds under greenhouse conditions. The effects of these debris on the germination and vegetative growth of the *A. retroflexus* seeds will be discussed.

(133)

The Succession of the Phytoplankton Community and Primary Productivity in a New Reservoir, Lake Anna, Virginia

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Lake Anna is a recently impounded reservoir constructed by the Virginia Electric and Power Company to provide cooling water for a four million kilowatt nuclear powered electrical generating facility, presently under construction in Louisa County, Virginia. Impoundment of the North Anna River created the 13,000 acre reservoir, which has been under limnological investigation since its formation in January, 1972. Preoperational investigations of the phytoplankton community indicated a distinct periodicity of standing crop, chlorophyll *a* and primary productivity. The mean annual algal standing crop increased for Lake Anna during 1975, in comparison with 1973 and 1974 values. Chlorophyll *a* concentrations and primary productivity showed a steady decline through the study period. Maximum values for these parameters occurred during the initial years of impoundment (1973 and 1974). These findings indicated that the development and stabilization of the phytoplankton community has followed the general trends expected for ecological succession in reservoirs. These trends are an increase in phytoplankton diversity and relative abundance of species, an initial increase in productivity, followed by a sharp decline, and stabilization. These events indicate that the Lake Anna phytoplankton community is approaching stabilization.

(336)

Range Determination of the Bog Turtle in Maryland

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A distribution survey of the bog turtle (*Clemmys nullenbergi*), a state-listed endangered species, was initiated in Maryland in March 1976. Twenty-eight colonies were historically known from Carroll, Baltimore, Harford and Cecil Counties. Methods involved classifying potential bog turtle habitat on soil survey maps according to their soil type, degree of saturation, and vegetation. Field work involved cataloguing areas and searching the potential sites for bog turtles. The addition of significant numbers of new colonies suggests a reassessment of the endangered status of the bog turtle in Maryland. However, final determination of status must wait until field work is completed.

(258)

Taxonomic Studies of the Genus *Agalinis* Raf.
(Scrophulariaceae) in the Southeastern
United States

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AND
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Southern Forest Experiment Station

Approximately 20 species of *Agalinis* occur in the Southeastern United States. Identification of field and herbarium material is often difficult due to overlapping morphological characters and a lack of descriptive information. Criteria used to separate species include pubescence of stems and corollas, sepal morphology, and presence or absence of yellow lines in the corolla. Field studies indicated that floral morphology (attitude of corolla lobes, corolla symmetry) may provide useful taxonomic information, previously overlooked. In addition, SEM studies of seeds has proven useful in separating groups of species. All species are root parasites; some will form numerous attachments to commercial tree species when grown in pots and may be potential pathogens. Some species of *Agalinis* will grow vigorously without attachment to any host.

(165)

Analysis of Variation in *Shortia galacifolia*

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North Carolina State University

Shortia galacifolia T. & G. is a rare and endangered species confined to two restricted areas along the Blue Ridge Escarpment. The objective of this study is to examine the variation of *S. galacifolia* throughout its geographical range. Fresh material and herbarium specimens of four populations of *Shortia* were examined. Morphological, anatomical, chromatographic, and cytological variation in the populations was analyzed. These results suggest that the taxonomic treatment of this species be reconsidered.

(6)

Observations on the Parasite Fauna of the
American Alligator, *Alligator mississippiensis* in
South Carolina

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Specimens of the American Alligator were obtained from the Par Pond reservoir system, located on the Savannah River Plant, Aiken, South Carolina, and from several coastal areas of South Carolina. All animals were systematically necropsied and examined for helminth parasites. The helminth fauna of the alligator included one species of pentostome, four species of trematodes and two species of nematodes. Results to be presented will focus on: 1) the distribution of the parasites within the host, 2) food habits and age of the host in relation to parasites present, and 3) a description of gross pathology produced by the parasites. In addition, the parasite fauna of alligators from a thermally altered

inland lake (Par Pond) and that of alligators from coastal areas of South Carolina will be compared.—*This study was supported by Contract E(38-1)-965 between ERDA and Wake Forest.*

(98)

Light and Electron Microscope Studies on Lesions
Associated with Red-Sore Disease in
Large-mouth Bass

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The gram-negative bacterium, *Aeromonas hydrophila*, and the peritrich ciliate, *Epistylis* sp., have been identified as the causative agents for red-sore disease in large-mouth bass, *Micropterus salmoides*, throughout the southeastern United States. The combination of the bacterium and the ciliate produces scale erosion and pit-like lesions on the surface of infected fish. The histologic and ultrastructural characteristics of the lesions were examined using light, fluorescent and electron microscope procedures. Special attention was focused on the host inflammatory response, as well as the attachment ultrastructure of *Epistylis* to the scale surface.—*This study was supported by Contract E(38-1)-900 between ERDA and Wake Forest University.*

(173)

Flora of Cedar Lake Reservoir, Jackson
County, Illinois

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Cedar Lake Reservoir is located approximately five miles south of Carbondale in southern Illinois. The area investigated consists of about 3000 acres within the Shawnee Hills Physiographic Division. High habitat diversity results from the very rugged topography. Pennsylvanian-aged bedrock underlies most of the region. Over 850 species of vascular plants have been collected and identified from the Cedar Lake area. Among these, several unusual records were made for southern Illinois.

(228)

Factors Affecting Protozoan Colonization of
Artificial Substrates In the Laboratory

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Artificial substrates which had been previously colonized by protozoa while anchored in Douglas Lake, Michigan were used as sources of potential colonizers of island substrates in a laboratory system. Numbers of species of protozoa on the laboratory island substrates were found to increase over time in a pattern similar to colonization of artificial substrates in the field, even though passive dispersal of protozoan dissemules was minimized. The length of time of previous colonization of the epicenters, their qualitative species composition, and their distance from the artificial islands were important in determining the rate of island colonization under laboratory conditions. The use of previously colonized artificial substrates as epicenters in studies of island colonization is advantageous because

the pool of potential colonizing species can be readily determined; this is not the case in field studies.

(149)

Aspects of Plant Growth Modeling: Leaf Aging and Branching Behavior

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Cotton, sorghum, and soybean plants were grown in the six Duke University phytotron greenhouses (17/11 to 32/26 C 8-hr/16-hr temperature regimes, 3°C steps) to determine temperature effects on leaf aging and vegetative branching or tillering. Leaves were tagged at early expansion and dead leaves counted periodically. Plants were mapped as to branch nodes or tillers at about the same stages of growth. In the species studied, branching or tillering was greatly enhanced at the cooler temperatures; the number of branch nodes increased linearly with decreasing temperature. Leaves aged more slowly at cooler temperatures; this temperature response will be compared with that for leaf expansion or rates of appearance. Implications in developing logic for plant growth models will be discussed.

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The Vegetation of Cumberland Gap National Historical Park

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A study of the vegetation of Cumberland Gap National Historical Park located at the tri-state corner of Tennessee, Kentucky and Virginia was conducted from March, 1974 to September, 1975. One-tenth acre (0.25 ha) circular plots were established in homogeneous stands of vegetation first stratified by topography and geology. Fifteen plant communities occurred ranging from mesic Hemlock-Rhododendron to xeric Pitch Pine-Virginia Pine types. Regression analyses were used to evaluate the importance of soil and site variables predicting importance of selected overstory taxa. Slope position, slope shape and soil texture were effective predictors of species importance on that landscape.

(323)

An Inventory of the Fishes of Gauley River, West Virginia

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Gauley River unites with New River at Gauley Bridge, West Virginia to form the Kanawha River. The drainage basin of Gauley River is approximately 3497 sq km, although the total length of Gauley River is only 167 km from head to mouth. Average annual discharge is

approximately 76 m³/sec. Average gradient is 6.1 m/km. An inventory of fishes of Gauley River was performed in 1976. A total of 48 species representing 9 families was collected. Some 13 species were added to the known Gauley River ichthyofauna, with specimens of *Lampetra aepyptera*, *Noturus flavus* and *Percina caprodes* being major distributional records above Kanawha Falls. Data indicate that while Kanawha Falls may be a major barrier to dispersal, fauna of the upper Kanawha River system may be restricted by a combination of other factors.

(309)

The Response of Lily Pollen to Aflatoxin B₁ in Media Containing and Lacking Phosphate

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Virginia Commonwealth University

Previous studies have shown that *Lilium longiflorum*, cv. 'ACE' pollen could be used as a bioassay system for the hepatocarcinogenic mycotoxin, aflatoxin B₁. The percent germination and the elongation of the pollen tube have been shown to be decreased by the mycotoxin. Dickinson's media was employed to test the effects of varying concentrations of aflatoxin B₁ (5, 10, 15, 20, 25, and 30 µg/ml) on growth and germination of pollen in the presence and absence of phosphates. With phosphates present elongation was inhibited by aflatoxin at all concentrations. Germination was stimulated at 5 and 10 µg/ml of the toxin, but gradually decreased as concentrations were raised. In the media without phosphate, tube elongation was slightly stimulated in concentrations of aflatoxin up to 20 µg/ml. At higher levels the elongation of the tubes were inhibited. In media without phosphate, the percentage of germination in the pollen was increased at the lower concentrations (5-20 µg/ml) and showed no effect at the two higher levels of aflatoxin B₁.

(34)

Phosphorus Cycling in an Alluvial Swamp Forest in the North Carolina Coastal Plain

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East Carolina University

The distribution and movement of phosphorus was determined in an alluvial swamp forest adjacent to the Tar River near Grimesland, North Carolina. Litterfall, stemflow and throughfall was quantified and the total phosphorus content of each compartment determined. Tupelo leaves, the dominant form of litterfall, ranged from 513 µg P/g dry wt in autumn to 2550 µg P/g dry wt in the spring. Stemflow and throughfall concentrations ranged from 0.027 ppm to 0.84 ppm and 0.042 ppm, respectively. Higher values were associated with the presence of the canopy and low rainfall. The biologically available phosphorus was determined by measuring ortho-phosphate in the interstitial water and acid extractable phosphorus in both the organic and mineral soil layers. The rate of disappearance from the overlying water to the litter and soil compartments was determined with the use of ³²PO₄. Rate of phosphorus disappearance from the water in the spring was 68.6% per day with the dominant pathway to the soil compartment.

(197)

Some Aspects of the Life History of *Isotria medeoloides*, an Endangered Orchid Species

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Little is known about *Isotria medeoloides*, a species often considered the rarest orchid in the eastern United States. Due to its infrequent occurrence and ephemeral nature, few people have been able to observe and study this plant in detail. As a result of a recent discovery of a new population in southern Illinois, *I. medeoloides* has been studied extensively during the growing season of 1976 to gather information on the life history of this nationally endangered plant. An environmental analysis of the site includes data on soil and air temperature, relative humidity, soil moisture, precipitation, and various soil analyses. Mapping of the herbaceous species and a quadrant sample of the woody species describe the site vegetation. Phenological aspects are discussed from data collected over a three-year period. A comparison of this site with other known sites will be discussed in an attempt to illustrate the historical and biogeographical aspects of *Isotria*.

(230)

Interaction of Temperature and Toxicants on the Growth Rates of *Chilomonas paramecium* (Flagellata) Populations

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Virginia Polytechnic Institute and State University

The cryptomonad flagellate *Chilomonas paramecium* was cultured and tested in an organic medium and cell concentrations were monitored with an electronic particle counter. *Chilomonas* was tested at 10, 20 and 30C. *Chilomonas* was more tolerant of chlorine, chromium, and zinc at higher temperatures. At 0.7 mg/l chlorine no growth was observed at 10 and 20C but growth was observed at 30C. At 1 mg/l chromium growth was depressed 50% at 10C but not at 20C and 30C. At 10C growth was severely depressed by 5 mg/l zinc; at 20C growth was depressed by 10 mg/l zinc; and at 30C growth was depressed by 25 mg/l zinc. No effect of temperature was observed on toxicity of phenol (growth depressed at approx. 250 mg/l) or copper (growth depressed at approx. 50 mg/l). In part the effects of toxicants on growth rates were affected by the organic growth medium but this effect was not a significant variable when comparing the temperature effects of a specific toxicant.

(207)

The Study of Fish Diversity in Relation to Stream Order in Blackburn Fork

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The function of stream order upon the diversity of fish in Blackburn Fork drainage system, a fourth order intermittent stream, was studied from the last of July through the last of October, 1976. Seventy-seven samples were taken for a total of over 3000 individuals comprising 26 species. The mean number of species per

stream order increased as the stream order progressed downstream. The diversity was calculated using \bar{D} . The mean \bar{D} values decreased from the first order streams to the second order streams, then increased in third order streams, but decreased in fourth order streams. While the \bar{D} means of stream orders were statistically similar, the dominant fish species of each stream order tended to vary. The first order streams were composed mainly of *Phoxinus erythrogaster* and *Etheostoma spectabile*. The second order streams were dominated by *Semotilus atromaculatus* and *Phoxinus erythrogaster*. Domination in the third order streams were by *Notropis ardens* and *Compstoma anomalum*. The fourth order stream was largely composed of *Notropis ardens* and *Notropis telescopus*. In the fourth order stream a prominent waterfall separated the collection sites. This order also had the largest number (10) of unique species. These factors could have influenced the diversity of the fish species in the fourth order stream.

(157)

A Phytotron Study of the Effects of Photoperiod and Temperature on Flowering and Growth Response in *Cucumis sativus* L. and *Cucumis hardwickii*

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Cucumis sativus L., *Cucumis hardwickii*, and hybrids of these two closely related species were evaluated in a study conducted in the Phytotron at North Carolina State University to determine the effects of photoperiod and temperature upon several components of sex-expression and growth. Treatments consisted of 3 photoperiods (PPD) (9, 12, and 15 hr daylengths) conducted at 2 temperature regimes (30C day:20C night and 30C day:13C night). Data will be presented on the following: 1) number of days to anthesis, 2) staminate:pistillate ratios, 3) aspects of flower location, 4) main stem and lateral length, 5) total leaf number, 6) node number. Flowering responses differed for the two species. *Cucumis hardwickii* flowered only under the 9 and 12 hr PPD at the 30C:20C temperature regime. *Cucumis sativus* flowered under all conditions. Growth measurements were highest under 12 hr PPD with 30C day:20C night temperatures.

(113)

Specific Binding of Radioactively Labeled Cortisol by Guinea Pig Thymic Preparations: Relationship to Glucocorticoid Resistance

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This study examines the relationship between the differential binding of radioactively labeled cortisol and the survival of "glucocorticoid resistant" thymocytes. Data are obtained which strongly indicate the existence of a small population of high affinity cortisol receptors equally distributed between sensitive and resistant populations. *In vitro* studies gave no indication of differences in metabolism of the hormone between sensitive and resistant populations. The data, therefore, indicate that resistance to the killing effects of cortisol is not the result of any differential binding of the hormone to specific receptors between these populations.

(179)

Nemalionopsis — Distribution and Classification (Algae: Rhodophyta)

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The second account of *Nemalionopsis shawi* from the United States is recorded. This freshwater member of the Rhodophyta has been found in Lower Barton Creek, Wake County, North Carolina. This alga was last reported in 1954 by Louis Flint from Louisiana. The family Thoreaceae is composed of the genera *Thorea* and *Nemalionopsis*; the characteristics of the group of red algae are discussed. The relationship between *N. shawi* as described by Skuja in 1934 and *N. tortuosa* as described by Yagi and Yonega in 1940 is presented. The lack of attention given to this alga in recent years has resulted in an ignorance of its ecology and life cycle by phycologists who often assume it to be one with the genus *Thorea*.

(10)

A Survey For *Trichinella Spiralis* (Nematoda) in Middle Tennessee Swine

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Middle Tennessee State University

A total of 154 hog diaphragms collected from Jones Locker, (site 1) Murfreesboro, Tennessee and Batey's Slaughter House, (site 2) Woodbury, Tennessee, were examined for *Trichinella spiralis* using compression, modified pooled sample, and maceration techniques. At Batey's Slaughter House 2.83% of the slaughtered hogs were fed a garbage diet. All swine studied were negative for *T. spiralis*. Recovery methods were tested by xenodiagnostic infection of 24 white mice with this nematode and subjection of these rodents at varying infection periods to the methods described. The results of this study would seem to indicate at present, that this helminth is an insignificant health factor in swine raised in the Middle Tennessee area.

(117)

Alkali Denaturation of Rodent Hemoglobins

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Hemoglobins of four rodents, *Dicrostonyx torquatus rubricatus*, *Lemmus trimucronatus*, *Microtus xanthognathus* and *Sigmodon hispidus*, were compared using an alkali denaturation technique. *S. hispidus* showed two components while the other three showed only one by this technique. Each hemoglobin had a characteristic rate of denaturation in 0.05 N NaOH with *D. t. rubricatus* denaturing most rapidly followed by *L. trimucronatus*, rapid component of *S. hispidus*, *M. xanthognathus*, and the slow component of *S. hispidus*. The rate of denaturation was found to decrease with decreasing concentration of alkali. Rate constants and half times were calculated but values were not closer for more closely related species. Mixtures of two hemoglobins were examined and percentages of the two components calculated from denaturation data. The Perutz mechanism for denaturation of hemoglobin by alkali is discussed and hypotheses made concerning specific amino acid residues.

(20)

Nitrite Toxicity and Methemoglobin Formation in Channel Catfish

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Memphis State University

Nitrite is an intermediate compound formed during nitrification of ammonia, the major waste product of fishes. Nitrite reacts with hemoglobin to produce methemoglobin, which has no oxygen carrying capacity. Nitrite is toxic to channel catfish, *Ictalurus punctatus*, with 24-hr TL_{50} values reported to be 33.8 mg/liter for fish weighing 40 g. The rate of hemoglobin conversion to methemoglobin in 20-g fish exposed to 5.0 mg/liter NO_2^- at pH 7.0 was 59.6% after 6 hr, 77% after 12 hr, and 83.5% after 18 hr. Fish exposed for 24 hr died with symptoms typical of NO_2^- poisoning. The toxicity of nitrite varies with pH. Channel catfish weighing 150 g survived several hours at 20 mg/liter NO_2^- at pH 7.0, but died within 10 minutes at pH 3.8. Twenty-gram fish exposed to 2.5 mg/liter NO_2^- for 24 hr at pH values of 9.1, 7.0 and 5.3 developed mean methemoglobin levels of 10.9%, 63.2% and 75.5%, respectively. Control methemoglobin levels ranged from 3.6% to 6.9%. The dramatic effect of pH on methemoglobin formation is due to increased amounts of the more toxic nitrous acid form (HNO_2^-) present at high hydrogen ion concentrations over the NO_2^- form, which is predominate under alkaline conditions.

(87)

Isolation of Protoplasts from Haploid Plants of the African Violet

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Haploid plants of the African violet have been obtained by culturing anthers from buds between 3mm and 5mm in diameter on a modified Skoog's medium. The haploid plants can be maintained in axenic culture and will grow and flower in the greenhouse. Protoplasts can be obtained from plants grown in axenic culture but not from greenhouse grown haploid plants. Factors affecting the yield of protoplasts from leaf and petiole tissue including osmotic agents, source and concentration of digestive enzymes, and temperature have been investigated. The most efficient combination of enzymes was 2% Cellulysin, .25% Macerozyme, .25% hemicellulase and .25% pectinase (GIBCO). A combination of .27M sorbitol + .27M mannitol was found to give the most consistent protoplast yields. Yield of protoplasts was affected by incubation temperature. Preliminary attempts to regenerate plants from protoplast cultures are discussed.

(57)

Observations on the Commercial Bait Fishery for Freshwater Shrimp, *Macrobrachium ohione* (Decapoda; Crustacea), in the Mississippi River near Baton Rouge, Louisiana

JAY V. HUNER
Southern University

Weekly samples of *Macrobrachium ohione* were collected from the commercial bait fisheries in the Missis-

issippi River near Baton Rouge, Louisiana. Shrimp were captured from boats at night with bow mounted scoops constructed with 6.25mm mesh hardware cloth in the vicinity of a navigation lock. Fishing began in early March 1976 and ended in mid-August 1976. It was most successful from early May through late June. Decline in catch appeared to be correlated with declining river levels. Few fish were caught. Mean size was 30.8 ± 0.2 mm (total length) ($n = 6828$); the mode was 27mm ($n = 851$); and the range was 17-92mm. Mean size declined from approximately 39mm in early March to approximately 28mm in mid-August. The first ovigerous females were observed in early April and were still present in mid-August. The mean size of ovigerous females was 66.1 ± 1.7 mm ($n = 88$); the mode was 67mm ($n = 13$); and the range was 26-92mm. Reduction in vulnerability to capture (survival?) of all shrimp in 5mm size classes was 0.59.

(248)

The Chromosome of Bacteriophage ϕ X174

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Work from a number of laboratories has led to a very detailed understanding of the structure and function of the genome of bacteriophage ϕ X174 (ϕ X). ϕ X is a small virus which directs the synthesis of nine gene products following infection of susceptible strains of *E. coli*. Four of these genes specify components of the virus particle, and lie contiguously on the ϕ X genome. The other five genes code for proteins involved in viral DNA replication, virus assembly, and lysis of the infected host cell. In addition to genetic characterization by the analysis of mutants, an essentially complete nucleotide sequence of ϕ X DNA has been determined. The genome is 5375 nucleotides in length, an amount of genetic information insufficient to independently code for all nine ϕ X gene products. This has been explained by the discovery of overlapping genes in ϕ X. Within overlapping genes a single nucleotide sequence is translated in two different reading frames to produce two completely different amino acid sequences.

(285)

A Preliminary Study of Section *Vaginatae*, Genus *Amanita* (Basidiomycetes) in North America

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University of Alabama, Birmingham

An intensive study has been initiated in which the taxonomy and nomenclature of taxa within section *Vaginatae* will be thoroughly investigated. This section contains organisms which possess some of the most variable macroscopic and microscopic features of any group of taxa within the genus *Amanita*. Pileus and stipe color variations abound while such microscopic features as spore shape and subhymenium and volva structure cover a broad range of diversity. In this paper the magnitude of these variations, as well as their potential for delimiting taxa within the section, will be discussed.

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Solemya velum, a Burrow-dwelling Bivalve Mollusk

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Solemya velum, a protobranch, is remarkable in that it dwells in a Y-shaped burrow. This burrow has recently been described, but its uniqueness has not been noted. No other bivalve is known to have such a burrow. The two upper arms of the burrow are symmetrically arranged, and join approximately 7 cm below the surface of the sand-mud substratum in which the bivalve lives. The vertical shaft extends downward at least 20 cm, but its full length has not yet been determined. The burrow's inside dimension is just large enough for the clam to move through it; it is oval in cross-section and uniform in size throughout. Several structural features of the *Solemya* facilitate their backward and forward movement within the burrow. *Solemya* has a unique, little understood, method of feeding; the form of its burrow is undoubtedly related to this unique feeding method.

(236)

Pseudotandry (False Maleness) in Female *Ilyanassa obsoleta* (Gastropoda: Prosobranchia)

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In some *Ilyanassa obsoleta* populations, adult females lack male attributes. In such populations, half of the immatures possess a bump in the same location as the penis of the adult male; the other half lack such a structure. I have raised immatures from such a population. Those with a bump became males; those without a bump became females. In other *Ilyanassa* populations, adult females possess male secondary traits, including a penial structure. In these populations, all immatures have a bump. About half of a group of these immatures raised to sexual maturity became males; the other half became females. Adult males from such a population, maintained from one reproductive season to another, did not change into females. Therefore, the presence of male characteristics in some *Ilyanassa* females is not the result of protandric hermaphroditism, but is an expression of false maleness or pseudotandry, a previously unrecognized kind of sexuality.

(260)

Early Ovule Development, Megasporegenesis, and Megagametogenesis in *Solidago graminifolia* (L.)
Salisbury (Asterales: Asteraceae:
Tubuliflorae: Astereae)

L. K. JOHNSON AND B. B. SMITH

York College of Pennsylvania

The unifoliar ovary produces a single paraxial ovule characterized by unequal funicular growth from incipience. The primary archesporial cell differentiates early, remains hypodermal, and functions directly as the megaspore mother cell. The single integument arises near the nucellar apex prior to the heterotypic division. Complete anatropous configuration it attained in conjunc-

tion with the homotypic division. A linear tetrad of megaspores is formed in which intercellular engorgement produces a ladder effect. Simultaneous disintegration of the micropylar couplet precedes that of the subchalaral member, leaving the chalazal member functional. Migration of this megaspore to the nucellar apex is accompanied by a disintegration of the nucellar apex and the formation of an integumentary tapetum. The first two mitotic divisions take place in the lower half of the sac. Following the third division, the nuclei organize into the Polygonum-type configuration. The antipodals undergo successive mitoses characterizing the mature sac with polyantipodality. The polar nuclei fuse before fertilization and the endosperm mother cell lies adjacent to the egg.

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The Effects of Low Doses of Ozone on the Subsequent Sensitivity of Soybean to Injury by High Ozone Doses

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Experiments were performed to determine the effects of low ozone (O₃) doses on the foliar injury response of soybean seedlings to higher O₃ doses. The range of O₃ concentrations used occurs in ambient air. Soybean plants pre-treated for 6 hr on 10 consecutive days with 2 to 5 pphm O₃ (below the visible injury threshold) were injured significantly more by exposure to 20 pphm O₃ for 3 hr (acute) than those pre-treated with filtered air. Plants pre-treated with 6 to 10 pphm O₃ (above the visible injury threshold) were injured significantly less by the acute exposure than those pre-treated with filtered air. Plants with foliar injury weighed less than those not injured. The range of O₃ concentrations that caused increased or decreased sensitivity are below the limits set by Federal Air Quality Standards.

(134)

Plankton Dynamics of the Mississippi River, the Big Black River and two Oxbow Lakes in a Record Flood Year (1972-73)

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Semi-monthly phytoplankton, zooplankton and physico-chemical analyses were conducted at 16 stations in the vicinity of the proposed Grand Gulf Nuclear Generating Station (Mississippi). Each water body had a distinct plankton assemblage prior to the dramatic rise in the water level of the Mississippi in Fall 1972. Plankton standing crops in the oxbows decreased more than an order of magnitude as the lakes were flushed by the flooding river. From November through June, plankton assemblages of the four water bodies reflected plankton composition and abundance of the Mississippi. An exceptional, brief period occurred in late winter when the Mississippi temporarily withdrew into its banks, and the oxbow plankton was again distinct from the river plankton. Following three months of renewed flushing distinctive assemblages again developed in late June in all four water bodies.

(257)

Implications of External Pollen Morphology for the Taxonomy of the West Indian Vernonias

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External pollen morphology of 39 *Vernonia* (Compositae) species was examined by light and scanning electron microscopy in conjunction with a systematic revision. External pollen morphology was correlated with a classification based on megamorphological features and provided a confirmation of subsectional assignments in the genus. It was of decisive value in placing certain taxa with intermediate megamorphological characteristics. Pollen morphology can provide a confirmatory and, in some cases, a decisive character for *Vernonia* taxonomy. It is suggested that the study of pollen morphology can provide a much needed basis for the logical interpretation and understanding of higher categories within *Vernonia*.

(111)

Observations on the Role of Thyroid Hormones on the *In Vitro* Conversion of Radioactive 17 β -Estradiol to 2-Hydroxyestrone by Hamster Liver Homogenates

WILLIAM B. KEITH
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The *in vivo* conversion of 17 β -estradiol to 2-hydroxyestrone is significantly depressed in thyroid-inhibited Golden Hamsters (Keith and Williams 1968). A preliminary *in vitro* examination using liver homogenates incubated in a medium containing required metabolic cofactors produced data at variance with the *in vivo* study, which suggests that the thyroid effect on estrogen metabolism is mediated through availability of cofactors. The experiments reported here supply data compatible with this assumption.

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A New Corticolous Genus and Species in the Myxomycetes

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AND

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Twenty-three field collections of an unusual corticolous Myxomycete were gathered from the bark surface of living trees, predominantly *Juniperus virginiana* and *Ulmus americana*. This taxon appears to be common in Florida, Kentucky, Ohio, and Tennessee during the months of July, August, and September. It is tentatively assigned to the family Didymiaceae because of the apparent absence of lime in the capillitium, subparallel arrangement of the threads, and dark color of the spores in mass not unlike certain species of *Didymium*. However, the presence of crystalline or granular lime on the peridium, a character shared by all members of the Didymiaceae but not with this new genus, raises some doubt as to the correct assignment of this new taxon.

Studies are now in progress using X-ray microanalysis to confirm the presence or absence of lime and attempts are being made to observe the plasmodium in culture to determine if it is of the phaneroplasmodial type. A brief description is given for this new, unnamed taxon: plasmodiocarps scattered to gregarious, sessile, usually pulvinate to effused on a broad base, silvery, glossy or often somewhat iridescent, up to 2mm across; peridium very thin, membranous, colorless, irregularly dehiscent; columella none; capillitium consisting of parallel, tubular invaginations of the sporangial wall, simple or sometimes forked below and there attenuating to short, slender, hyaline threads attached to the base of the plasmodiocarp; spores in mass brown, globose, minutely and evenly echinulate, 11-13 μm in diameter.—*Research supported by Grant BMS 75-19098 from the National Science Foundation.*

(140)

Summer Drift of Macroinvertebrates in a Large Warm Water River

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Macroinvertebrate drift in the New River, a large warm water stream in Western North Carolina and Southwestern Virginia was examined from June-September 1976. Numbers and biomass per m^3 were examined on a diel basis from tri-weekly collections. Sampling problems normally associated with larger rivers were avoided by working from low water bridges using apparatus of our own design. Samples were taken at three sites in transect across the stream and at the surface and in the water column at each site. Significant numbers of terrestrial arthropods especially during windy periods and emerging adult insects were collected in the surface nets. The subsurface nets collected mostly immature insects. Diel patterns were obvious with peaks in both variety and numbers within 2 hours after sunset. Dominant organisms in the drift included species of *Isonychia*, *Ephemera*, *Perlesta*, *Hydropsyche* and *Poly-pedilum*.

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Cover-Typing A Proposed Research Natural Area With An In Depth Approach To Method Evaluation

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An area approximately 283 hectares that is being considered for designation as a U.S. Forest Service Research Natural Area was sampled in part with the use of Kuchler's comprehensive method. Seventy units were delineated on aerial photos and a 5% field sample was taken from each unit. A total of 55 species were recorded during the study. Species richness (S) was 47 for the bottoms and 45 for the uplands. Average basal area for the bottoms was 27 m^2/ha and 25 m^2/ha for the upland units. North facing slopes had an average basal area of 27 m^2/ha , compared with 24 m^2/ha on south facing slopes. Coves and ravines were lower at 22 m^2/ha . Basal area for combined uplands and bottoms ranged from 14 m^2/ha -46 m^2/ha . Kuchler's comprehensive method and Reciprocal Averaging ordination were compared for classification of units for purposes of constructing a vegetation map of the study area.

(301)

Structure and Soil Moisture Relationships of a *Quercus prinus* (Fagaceae) Stand in Southern Illinois

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A fifty-three hectare stand incorporating a disjunct population of *Quercus prinus*, located in Saline County, was sampled during the spring, summer and fall of 1976. Circular plots were used to obtain data on the overstory, sapling and seedling strata. Basal area of the overstory ranges from 10.8 m^2/ha to 49.0 m^2/ha , with a mean of 23.5 m^2/ha . Average basal area of *Q. prinus* is 8.8 m^2/ha and ranges up to a maximum of 36.5 m^2/ha . Most overstory species are reproducing successfully throughout the stand. In conjunction with the vegetation sampling soil moisture was monitored, using fiberglass electrical resistance cells, in the Saline County stand and another large stand containing *Q. prinus* in Union County, Illinois. Twenty-nine stations were established and monitored throughout the sampling period. Direct gradient analysis revealed that many of the overstory species were distributed in response to soil moisture. Historical factors were also found to be important in the determination of present stand structure.

(144)

ATP Levels of *Daphnia pulex* (Cladocera) Following Simulated Entrainment

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A simulated system modeled after Coutant was used to determine the effects of entrainment on the ATP levels of *Daphnia pulex*. Entrainment was divided into temperature, chlorine, and sheer force components and a combination of all three components. Test organisms were 8 days old. After exposure to test conditions ATP was extracted with boiling tris buffer. ATP levels, expressed as μg ATP/organism, for the various tests were as follows: temperature—11.2 μg (30% decrease from control), chlorine—0.5 μg (45% decrease from control), sheer force—6.2 μg (12% decrease from control) and combined effects—0.9 μg (40% decrease from control). Statistical analysis showed significant ($P < .05$) effects of chlorine and combined components on ATP levels.

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Diet and Growth of the Killifish, *Fundulus heteroclitus* (Pisces: Cyprinodontidae), from a North Carolina Salt Marsh

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A population of *Fundulus heteroclitus* (common mummichog) was sampled monthly for 15 months at high tide on a *Spartina* marsh surrounding Far Landing Bay in Carteret County, North Carolina (34°42'N, 76°41'W). Plant material was prevalent in the summer-fall diet of the mummichogs but in the winter and spring, animal material predominated. Small crustaceans (amphipods, tanaids and copepods) occurred year round in at least 40% of the guts examined. Individual

F. heteroclitus less than 30mm standard length (SL) fed almost entirely on small crustaceans, insects and polychaetes. In addition to these items larger mummichogs contained *Uca* spp., filamentous algae, detritus and an algal-detrital conglomerate. Recognizable particles of *Spartina* detritus occurred in less than 20% of the fish examined. Reproductive size was attained in 5-6 months. The growth rate was greatest in the first season and few fish survived more than 2-3 years but the growth curve did not level off at this time. The shape of the survivorship curve showed an increased mortality in the older age classes but did not indicate that physiological death was prevalent in the population.

(178)

Floristic and Ecological Investigations of Algal Communities on Sandstone Cliffs in East-central and Southeastern Ohio

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University of North Alabama

In 1975, algal communities on six sandstone cliffs in east-central and southeastern Ohio were sampled at monthly intervals. A rich subaerial flora of at least 170 species of algae, exclusive of diatoms, was identified. Presence-absence data were analyzed using association analysis, information analysis, and perpendicular axis ordination. Algal communities were described and were correlated with various environmental factors. Small variations in moisture appear to be the main environmental factor determining algal species distribution, although thalloid liverworts, rock texture, and the occurrence of iron-bound sandstone may modify moisture availability. Several species, including *Protococcus vestitus*, and a new species of *Trochiscia* were commonly associated with leafy liverworts and mosses. Most of the observed increase in biomass of algal communities on the cliffs examined, occurred when the forest canopy was absent.

(107)

LAP and MDH Isozyme Patterns in Sixteen Southern Pleurocerid Snail Populations

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Isolated populations of the operculate snail Family Pleuroceridae (Mesogastropoda: Prosobranchia) are widespread in the southeastern U.S. Their large variation in shell form is the primary basis for over 200 species names. To elucidate the relationships between populations and species, we studied isozyme patterns in 16 populations of *Goniobasis* spp. and *Pleurocera* spp. from Georgia (12), Florida, Tennessee, and Kentucky (2). Foot homogenates of from 10 to 35 individual snails from each population were applied to 7% polyacrylamide disc gels in 0.077 M tris-citrate buffer to separate anodally-migrating leucine-aminopeptidase (LAP) and malate dehydrogenase (MDH) isozymes. LAP and MDH patterns appeared identical in all populations. LAP showed five weak bands, often with one or more bands absent in an individual, and with bands 2 and 3 varying in relative intensity. MDH always re-

vealed three dark bands. These results suggest little or no variation in LAP and MDH isozymes over a broad geographical area, over time, and between genera.

(96)

Induced Resistance of *Crithidia fasciculata* (Kinetoplastida: Trypanosomatidae) to Carbonyl cyanide m-chlorophenylhydrazone, an Uncoupler of Oxidative Phosphorylation

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Crithidia fasciculata when initially cultured in medium containing 10^{-6} M carbonyl cyanide m-chlorophenylhydrazone (CICCP) remained in lag phase for 3-4 days. After this prolonged lag period the organisms multiplied with a generation time about 1.5 times that of untreated cultures. Upon subinoculation into medium containing 10^{-6} M CICCP the cultures exhibited lag periods and generation times similar to those of control cultures. Resistance to CICCP was lost after about 30 hours of growth in medium lacking the uncoupler. The resistant cells were significantly smaller than their non-resistant counterparts. The protein, carbohydrate and lipid to dry weight ratios were the same for both CICCP adapted and control cells. Resistant cells used $0.67 \mu\text{l O}_2/\text{min}/\text{mg}$ protein as opposed to $1.29 \mu\text{l O}_2/\text{min}/\text{mg}$ protein taken up by control organisms. The sensitivity of oxygen utilization to cyanide and diphenylamine was unchanged.

(205)

Effect of Temperature on the Chlorine Avoidance Behavior of the Golden Shiner

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The avoidance behavior of the golden shiner (*Notemigonus crysoleucas*) to combined temperature and chlorine exposures was evaluated in a field laboratory located at the power plant site. Responses were observed in a shallow linear trough that received chlorinated and untreated water at opposite ends and drained at the center, forming a distinct separation of water in each half of the trough. Initially, the temperature on each side of the trough was held constant and the fish were subjected to successively higher doses of total residual chlorine (TRC), from 0.025 to 0.800 mg/liter. The fish were tested at four acclimation temperatures: 12, 18, 24, and 30C. These experiments were repeated after heating the treated water to a preferred level selected at that acclimation temperature. Results indicated that warmer water attracted fish at low chlorine concentrations but intensified the avoidance response at higher, lethal chlorine concentrations. Acclimation temperature did not affect chlorine avoidance directly, but instead, influenced behavior indirectly by its effect on the chemical dissociation of hypochlorous acid comprising free residual chlorine.—*This research was supported by the American Electric Power Service Corporation, Canton, Ohio.*

(84)

Effects of Actinomycin D on Skeletal Abnormalities in Mice Heterozygous for the Brachyury (T) Gene

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Random bred female mice of the Charles River CD-1 strain were bred to CD-1 × Ttf F₁ males obtained from the cross CD-1 ♀ × Ttf/t²⁵ ♂. These F₁ males were either heterozygous for the brachyury (T) semidominant lethal gene or were +/+ (wild type). In the F₁ fetuses from the T + × +/+ cross, the expected 1:1 ratio of short to normal tail lengths was observed on gestation day 17. All fetuses from +/+ × +/+ matings were normal. Additional females were mated as above and injected ip on gestation day 6½ (sperm day = day 0) with 0.1 mg/kg actinomycin D. Skeletal abnormalities were significantly increased in fetuses from the T/+ × +/+ matings vs those from +/+ × +/+ matings, while other parameters measured (prenatal mortality, weight gain, tail length, and gross and visceral abnormalities) were not affected. The brachyury gene thus appears to enhance the adverse effects of actinomycin D on skeletal development.

(311)

Interaction of Griseofulvin and Rifampicin With IAA, GA₃, and Red Light (660 nm) in the Growth of Apical Coleoptile Segments of *Triticum vulgare* cv Arthur

VERNA R. LAWSON AND GLENDA D. KNOX
Alcorn State University

Red Light (660 nm), IAA and GA₃ promote growth of apical coleoptile segments. Griseofulvin inhibits growth except at low concentration. When segments are exposed to red light, IAA or GA₃ and griseofulvin concomitantly, the growth enhancement due to the former decreases significantly. When the addition of IAA or red light is delayed 30 min to 6 hr after exposure to griseofulvin, little if any red light or IAA effect is apparent. Delay of exposure to griseofulvin following treatment with IAA or red light permits an incremental increase in growth as the delay of exposure to griseofulvin increases from 30 min to 6 hr. Rifampicin permits growth comparable to the control and does not decrease the red light effect except at concentrations greater than 10 μM. As the concentration of rifampicin increases from 0.1 to 500 μM, the IAA GA₃ effects decrease proportionately. The enhancement due to red light or IAA depends on the time of addition of rifampicin relative to that of IAA or red light.

(310)

Interaction of Chloramphenicol and Cycloheximide With IAA, GA₃ and Red Light (660 nm) in the Growth of Excised Coleoptile Segments of *Triticum vulgare* cv Arthur

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Alcorn State University

Cycloheximide in concentrations of 1 to 500 μM inhibits growth of apical coleoptile segments relative to the

dark water control whereas chloramphenicol over the same concentration range exhibits no effect. When each of the two is used with an optimal concentration of the growth promoter IAA, cycloheximide completely prevents any IAA effect whereas chloramphenicol has a similar effect only in concentrations greater than 250 μM. There appears to be no interaction of GA₃ and chloramphenicol. However, the inhibitory effect of cycloheximide appears to be enhanced by GA₃. In general, regardless of the time (0 to 6 hr) of exposure to red light or to chloramphenicol following excision of segments, the red light effect remains. Except at the lowest concentration applied, cycloheximide totally inhibits the red light effect. Even at a concentration of 0.1 μM cycloheximide, the red light effect is destroyed when the exposure to red light is delayed for six hours. When the segments are exposed to red light immediately upon excision and to varying concentrations of cycloheximide at intervals thereafter, the inhibitory effect depends on the time of application as well as on the concentration.

(224)

Daily Activity Patterns of Central Florida Anhingas

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Over 70 hours of random observations were made, in 5 to 15 minute periods, between September 1974 and February 1975, of a non-breeding group of Anhingas, *Anhinga anhinga*, in Gainesville, Alachua County, Florida. A distinctly stereotyped pattern of daily activity was noted. Individual birds were loyal to specific perches and feeding areas. They were defensive of their perches but normally defended their foraging areas only while fishing. Feeding areas were typically adjacent to perch sites, and most foraging was concentrated along heavily vegetated banks or in shallow areas with accumulated debris. Birds remained in the water only 3 to 14 (x = 8.8) min at a time and spent less than 5% of the day foraging. Feeding success varied considerably, with a minimal mean of 0.19 captures per min. Captured fish were mostly centrarchids. The Anhingas spent over 90% of the day perching, sunning and/or preening. From 1.3 to 0.5 hr before sunset the birds flew to a communal roost ¼ mi from the study area and usually returned to their respective daytime perches a few minutes before sunrise.

(62)

Ecological Parameters Affecting Speciation and Distribution of Florida's Troglotic Crayfishes

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Field observations suggest that available sources of food energy dictate which species groups of Florida's troglotic crayfishes inhabit particular cave systems. Species complexes which are most restricted to "energy islands" become ecologically and geographically isolated from other populations and exhibit increased speciation. For example, members of the *Procambarus lucitugus*

complex seem to have demanding energy budgets and occur only in localized karst areas exhibiting mature features and high energy input. Dependency on constant energy supplies provided by large sinkhole entrances and/or bat roosts probably limits their dispersal ability. These crayfishes also tend to occur in greater densities, and populations have disproportionately large numbers of young juveniles. In contrast, *Procambarus pallidus*, *P. horsti*, and *P. orcinus* inhabit systems with limited energy input such as springs and sinkholes with small openings. *Troglocambarus maclanei* also appears to have a low energy budget and is capable of interstitial movement from one cave system to another. This species has the widest geographical distribution of any Florida troglobite.

(291)

Vegetative Reproduction and Structure of Communities of *Justicia americana* (L.) Vahl.

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Justicia americana (water willow) has long been recognized as a primary component of certain habitats of riparian ecosystems in the southeastern United States. Penfound, in his study of water willow as a breeding place for malarial mosquitoes in Wilson Lake, Alabama expressed the opinion that vegetative reproduction was the primary means of reproduction in this species. My observations of water willow populations in Ohio and in Alabama indicated that vegetative propagation was indeed likely to be important. Community structure and vegetative reproduction were studied in the essentially monotypic stands of water willow within the Flint and Paint Rock Rivers of North Alabama. Vegetative reproduction was most successful with nodal sections of the horizontal rhizome and to a lesser degree with nodal sections of the anatomically comparable vertical stem. Vegetative reproduction was found to occur in the dark, while floating, at pH 4-9, and slightly from 5 and 10 cm depths. Development of the shoot occurred from axillary buds, while roots were produced adventitiously from the dissected dictyosteles.

(15)

Effects of Chlorinated and Bromochlorinated Power Plant Condenser Cooling Waters on Survival and Blood pH of Atlantic Menhaden (*Brevoortia tyrannus*) and Spot (*Leiostomus xanthurus*)

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Chesapeake Biological Laboratory

Lethal and sublethal effects of chlorinated and bromochlorinated estuarine waters on juvenile menhaden (*Brevoortia tyrannus*) and spot (*Leiostomus xanthurus*) were observed during a long term, 19-20 day on-site study at Potomac Electric Power Company's Morgantown Generating Station. Test water was continuously pumped from the condenser discharge of each of the station's two identical generating units, one treated with chlorine (Cl₂) and the other with bromine chloride

(BrCl). The water flowed into large (1.2m × 2.4m × 0.9m) partitioned troughs designed to simulate first order halogen decay rates observed in the plant discharge canal at 5, 30 and 60 minutes. All fish were acclimated in dechlorinated plant discharge water prior to the study for a minimum of 30 days. Test species were held in separate nylon cages situated in the troughs where mean concentrations of 0.062, 0.032 and 0.014 mg/l Cl₂ (total residual chlorine) and 0.081, 0.045 and 0.020 mg/l BrCl (as equivalent total residual chlorine) were maintained throughout the test period. Preliminary analyses indicate no significant differences occur within or between chlorine, bromine chloride and control menhaden groups. Preliminary analyses of spot data indicate that significant differences in mortality occur between the halogenated groups of fish and the controls; however, no significant differences occur within each halogenated group. Blood pH was measured for all surviving test fish at the termination of the study. No significant differences were found within all menhaden groups, except between fish at the highest Cl₂ (0.062 mg/l) and highest BrCl (0.081 mg/l) concentrations relative to the control fish. Analyses of spot blood pH indicate no difference among fish exposed to BrCl concentrations; however significant differences occur between BrCl and control groups; between Cl₂ and control groups; and between high and low Cl₂ groups. No differences were found within either menhaden or spot controls.—*This research was supported by Dow Chemical USA, Ethyl Corp., Great Lakes Chemical Corp., Potomac Electric Power Co., in cooperation with Martin Marietta Corp.*

(5)

A Survey of Helminth Parasites from Turtles in Rutherford County, Tennessee

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From July, 1974, through September, 1975, 102 turtles — *Chelydra serpentina*, *Graptemys geographica*, *Chrysemys scripta elegans*, *Sternotherus odoratus*, *Trionyx spinifer*, *Terrapene carolina*, and *Kinosternon subrubrum* — were collected along or near the Stones River, Rutherford County, Tennessee. Thirteen species of parasites were identified including six trematodes, five nematodes, and two acanthocephalans. Helminths parasitized 67.6% of the turtles.

(262)

Promiscuous Pollination in *Thaspium barbinode* and *Zizia trifoliata* (Apiaceae)

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Members of the Apiaceae are considered to have an unspecialized or "promiscuous" pollination system in which pollination can be, and often is, effected by anything which happens to visit the umbel. However, a comparative study of the promiscuous pollination systems of two species of the related genera *Thaspium* and *Zizia*, *T. barbinode* and *Z. trifoliata*, has revealed a much higher degree of pollinator specificity than has been assumed. Analysis of the kinds, numbers, behavior and pollen loads of the insect visitors to plants of these two species has provided a basis for the determination of the effective pollinators. Results indicate that effective pollination for both species is predominantly by short tongued bees of the genus *Andrena* (family Andreni-

dae), particularly, *A. ziziac*. Effectiveness of pollination by *Andrena* spp. and certain other short-tongued bees and flies is correlated with protogyny and possession of a floral "tube," formed by infolded petals, in *Thaspium* and *Zizia*. Also, differences between the percentages of certain visitors and effective pollinators to these plants may be correlated with the strong differences in umbel compactness between *T. barbinode* and *Z. trifoliata*.

(93)

Stability and permeability of *Culex pipiens* haemolymph and its effect on susceptibility to *Plasmodium gallinaceum*

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We have shown that the factors of susceptibility of certain mosquitoes to *Plasmodium gallinaceum* are systemic and present in the haemolymph. They can be transferred orally, through injections, or by parabiosis. We also have shown that the factor(s) is toxic to the parasite. Recent experiments have shown that the toxic factor does not dialyze through a 4.8 nm membrane, indicating a relatively large molecule. The non-dialyzing material was then exposed to 60C, 80C and 95C and the factor retained its effectiveness against oocyst development in susceptible mosquitoes infected with *P. gallinaceum*.

(101)

Haptoglobin levels in *Mesocricetus auratus* (Mammalia: Rodentia: Cricetidae) during infection with *Dipetalonema viteae* (Nematoda: Spirurata: Dipetalonematidae)

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The levels of haptoglobin, a serum protein, normally increase in response to either mechanical or chemical destruction of subcutaneous tissue in rodents such as rats, mice, hamsters and gerbils. Haptoglobin levels were monitored in hamsters, *Mesocricetus auratus*, during the course of an infection with the subcutaneous filariid *Dipetalonema viteae*. No significant increase in haptoglobin levels were noted during prepatency, patency, or after the extinction of the microfilaremia.

(326)

Comparative Early Life Histories of Representatives of the cyprinid subgenera *Hydrophlox* and *Notropis*

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The Academy of Natural Sciences of Philadelphia

In one species of the subgenus *Notropis* eggs are laid in open water and in another related species eggs are laid over *Nocomis* nests after the nest is complete. On the other hand, in three *Hydrophlox* species eggs are laid over *Nocomis* nests during the building process which causes their eggs to be buried. Representatives of

these morphologically similar subgenera display different reproductive adaptations as a consequence of such contrasting reproductive habits. *Notropis* eggs are non-adhesive and have large perivitelline spaces and colorless yolk in contrast to *Hydrophlox* eggs which are adhesive and have moderate perivitelline spaces and yellow or orange yolk. Newly hatched larvae also exhibit differences: unpigmented eyes and deflected head in *Hydrophlox* and variability in these characters in *Notropis*. The adaptive significance of these traits is evaluated relative to their respective ecological habits.

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Phenological Phenomena and Growth Patterns of Sixteen Northern Hardwoods

MARGARET LOWMAN
Duke University

Phenological studies were conducted for sixteen tree species in a northern hardwood forest to determine growth patterns and analyze them in terms of possible successional implications. Seasonal cambial growth and leafing were examined in the Hopkins Memorial Forest of Williams College in Williamstown, Massachusetts, a maple-beech climax forest. Data revealed distinct trends in timing and priority of these growth events between the early and later successional species. Early successional types exhibited early, rapid cambial growth and later leafing; their trunks are ring porous. Later successional species were characterized by early leafing and later, more gradual trunk growth. Without exception, late successional status was indicative of diffuse porous morphology. This study revealed differences between early and late successional species within a northern hardwood forest. It is hypothesized that a specific phenological pattern may impart an ultimate competitive advantage in a successional community. Within this relatively undisturbed New England forest site, the seasonal sequence of early leafing and later wood growth—as exhibited by diffuse porous types—was followed by all late successional species. This priority of producing seasonal photosynthetically active tissue before wood biomass addition seems to be the most advantageous in a long term successional community.

(161)

The Regulation of X Chromosome Activity in *Drosophila*

JOHN C. LUCCHESI
University of North Carolina, Chapel Hill

In *Drosophila melanogaster*, the level of X-linked gene products is found to be equivalent in normal males and females (dosage compensation) and in metafemales (3X; 2A); it is also equivalent in triploid females, intersexes (2X; 3A) and metamales (XY; 3A). In all instances, the expression of X-linked genes is regulated in such a fashion that it is concordant with the level of autosomal gene activity. This means that at least five different transcriptional levels exist for X-linked structural genes: the lowest in metafemales, the highest in metamales, and three different intermediate levels, in females (diploid or triploid), intersexes and males.

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A Comparative E.M. Study of Vesicle Morphology in Zoospores of Certain Fresh Water and Marine Oomycetes

CAROL Z. LUNNEY AND CHARLES E. BLAND
East Carolina University

General ultrastructural features and vesicle morphology were compared in zoospores of two genera of fresh-water oomycetes, *Pythium proliferum* and *Lagenidium giganteum* and two marine oomycetes, *Lagenidium callinectes* and *Haliphthoros milfordensis*. In addition, changes in zoospore vesicle morphology in relation to salinity were studied in a "marine" isolate of *Lagenidium callinectes* which was induced to grow and sporulate in media of varying salinities. The structural/functional relationship between salinity and the type and morphology of vesicles found in zoospores is described and correlated. The role of certain vesicles in the process of zoospore encystment is described also.

(30)

Distributional Patterns of Standing Crop Mineral Nutrients in the Forest Floor Horizons in Upland Oak-Hickory and Mixed Hardwood Forests in Southwestern Illinois

JEFFREY C. LUVALL AND GEORGE T. WEAVER
*Savannah River Ecology Laboratory
and Southern Illinois University, Carbondale*

Distributional patterns of standing crop mineral nutrients within forest floor horizons were studied in two unglaciated oak-hickory and mixed hardwood forests in southwestern Illinois. Following autumn leaf fall, forest floor material was collected from 112 0.04 ha plots. Large wood material > 10 cm dia. was inventoried from the entire plot. Woody material > 2.5 cm dia. ≤ 10 cm dia. was collected from three 3.8 m² quadrants in each plot; O₁ and O₂ horizons were collected from six 0.25 m² quadrants per plot. Plots were classified according to slope position, physiographic form and aspect. Storage patterns varied with the nutrient and the horizon in which it was found. Results were analyzed to test the hypothesis that these site types influenced mineral nutrient storage patterns.

(100)

Litomosoides carinii Infections in the Mongolian Jird (*Meriones unguiculatus*): Comparison of Ocular, Oral, and Subcutaneous Routes of Inoculation

JOHN W. MCCALL
College of Veterinary Medicine, University of Georgia

Experiments were designed to compare early infections established by ocular, oral, and subcutaneous inoculation of infective larvae, and to determine whether 4 day old larvae collected from the pleural cavity are capable of penetrating the conjunctiva and migrating a second time to the pleural cavity following ocular inoculation. In the first experiment, groups of 5 jirds were given 26-30 infective larvae by ocular, oral, and subcutaneous inoculation. Jirds infected by ocular and oral routes were given pentobarbital sodium (50 mg/kg) just

prior to inoculation. At necropsy 15 days postinoculation, mean percent worm recoveries in jirds inoculated by ocular, oral, and subcutaneous routes were 22, 4, and 60, respectively. In the second experiment, groups of 4 nonanesthetized jirds were given 26-30 four day old larvae by ocular and subcutaneous routes of inoculation. Mean percent worm recoveries in jirds inoculated by the ocular route were considerably lower than those of jirds inoculated subcutaneously (12 vs. 66).

(198)

The Application of r- and K-Selection Concepts to Herbaceous Plants

RAYMOND A. MCCORD AND EDWARD E. C. CLEBSCH
The University of Tennessee, Knoxville

Seed number per plant, seed weight, total biomass, and reproductive effort were used to represent r- and K-strategies of herbaceous plants. A data set of these plant strategies was obtained from the botanical and ecological literature and original field work. The plant species in the data set were assigned to r- and K-groups which were defined by the life history and the selection type of the environment of the plant species. Differences in the r- and K-strategies of these r- and K-groups were tested using discriminant analysis methods. The results of the analyses support the tendency of r-strategies to be found in r-selection environments. The strategies of species from environments described as having K-selection were not clearly defined.

(295)

A Preliminary Survey of Plant Communities Found at the Childersburg Field Experiment Station

MARY ELLEN McDONALD AND DAVID T. JENKINS
University of Alabama, Birmingham

A survey of plant communities of the Childersburg Field Experiment Station located on the Coosa River flood plain was undertaken. Plants were collected and identified from pine forest, deciduous forest, old field, swamp, various wet sites, and numerous intermediate habitats, present as a result of past perturbations. These collections are preliminary to a study of the r- and K-selection of the old field habitat.

(143)

Temperature Effects on the Acute Toxicity of Two Simulated Effluents to *Daphnia pulex* (Cladocera)

MATTHEW J. MCGINNIS, ARTHUR L. BUIKEMA, JR.,
AND JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University

Acute toxicity tests of mixed age adult *Daphnia pulex* to two simulated effluents were conducted at four acclimation temperatures (11, 15, 20 and 25C) in a soft reconstituted water. Components of the simulated cooling tower blowdown mixture (SBM; in mg/l) are: zinc (2), phosphate (25), chromate (15), sulfate (824), and boron (0.5). Average 48 hr LC-50s for the SBM (expressed as fractions of the above solution) at 11, 15, 20 and 25C were: 0.03, 0.01, 0.003 and 0.001, respectively.

Components of the arbitrary refinery mixture (ARM; in mg l) are: NH₃-N (10), total chromium (0.25), oil and grease (10), phenol (0.1), sulfide (0.17) and TSS (20). Average 48 hr LC-50s for the ARM (expressed as fraction of the above solution) at 11, 15, 20 and 25C were: 0.16, 0.13, 0.07 and 0.02, respectively. The acute toxicity of each effluent to *Daphnia* increased at higher acclimation temperatures. With both the SBM and the ARM, the variation in response of the *Daphnia* increased as temperature decreased. This response may be due to general temperature effects on organism metabolism and low temperature suppression of molting.

(247)

Ultrastructure of Chromatin During Transcription and Replication

STEVEN L. MCKNIGHT AND OSCAR L. MILLER, JR.
University of Virginia

The basic concept of the "nu-body" structure of eukaryotic chromatin is that each repeating spherical subunit of nu-body contains eight histone polypeptides tightly associated with about 200 base pairs of duplex DNA. By spreading embryonic *Drosophila* nuclei, we have visualized the structure of chromatin regions involved in transcription and replication. Chromatin regions visible between RNA polymerase molecules on non-ribosomal genetic loci appear identical to inactive nu-body chromatin. Similarly, newly replicated chromatin appears to adopt a nu-body conformation on both sister strands immediately behind each DNA replication fork. From these morphological observations we conclude that: 1) the presence of histone proteins neither represses nor regulates gene expression *in vivo*; and 2) the histone-DNA nu-body complex is an extremely dynamic structure that is able to accommodate the enzymatic functions involved in DNA replication and RNA transcription. Results of current work using immunological probes of histone localization will be discussed.

(32)

Impact of a Nuclear Fuel Reprocessing Facility on the Plutonium Concentration of Adjacent Ecosystem Components

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Savannah River Ecology Laboratory
AND
A. L. BONI AND J. C. COREY
Savannah River Laboratory

Chronic low level releases of the transuranic elements are known to occur from nuclear fuel reprocessing facilities. Among these elements, plutonium is the most important because of its long half-life and high toxicity. At the Savannah River Plant, the input of plutonium into both natural and agricultural ecosystems is being evaluated. The input of plutonium is measurable up to 3 km from the facility. Although the soil contains measurable amounts of plutonium, most of the plutonium concentration in ecosystem components is due to direct deposition on the component or resuspension of plutonium from the soil. Plutonium concentrations are lower in crop species than native species. Implications of these findings are discussed.

(293)

Citico Creek Nature Study Area, Cherokee National Forest: Floristics and Politics

JEFFRY L. MALTER
University of Tennessee

Citico Creek Nature Study Area, Cherokee National Forest, Monroe County, Tennessee, has been set aside as a proposed National Wilderness Area. Comprising 5600 ha of both virgin hardwood forest and replanted timberland, the area borders on the Slickrock Creek National Wilderness Area and lies 11.3 km south of the Great Smoky Mountains National Park. The aim of this study has been to determine the vascular flora. Comparison with several surrounding areas and their floristic elements will be made. Particular mention of plants in the endangered or threatened categories will be stressed. The political consequences of setting this area aside will be discussed in light of its vegetational future. Land-use of the surrounding area and its effect on preservation of the flora will be stressed, pending a final decision by Federal agencies, sometime in 1977.

(171)

Screening of Native Root Parasites in the Scrophulariaceae as Pathogens of Commercial Timber Species in the Southeastern United States

WILLIAM F. MANN, JR.
Southern Forest Experiment Station
LYTTON J. MUSSELMAN
Old Dominion University

Nineteen conifer and hardwood species important for timber production in the Southeast were grown in pots with 15 species of Scrophulariaceae. Some seeds of the parasites failed to germinate, some plants died before haustoria counts could be made, and a few plants were purposely destroyed when more than one parasite was in a pot with a single potential host tree. Most of the parasitic plants had a broad host range. The one exception was *Seymeria cassioides*, which seemed to prefer pines to hardwoods. Data suggest many of the Scrophulariaceae are potential pathogens of important timber species, especially when they are grown under intensive culture.

(47)

An Assessment of Continuous and Intermittent Chlorination and Bromochlorination Schemes for Control of Fouling Organisms in Cooling Water Systems Utilizing Estuarine Water

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LEONARD B. RICHARDSON AND LAWRENCE H. LIDEN
Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory

The relative antifouling effectiveness of chlorine and bromine chloride under both continuous and intermittent modes of application was evaluated during the 1976 fouling season in Chesapeake Bay. Chlorine and bromine chloride were evaluated simultaneously for 20 day periods in the late Spring, Summer and early Fall. The halogens were added to unfiltered estuarine water delivered to several artificial substrate systems designed for

quantitative biofouling studies. The following halogen application schemes were studied: 1) 0.1 mg/l total residual halogen (TRH) applied continuously, 2) 0.3 mg/l TRH applied continuously, 3) 0.2 mg/l TRH applied for 15 minutes every three hours and 4) 0.5 mg/l TRH applied for 15 minutes every three hours. The studies showed that continuous halogenation at both concentrations was more effective in controlling fouling than either intermittent scheme. Continuous halogenation at 0.3 mg/l TRH was more effective than 0.1 mg/l TRH. Preliminary analyses indicate that chlorine and bromine chloride are equally effective at each level of application studied. — *This research was supported by the Baltimore Gas and Electric Company and Dow Chemical USA.*

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The Influence of Weather on Autumn Shorebird Migration in Piedmont North Carolina

CHRIS MARSH

North Carolina State Museum of Natural History

A five year (1972-1976) survey of early fall shorebird migrants in Raleigh, Wake County, North Carolina, revealed a strong correlation between the arrival of the birds and the position of pressure systems affecting wind direction. 95% of the migrants arrived with northwest winds arising in northwest Canada or the Great Lakes region. This disproportionate number of western species recorded during the survey (Avocet, Buff-breasted sandpiper, Stilt sandpiper, Western sandpiper, Wilson's phalarope) supports the assumption that most of the shorebirds that migrate through piedmont North Carolina are of western origin.

(7)

Digenetic Trematodes of Bats from Ecuador

MATTHEW MARSHALL AND GROVER C. MILLER

North Carolina State University

From May 22 to July 4, 1975 studies were conducted on the local fauna in the province of Morona Santiago in the village of Sucua, Ecuador. Avian, amphibian, reptilian, and mammalian specimens were collected and examined for parasites. This report deals with the descriptions of certain trematodes from bats. Emphasis is given to the probability of new genera and species in the trematode families: Urotrematidae, Lecithodendriidae, Anenterotrematidae.

(276)

Observations on New Fungal Parasites of Insect Eggs Producing Appressorial Complexes

W. WALLACE MARTIN AND DAVID D. DEAN¹

Randolph-Macon College

Organisms representing two or more closely related species of saprolegniaceous fungi have been discovered as parasites in the eggs of midges and caddis flies. The fungi produce elongate eucarpic mycelia which grow within the gelatinous egg mass matrix. Upon contacting the egg surface a hyphal tip branches to produce a clasper-like complex of appressoria which attaches to the egg chorion and subsequently penetrates it with many fine haustoria. The sporangia are slightly pigmented, typically ellipsoidal, and produce a number of large primary zoospores which, as in *Achlya*, encyst near the

mouth of the sporangium before giving rise to secondary zoospores. The zoospores are renewed by internal proliferation as in *Saprolegnia*. Sexual reproduction is typical of the Saprolegniaceae and results in the formation of several oospores contained within an oogonium. — ¹ *Present address: University of North Carolina, Chapel Hill.*

(130)

Permanent Documentation in Natural Areas

WILLIAM H. MARTIN

Eastern Kentucky University

(No abstract received)

(289)

Seasonal Changes in the Vegetation of Two Carolina Bays

SUSAN J. MASHBURN AND REBECCA R. SHARITZ

Savannah River Ecology Laboratory

Floral composition and the standing crops of dominant plant species in two Carolina Bays on the Savannah River Plant (Aiken, S.C.) were compared on a seasonal basis. Patterns of vegetational zonation relative to water depth were described using the line intercept technique. Seasonal differences in total standing crop and shifts in species dominance were quantified. The marked differences between the two bays will be discussed in relation to sediment characteristics and water quality data.

(128)

Species Biology as a Component of Management Plans

J. R. MASSEY

University of North Carolina — Chapel Hill

AND

JAMES MATTHEWS

University of North Carolina — Charlotte

(No abstract received)

(154)

Photosynthesis Response to Varying Leaf Water Potentials in Four Arctic and Alpine Species of *Saxifraga* (Saxifragaceae)

MICHAEL A. MASTERS

Duke University

Four closely related species of *Saxifraga* subsection *nivali-virginiense* of section *Boraphila* occur in ridge and meadow microsites of Alaskan and Rocky Mountain tundras. Each species of these rosette plants grows in only one of the four microsites. Field measurements showed that soil water availability late in the growing season is lower at the ridge sites. Field-collected plants were grown in the phytotron to test their response to conditions ranging from the absence of water stress to weekly water stress of -15 to -20 bars. Especially when grown under periodic water stress, both the arctic and alpine ridge species showed less of a decrease in photosynthetic capacity as leaf water potential was decreased than did either of the meadow species. Diffu-

sive resistances of turgid leaves of all four species grown under both watering regimes were low, indicating little anatomical control of transpiration. Stomatal response is being examined.

(321)

Seasonal Distributional Patterns of Fishes in the James River, Virginia

EUGENE G. MAURAKIS

Virginia Electric and Power Company

WILLIAM S. WOOLCOTT

University of Richmond

An investigation was made of the seasonal near shore distributional patterns of 17 species of fishes in an 8 km stretch of a Piedmont section of the James River, Virginia. Fishes were collected from shore areas by electro-fishing from a boat from July, 1973 through June, 1974. The seasonal distributional pattern of each species was established by analyzing their percent frequency of occurrence. Species with similar patterns were grouped and five seasonal distributional trends were identified. The greatest number of species were present during the summer months, the smallest number in the winter. The frequency of occurrence of four species did not change throughout the year.

(125)

Essential Components of Stewardship Plans

TIM MCCALL

The Nature Conservancy

(No abstract received)

(121)

Natural Areas Evaluation in Georgia

JERRY MCCOLLUM

Georgia Department of Natural Resources

(No abstract received)

(92)

In vitro Induced Organogenesis on Intact Embryos and Excised Embryo Parts of Loblolly Pine (*Pinus taeda* L.)

ASHA MEHRA-PALTA AND R. L. MOTT

North Carolina State University

Adventitious shoot buds were induced at high frequencies on the cotyledons and to a lesser extent on the hypocotyl region of intact embryos of loblolly pine. The seed pre-treatment, culture medium, growth factor combination and culture environment were found to strongly influence this adventive bud induction phenomenon. Both frequency and intensity of bud formation can be greatly enhanced if excised embryo parts, like cotyledons, hypocotyls and shoot tip explants, are used instead of intact embryos. These buds, when isolated from the original explants, developed into vigorously growing shoots some of which have been rooted. The culture

medium and the environment play a significant role in both bud induction and subsequent shoot growth. These techniques are now being optimized to a stage where they could provide useful methodology for programs on clonal propagation of superior pine genotypes of value to the forest tree management.

(123)

Habitat-Vegetation Classification by Remote Sensing

FRANK MILLER

Mississippi State University

(No abstract received)

(288)

The Floristics And Vegetation Patterns of Sea Island, Georgia

GERALD J. MILLER

Decatur, Georgia

Due to a multiplicity of factors the coastal areas of Georgia have previously escaped the intensive/pervasive development which characterizes the remainder of the eastern seaboard. Now, however, the increased pressure for recreation coupled with greater accessibility, viz., Interstate 95, is changing that. This situation, i.e., the development of these insular ecosystems, is exacerbated by the state's environmentally bankrupt policy of taxing land or its potential, rather than actual use. This is especially evident on Sea Island, Georgia, where economic pressure is forcing accelerated subdivision of natural areas. The islands flora and vegetational patterns were assessed during the growing seasons of 1975-76. The results of this investigation will be presented as well as projections as to the ecological future of this area.

(172)

Progress in the Flora of Illinois

ROBERT H. MOHLENBROCK

Southern Illinois University, Carbondale

A summary of the work in progress on the Illinois flora is presented. Particular attention is given to the general elements which comprise the flora and the distribution of them. A brief historical account of the development of Illinois floras is given.

(175)

Woody Plants of the Francis Marion National Forest

ROBERT H. MOHLENBROCK

Southern Illinois University, Carbondale

The Francis Marion National Forest, located north of Charleston, South Carolina, contains over 245,000 acres of swamps, bottomland forests, pocosins, pine flatlands, and other habitats. General characteristics of the forest are given, followed by a discussion of the woody plants which occur. More than 175 species of woody plants have been recorded from the forest.

(320)

Abundance and Seasonal Occurrence of Shore Zone Fishes in Central Chesapeake Bay

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*Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory*

Shore zone fishes were sampled monthly over a 5-year period (1971-1975) between Kenwood Beach and Cove Point on the Maryland Western Shore (Calvert County) in the central portion of the Chesapeake Bay. A total of 116,835 fish, representing 54 species, were collected during the years 1972 through 1975. Only relative abundance of each species taken per station was determined during 1971. During the five year period Atlantic menhaden (*Brevoortia tyrannus*), Atlantic silverside (*Menidia menidia*), Bay anchovy (*Anchoa mitchilli*) and spot (*Leiostomus xanthurus*) accounted for 90% of all fish collected each year. Strong seasonal patterns in species occurrence and abundance was evident. Similar numbers of fish species were taken from all stations sampled each year. However, there has been a steady decrease in the mean number of species taken per station with 26.5, 25.2, 22.2, 17.0 and 14.5 species collected from all stations during 1971 through 1975, respectively. This decrease was resulted from a decline in numbers of species taken throughout the year and not from a decline during a particular season of the year. Seasonal variations in temperature and salinity were similar among stations and to those found during previous years.—*This research was supported by the Baltimore Gas and Electric Company, Baltimore, Maryland.*

(250)

The Synaptonemal Complex and Mammalian Meiosis

M. J. MOSES AND S. J. COUNCE
Duke University

The synaptonemal complex (SC) forms the proteinaceous axis of pachytene bivalents and appears to be a prerequisite for crossing over. A simple spreading method yields whole complements of selectively stained SC's in which kinetochore regions can be identified. This technique has been utilized for preparation of pachytene karyotypes from spermatocytes of a number of mammalian species, for both quantitative and qualitative studies of chromosome behavior and morphology during first meiotic prophase, and most recently, for cytogenetic analysis of chromosome aberrations.—During pachytene, autosomal SC lengths vary while relative lengths and arm ratios remain constant. The uniform control that this implies also extends to somatic cells, as indicated by a 1:1 relationship between relative lengths of SC's and mitotic autosomes. Synaptic events begin at the nuclear envelope where single axes of unpaired homologues become lateral elements of the SC and are joined to a central element by transverse filaments. SC formation proceeds asynchronously toward the kinetochore. The axial elements disassemble in different species before, during, or following desynapsis. X and Y chromosome axes form short lengths of SC but follow an independent schedule and undergo unique differentiations. Studies of acrocentric-metacentric trivalent formation in lemur hybrids, and translocations in the

mouse show that SC analysis in spreads is uniquely applicable to cytogenetic studies.—*Research supported by grants from the NSF (GB-40562, BMS 74-22186), and NIH (GM-23047; also 5-S01-RR-05404 and CA-14236 to Duke University).*

(91)

The Need for Sequential Environments in Tissue Culture Bud Production and Subsequent Bud Growth for Loblolly Pine (*Pinus taeda* L.)

R. L. MOTT, RICHARD H. SMELTZER AND
ASHA MEHRA-PALTA

North Carolina State University

Culture environment has been found to be of great importance for adventitious shoot bud induction on loblolly pine embryos. Both thermoperiod and photoperiod greatly influenced the bud induction process. The environmental conditions required for optimal sustained growth of these shoot buds to form viable shoots significantly differed from those required for bud induction but were similar to those required for normal embryo development to form seedlings. These morphogenetic responses were sensitive to environments in ways different from those observed for callus cultures of pine. Results obtained in these studies of tissue culture propagation in this commercially important Southeastern timber species demonstrate the need for environment control which can be effectively provided in the phytotron.

(166)

Weedy Amaranths of the Southeastern U.S.: Some Taxonomic Problems

JAMES C. MURPHY
North Carolina State University

The weedy amaranths of the southeastern U.S. include members of the section *Amaranthus*, mainly *Amaranthus hybridus* L., *A. retroflexus* L., *A. cruentus* L., *A. palmeri* Watson, *A. spinosus* L., and *A. graecizans* L. Some confusion exists in distinguishing the first three species, a fact which has led to misrepresentation of their distributions. Nevertheless, the differences are real. It is possible that hybridization and introgression are a cause of the confusion among the three species, but more likely, a misunderstanding of the key characters is the chief basis for the confusion.

(169)

Parasitism and Haustorial Structure of *Ximения americana* L. (Olacaceae)

LYTTON J. MUSSELMAN
Old Dominion University

WILLIAM F. MANN, JR.
Southern Forest Experiment Station

Haustoria arise within ten days of germination from distinctive primordia which superficially resemble lateral roots but which lack vascular tissue. Anatomically, the mature haustorium of *Ximения* resembles that of *Buckleya* and *Pyrularia* of the Santalaceae in having a well developed mantle, collapsed zone, and interrupted zone. While all roots examined in nature produced haustoria,

seedlings will survive for an indefinite time without attaching to any host root. Thus, parasitism appears to be facultative.

(246)

Re-examination of Phyletic Relationships within the Family Pteronarcidae (Insecta: Plecoptera)

CHARLES H. NELSON

University of Tennessee, Chattanooga

The recent discovery of the male of *Allonarcys comstocki* (Smith) now means that all the described species of the family Pteronarcidae are known from both sexes. This added information has prompted a re-examination of phyletic relationships within the family Pteronarcidae using numerical phenetic and cladistic techniques. Phenetic procedures include the UPGMA, WPGMA, principal components analysis and the function-point clustering method. The results obtained from the aforementioned methods are compared to that generated using the quantitative cladistic procedure of a minimum length Wagner Tree. The resulting Wagner tree for the Pteronarcidae is then used to determine the past dispersal pattern for the species of this family. Various classifications for the Pteronarcidae — phenetic, evolutionary, cladistic — are examined and the advantages as well as disadvantages of each discussed.

(231)

Fungal Parasites of New Zealand Tardigrades (Phylum: Tardigrada)

DIANE R. NELSON

East Tennessee State University

Tardigrades were collected for an ecological study of the Kowhai Bush at Kaikoura, New Zealand. The 220 samples consisted of five replicates of 42 microhabitats and ten special collections of rarer substrates, including such tardigrade habitats as mosses, lichens, hepatics, fungi, grasses, bark, soil, and various vascular plants. Preliminary examination of the tardigrades with an ETEC scanning electron microscope of the University of California at Davis revealed a high incidence of fungal parasites in the tardigrade populations. Three types of fungi were observed infecting several *Macrobiotus* and *Hypsibius* species. Spores, hyphae, and fruiting bodies were photographed with the SEM. Species identification is dependent on culturing the fungi from fresh material collected from the Kowhai Bush.

(164)

Misapplication of the Name *Stachys nuttallii* (Lamiaceae) for an Unnamed South-eastern Species

JOHN B. NELSON AND JOHN E. FAIREY, III

Clemson University

A recent study of the Southeastern species of *Stachys* points out a problem involving the correct placement of *S. nuttallii* Shuttlew. ex Benth. A problem arose upon examination of a sheet from US identified as a "Cotype" of *S. nuttallii*. Examination of a photograph of the holotype of KEW made it clear that the type material represents what is commonly known as *S. riddellii* House.

The name *S. nuttallii* is, therefore, rightfully applied to the species previously known as *S. riddellii*, an illegitimate name, since Bentham's publication precedes House's by 73 years. The species commonly known as "*S. riddellii*" must now be recognized as *S. nuttallii*. There remains, however, the problem of naming those plants, primarily from the Blue Ridge Mountains, known to most botanists as "*S. nuttallii*." No valid names have been uncovered in the literature for the species in question, and the plant known for so long as "*S. nuttallii*" actually has no published name. We propose to describe and name this distinct taxon as a new species.

(175)

A Floristic Model of the St. Francois Mountains in the Missouri Ozarks

PAUL W. NELSON

Southern Illinois University, Carbondale

The Ozark Forest displays much vegetational diversity due to its antecedent history, past plant migrations, and physiographical features. This diversity is perhaps most revealed at Johnsons Shut-Ins State Park, Reynolds County, in the St. Francois Mountains where Pre-Cambrian crystalline rocks and Cambrian sandstone, limestone, and dolomite sediments are encountered. As a result, a great diversity of habitats harbors a multitude of taxa, including glacial relicts, endemics, unusual and endangered species, and distinct plant communities.

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The "Achene-Complex" and Related Structures in the Compositae

GUY L. NESOM

University of North Carolina, Chapel Hill

Chrysogonum, *Liudheimera*, *Engelmannia*, and *Berlandiera* are closely related genera in the subtribe Melampodiinae which share a unique morphological feature, the "achene-complex." This is a dispersal unit composed of a ray achene basally fused with a phyllary and 2-4 paleaceous bracts which are associated with the outer row of disc flowers. Species of these four genera all have a distinctive bit of expanded tissue elaborated from the base of the phyllary of the achene-complex or from the bracts of the attached disc flowers. In *Parthenice mollis* and some species of *Parthenium* and *Melampodium* bracts which either are closely associated with the achenes or which completely enclose it apparently are rich in lipids. The possible functional roles of the achene-complex and related compound structures may indicate that they evolved as a mechanism to facilitate ant dispersal.

(145)

Effects of Simulated Entrainment on the Metabolism of *Daphnia pulex* (Cladocera)

LINDA A. NEWBURN AND ARTHUR L. BUEKEMA, JR.
Virginia Polytechnic Institute and State University

The purpose of this research was to study the independent and combined effects of chlorine, temperature and mechanical stress on the metabolism of *Daphnia pulex*. Exposure times were modeled after those of

Coutant. Four chlorine concentrations, 0.35 to 0.59 ppm, were tested. Temperature was increased 10 and 14C above acclimation (20C). Mechanical stress was tested by pumping the *Daphnia* through 45.75 m of 12.5 mm ID tubing at a velocity of 4 l/min. Exposure to all chlorine concentrations depressed the metabolism 9.8%, but the effects were not significant. While a 10C temperature did not significantly depress metabolism (12.6%), a 14C increase caused a significant ($P < 0.02$) decrease (36.4%). Mechanical stress caused a 37.2% increase in metabolism which was significant ($P < 0.01$). There appeared to be no change in metabolism after simultaneous exposure to the three stresses. It is hypothesized that the increase in metabolism caused by mechanical stress was negated by the decreases due to exposure to chlorine and temperature.

(21)

Effect of Abrupt Change in Ionic Composition of the Medium on Plasma and Urine Electrolytes in Channel Catfish, *Ictalurus punctatus*

VIRGINIA M. NORTON, DARRELL CRISWELL,
AND KENNETH B. DAVIS
Memphis State University

The effect of the ionic composition of the external medium on the osmoionic regulatory ability of channel catfish is under examination. Animals maintained in water with a high content of calcium were anesthetized, the urinary bladder was cannulated, and fish transferred to deionized water, tap water or hardened tap water for a 48 hour period. Plasma Ca, and PO₄ were not affected, but plasma Cl was lower in deionized (94 ± 1.25) compared to tap (103 ± 1.80) and hard water (105 ± 1.84 mEq/l). Urine volume was similar for all groups with the second collective 24 hour samples lower than the first 24 hour samples. Urinary excretion rates for Na, Cl and Ca were higher initially, perhaps due to surgical stress. Fish in deionized water showed a marked decrease in Na, Cl and Ca excretion throughout the 48 hour period when compared with the fish in tap water and hardened water. The fish transferred to deionized water exhibited a marked increase in urinary PO₄ excretion than the fish in tap water and hardened water. Fish maintained in hardened water in general exhibited higher excretory rates for Na, Cl, and Ca.

(148)

Balanced Shoot and Root Functions: Photosynthate Production and Nitrogen Uptake

D. L. OSMOND AND C. DAVID RAPER, JR.
North Carolina State University

Plant scientists, when interpreting plant growth, often set growth of all plant parts as dependent on a carbon substrate, soluble carbohydrate, supplied by a single organ, the leaves. Similarly, when attempting to describe nutrient uptake, they frequently consider as the only limits to mineral nutrient absorption some feature of the root system such as length or surface area or some characteristic of the external soil solution such as ionic concentration. However, growth of the whole plant can only be explained by acknowledging the interdependence among the activities of each organ as well as the resulting balance maintained among the separate functions of all organs of the growing plant. An under-

standing of this functional interdependence between shoot and root is essential in coupling phytotron and field research to predict growth and yields of agronomic crops. We are attempting such an understanding in a series of experiments for which changes in rates of growth, carbohydrate flow, and nitrogen accumulation are calculated in response to changes in light, temperature and nitrogen availability.

(264)

Pollination in *Hexastylis arifolia* (Michx.) Small and *H. minor* (Ashe) Blomquist (Aristolochiaceae)

DEBORAH OTTE
University of North Carolina, Chapel Hill

The pollination ecology of the genus *Asarum sensu lato* has remained a mystery over the years. A number of people have postulated possible pollination mechanisms, however, no definite statements with convincing evidence and documentation have been made. Careful field observations and data from experimental plants now indicates that both *Hexastylis arifolia* and *H. minor* are autogamous. Effective pollination, however, typically requires a vector — the plants are self-fertile but do not self-pollinate. Pollination is affected by various, and presumably nonspecific, vectors such as small dipterans, small hymenopterans, and thysanopterans. The pollination mechanism appears to be successful and efficient, for fruit set in the populations studied is over 90%.

(324)

Comparative Studies of Cyprinid Fishes in the Southeast

L. M. OUTTEN
Mars Hill College

Studies were made on the life history, ecology, coloration, meristic characters, proportional measurements, morphometric variation, and distribution of cyprinid fishes, as *Notropis leuciodus* and *N. rubricroceus*, in the southeastern United States.

(88)

Interactions of Environment and Media Composition in Adventive Bud Induction on Cultured Embryos of Loblolly Pine (*Pinus taeda* L.)

HARINDER K. PALTA AND R. L. MOTT
North Carolina State University

A series of different environments and media were evaluated for their effectiveness in promoting tissue culture bud induction. The environments differed in temperature and light regimes. The media differed primarily in salts composition; growth regulators were kept uniform. In this study, both adventive bud frequency and intensity were used as the criteria for the selection of optimal environment and media combinations. Results will be presented to show that both of these experimental variants influence the morphogenetic potentialities of the cultured loblolly pine explants.

(256)

Compatibility Studies in the Genus *Camellia*
(Theaceae)

CLIFFORD R. PARKS

University of North Carolina, Chapel Hill

Twenty-five of the over eighty recognized species are represented in western botanical and horticultural collections of the southeastern Asiatic genus *Camellia*. A cross-compatibility survey involving as many hybrid combinations as possible has been carried out using the available taxa. Although some hybrid combinations are much easier to synthesize than others, nearly all attempted combinations have been successful. Hybrids formed between morphologically similar parent species often exhibit a high level of vigor and fertility, but some hybrids which bridge sections also exhibit great vigor and some fertility. From these and other available data on the *Camellia* species in cultivation, it can be concluded that the level of genetic differentiation between many species combinations is not very great, even some placed in different morphologically defined sections of the genus. These compatibility data and chemotaxonomic studies provide evidence that several species have originated as hybrid derivatives of cultivation.

(314)

Effects of Salinity on the Rate of Rubidium Uptake by Several Species of Marsh Grasses

ROLANDO T. PARRONDO AND JAMES G. GOSSELINK

Louisiana State University

Low concentrations (up to 1 mM/l of NaCl in the absorption solution) enhanced the uptake of Rb by excised root tissue but was inhibitory at higher concentrations. Calcium at 2 mM/l also enhanced Rb uptake. However, magnesium did not show any appreciable effect on the rate of absorption of Rb. Ten g/l of NaCl, whether given prior to or during the absorption period, reduced the accumulation of Rb by intact seedlings. However, the degree of inhibition varied among species, being highest in *S. patens* and lowest in *D. spicata*. It is concluded that NaCl concentrations in the marsh inhibit the absorption of Rb, and presumably that of K by these species. The relative tolerance to salinity by these species is briefly discussed.

(151)

The Effect of Size at Flowering on the Vegetative Growth and Seed Yield of Soybean
(*Glycine max*)

DAVID T. PATTERSON, MARY M. PEET,
JAMES A. BUNCE, AND PAUL J. KRAMER
Duke University

The effect of plant size at flowering on final seed yield was studied in soybean grown in controlled environment rooms at 26C day and 20C night. A 37-day period of photoinductive 8 hr days was given, beginning at 22, 30, and 38 days after planting (three, six, and nine main stem trifoliolate stages, respectively). Delay-

ing the beginning of photoinduction for 8 days resulted in an increase in final total seed weight per plant of 34%. When photoinduction was delayed 16 days, there was an 84% increase in total seed weight. The increased seed yield was positively correlated with the increased number of axillary nodes produced as photoinduction was delayed. There was little effect of delaying photoinduction on the average number of pods per node, number of seeds per pod, or weight of individual seeds.

(55)

The Relationship of Microbial Colonization and Chemical Changes of Decomposing Leaf Material in a Large River

ROBERT W. PAUL, JR., JUDITH G. CROXDALE,
AND ERNEST F. BENFIELD

Virginia Polytechnic Institute and State University

The objectives of this study were to document the presence and distribution of surface colonizing microorganisms and to monitor changes (cellulose, lignin, and hemicellulose) during leaf decomposition in a large river. American Sycamore (*Platanus occidentalis* L.) leaves were enclosed in 1 mm mesh nylon bags and exposed in the New River during the Spring, 1976. Samples were retrieved after exposures of 10 days, 3, 4, 6, 8, and 14 weeks. Upon recovery subsamples were fixed, critical point dried, and examined by scanning electron microscopy (SEM). Leaf material was dried at 50C and the cell wall fractions were analyzed. Fungal and bacterial colonization increased with time. Areas along leaf veins and at stomatal openings on the underside of the leaf blade were colonized earliest, and were the first to be degraded. Leaf fiber and lignin content as percent dry weight increased until 8 weeks, then declined at 14 weeks. SEM visual evidence supported fiber degradation between 8 and 14 weeks of exposure.

(67)

Studies of the Life History and Ecology of
Orconectes palmeri palmeri (Faxon)
(Crustacea: Decapoda: Cambaridae)

JAMES F. PAYNE AND JAMES O. PRICE
Memphis State University

The life history and ecology of the crayfish *Orconectes palmeri palmeri* were studied in a variety of lotic habitats in the Chickasaw Basin of western Tennessee. Prior to oviposition in February and March, females constructed and inhabited shallow burrows, especially within and around heavy debris. Juveniles appeared in open-water samples in March, and April, and most specimens reached adult size (carapace length, 21-25 mm) by late September and October. In November 85% of all males were form I and females showed active cement glands; most form I males molted to form II during June. Apparently three adult age classes existed in open water during most of the year; these were: first year (21-25 mm), second year (26-35 mm), and third year (36-42 mm). Stream channelization of several sites within the study area probably eliminated suitable habitat for this species.

(28)

Data Reduction by Seasonal Partitioning of Litterfall Biomass

JOHN A. PEARSON AND GEORGE T. WEAVER
Southern Illinois University, Carbondale

Litterfall samples from oak-hickory forests of south-western Illinois were collected throughout the calendar year 1975. Temporal fluxes in the relative abundances of foliage, twigs, and reproductive components were used as a basis to recognize 4 to 6 biomass seasons. This partitioning is then applied to combine samples within a season for chemical analysis of macronutrients and micronutrients. In turn, this will describe changes in litterfall nutrient content on a temporal basis.

(152)

The Effect of Increasing Soybean Density in Controlled Environments on their Production and Variability

MARY M. PEET, DAVID T. PATTERSON
AND JAMES A. BUNCE
Duke University

Soybeans were grown in controlled environments at three spacings (2.55, 5.10 and 7.65 plants/m²) to determine the effect on vegetative and reproductive growth and on variability. Dry weights, axillary node numbers and yield were higher in low-density (LD) treatments than in the medium (MD) and high (HD) density treatments, which in most cases did not differ significantly. None of the density treatments differed significantly in height, main stem nodes, percentage of nodes with pods, seeds per pod or pods per node, possibly because these characteristics were determined before crowding became severe in any treatments. For vegetative weights and most morphological characteristics (except nodes without pods) variability and number of replicates required increased with crowding. For reproductive weights and yield, however, both variability and replicates required were lowest in the MD treatment. Thus, under densities where individual plant dry matter production is maximal, variability is not necessarily minimal.

(119)

Strategies For the Preservation of Natural Diversity

ROBERT PEET
University of North Carolina—Chapel Hill
(No abstract received)

(50)

Carbon Partitioning in the Yadkin River, a North Carolina Piedmont Stream

J. C. PERKINS AND D. A. BRAATZ
Duke Power Company

In this presentation we offer one view of the Yadkin River ecosystem as a functional unit, through a com-

partmental analysis and overview of carbon as it occurred and was utilized in the water, in the sediments, and in the biota. Water chemistry, phytoplankton, periphyton, zooplankton, benthos, detritus, and fish samples collected monthly in 1975 indicated that the river was a heterotrophic system. Averages of monthly distribution of total organic carbon (TOC) within the "drift" fraction were 52.25% particulate detritus (> 1.0 μ), 47.37% dissolved, 0.34% phytoplankton, 0.037% zooplankton and macroinvertebrates, and 0.004% vertebrates. Averages of monthly distribution of TOC in the "residential" fraction were 42.60% periphyton, 41.90% vertebrates, and 15.50% macroinvertebrates.

(209)

Composition and Biomass of Demersal Fishes Associated With Silty-Clay and Sandy-Loam Estuarine Substrates

PETER W. PERSCHBACKER AND FRANK J. SCHWARTZ
University of North Carolina

Demersal fish populations of two adjacent sites in a power plant intake canal tributary to the Cape Fear River estuary near Southport, North Carolina, were sampled on 18 occasions between November 1975 and May 1976 with 6.8m otter trawls. The canal was dug in 1972. Differences in fish abundance and presence or absence of a species was attributed to substrate preference. Environmental parameters and total numbers of individuals captured were similar at the two sites which physically differed by the percentage of clay or sand in the sediment. The canal site possessed a greater (51.9 vs. 22.5%) clay substrate (organic or inorganic particles \pm .002 mm) and produced a significantly greater biomass and species richness than the 19W site. This was attributed to a greater availability and variety of food organisms in the silty-clay as opposed to the sandy 19W habitat. Total biomass was 102.3 kg for the canal vs. 75.1 kg at 19W. The affinity index was 66.6 where 25 of the 37 total species were common to both stations.

(116)

Chilling as an Environmental Stress Factor Upon the Embryological Development of *Mus musculus* L., C57B1/6J Strain

CYNTHIA PETRALIA AND DAVID STASZAK
Georgia College

Pregnant female mice of the C57B1/6J strain were exposed to three experimental temperatures: 22.8C, 18.5C, and 10C without nesting material and without acclimatization. They were placed in a controlled environmental chamber on the seventh day of gestation and were removed 144 hours later on the thirteenth day of gestation. Newborn pups were examined for morphological defects. Data on litter size, mortality rates, and weights of pups were recorded. Weight gain for a month postpartum was also recorded. Evidence of the deleterious effect of chilling was detected as indicated by mortality, malformation, and litter size.

(315)

A Plant Exposure System for Atmospheric Pollution Research

ROBERT B. PHILBECK

*United States Department of Agriculture,
Agricultural Research Service,
North Carolina State University*

A different exposure chamber design has been employed for air pollution studies during the past two years. These chambers are cylindrical in design and have an impeller (120 rpm). Both features help insure optimal mixing of the introduced pollutants within the chamber. The chamber acts as a modified constant stirred tank reactor (CSTR). Pollutant uptake is determined by measurement of chamber inlet concentration — chamber exhaust concentration with a correction for an empty chamber. The chamber permits continuous measurement of pollutant uptake, not CO₂ exchange and transpirational losses. Monitoring equipment is time shared using a simple electromechanical scanner. All environmental parameters can be continuously recorded on strip chart recorders. Light intensity, temperature, air flow, pollutant type and concentration, and relative humidity can be programmed for each chamber. Four commercial plant growth chambers are used to grow plants under known light intensity, relative humidity, and temperature prior to the exposure studies. Instrumental and biological calibration results will be presented and discussed.

(25)

The Effects of Nitrogen Enrichment on the Structure and Function of an Old-Field Plant Community

JOHN E. PINDER, III

Savannah River Ecology Laboratory

The effects of nitrogen fertilizer on the productivity and diversity of an old-field plant community were measured. The community is dominated by several species of perennial grasses, while subordinate species are primarily annual and biennial forbs. NO₃-N was applied in equal monthly doses from April 1973 to August 1973. Total application rates were 0, 75, 150, and 225 kg N/ha. Application of 75 kg N/ha doubled the net production and standing crop of the community. Application of N at rates exceeding 75 kg N/ha had little additional effect on net production. Species diversity was reduced by nitrogen enrichment. The increase in net production of dominant species was greater than that of subordinate species indicating that the ability of the perennial grasses to monopolize the community's resources increased with nitrogen enrichment.

(24)

Relationships Between Structure and Function in an Old-Field Plant Community

JOHN E. PINDER, III

Savannah River Ecology Laboratory

The relationships between structure and function in an old-field plant community were studied by removing various species. The community is dominated by several species of perennial grasses while the subordinate species

are primarily annual and biennial forbs. The removals involved the manual extraction of either dominant or subordinate species. The removals were performed in April, 1972, and their effects on community net production and nutrient uptake were measured through September, 1972. The results suggest a relatively simple community organization. The perennial grasses appear to monopolize the community's resources and limit the growth of most forb species. The forbs appear to be utilizing resources that are not readily accessible to the dominants.

(220)

Habitats of the Bog Turtle, *Clemmys muhlenbergi*, in the Southern Part of Its Range

STEVE PLATANIA

Towson State University

BEN A. SANDERS

United States Forest Service

Although the geographical distribution of the bog turtle, *Clemmys muhlenbergi*, has received considerable attention, and there has been much effort on the local level to locate and catalogue colony sites, little habitat analysis has been done. During the last several years we have been trying to correlate population density of bog turtles with habitat type. In the piedmont of Maryland, Delaware, and North Carolina this turtle is most commonly found in sedge meadows associated with silt loam soils (Baile, Codorus, Glenville, Hatboro, and others) of flood plains. Several species of sedges (*Carex*) and grasses (*Poa*, *Panicum*, *Lyseria*) dominate. Highest densities occur in early successional stages when there is a minimum of woody vegetation. Artificial maintenance of such conditions by animals grazing, power line right of ways, etc. is important for the survival of many colonies. In the mountains of Virginia and North Carolina bog turtles are also associated with sedge meadows, but they are found in certain mountain bog communities, as well.

(199)

Franklinia alatamaha

GAYTHER L. PLUMMER

University of Georgia

Evidence accumulates that this member of the *Theaceae* was never native to Georgia. The "Lost Gordonia" was discovered by John and William Bartram in 1765 and seen last in 1803 by John Lyon where the Bartrams found it. It persists as a cultivar.

(304)

The History and Pattern of Land Use of Hobcaw Forest, Winyah Bay, Georgetown County, South Carolina

RICHARD D. PORCHER

The Citadel

During 1975-76 the history and pattern of land use of the 7000 acres of Hobcaw Forest was investigated. This study was conducted so that results from future studies on forest productivity and vegetational succession can be adequately evaluated. Aerial photographs, old maps, interviews, vegetational analyses, field surveys of dikes, canals, banks, etc., deeds, and archeological data

were used and indicate little agricultural activity until 1767. From 1767 until 1865, rice planting and related activities resulted in clearing of inland and river swamps for rice cultivation, and clearing of upland forest for homesteads, fields, and pastures. Following the decline of the rice industry after 1865, most cleared land reverted to forest. Property lines of the original plantations that comprised Hobcaw Forest were established on an aerial photograph. Using a series of overlays, the land use of each plantation has been documented from 1767 to the present. Of particular interest is the rate of succession and present forest composition following secondary succession on the abandoned pastures and fields, the earliest dating from 1796. — *This study was funded by the Belle W. Baruch Forest Science Institute of Clemson University.*

(225)

Seasonal Fluctuations in the Frequency of Water-bathing by Small Land Birds

ELOISE F. POTTER
Carolina Bird Club

Almost daily random observations made at three ground-level pools in my yard near Zebulon, North Carolina, during a three-year period have provided water-bathing data for more than 40 species of small land birds that frequent woodland habitats. These include winter, summer, and year-round residents plus a few fall transients. The species seen bathing most frequently is the American Robin (*Turdus migratorius*), a year-round resident that is abundant during fall migration. Seasonal fluctuations in water-bathing activity for this and other species are examined in relationship to the cycle of molt, to local weather conditions, and to published records from North Carolina for other feather maintenance behaviors such as anting and sunbathing. The study indicates that water-bathing, like anting and sunning, is most frequent when the birds are molting.

(203)

Impingement Studies at the Appalachian Power Company's Generating Station at Glen Lyn, Virginia

WAYNE A. POTTER, K. L. DICKSON, J. CAIRNS, JR.,
AND J. R. STAUFFER, JR.

*Virginia Polytechnic Institute and State University
and University of Maryland*

The fishes impinged on the intake screens of the Glen Lyn Power Station were surveyed from May 1976 through March 1977. The materials back-washed off the vertical travelling screens were collected and fish removed for one 24 hr period each week during the survey. Collections were made with baskets of the same mesh size of the intake screens (0.375 in.²) unless excessive amounts of debris (leaves, algae, trash) were impinged. These studies were conducted to document the effects of the power plant's intake on the fishes of the New River in the vicinity of Glen Lyn, Virginia. Generally, low numbers of specimens were impinged during a 24 hr period (less than 20). The most frequently impinged species are discussed and comparisons are made to the relative species composition of fishes in the New River at Glen Lyn. — *This research was supported by the Appalachian Power Company.*

(202)

Entrainment Studies at the Appalachian Power Company's Generating Station at Glen Lyn, Virginia

WAYNE A. POTTER, K. L. DICKSON, J. R. STAUFFER, JR.,
AND J. CAIRNS, JR.

*Virginia Polytechnic Institute and State University
and University of Maryland*

The composition of larval fishes of the New River near Glen Lyn, Virginia and of those entrained by the Glen Lyn Power Station were studied from May through August 1976. Replicate samples (3) were taken during day, dusk, and dawn periods at six stations twice weekly during the sample program. Collections were made with rectangular drift nets with mouth openings of 0.63 m by 0.94 m and netting of 0.5 mm mesh. These studies were conducted to document the effects of the power plant's intake on the fishes of the New River in the vicinity of Glen Lyn. The composition of the collections and temporal changes in species composition are discussed. — *This research was supported by the Appalachian Power Company.*

(56)

Cumaceans (Crustacea: Malacostraca) in the Gulf of Mexico

CHARLES E. POWELL, JR.
Academy of Natural Sciences of Philadelphia

The biogeography of the cumaceans reported from the Gulf of Mexico and the Caribbean Sea will be discussed. Specific and generic distributions within the Gulf of Mexico will be compared with those in the Caribbean Sea and the tropical Atlantic Ocean, and factors limiting cumacean distribution will be discussed. Samples taken by the author include the genera *Makrokyllindrus* and *Campylaspis*. Neither of these genera has previously been found in the Gulf of Mexico, although *Campylaspis* has been collected at the island of Anguilla in the West Indies.

(322)

The Diel Distribution and Relative Abundance of Fish Species in a Freshwater Tidal Creek

J. CHRISTOPHER POWELL
George Mason University

Adult and larval fishes were sampled in Kanes Creek, Fairfax County, Virginia from March to October 1976. Four stations in the creek and one in the adjoining bay were sampled both day and night at approximately 2 wk intervals. Twenty-three species were collected, using experimental gill nets, traps, fyke nets, and plankton nets. Data collected provided information on spawning activity, day-night occurrence and relative abundance of both larval and adult fishes at the five stations. The most numerous adult species were *Morone americanus*, *Brevoortia tyrannus*, and *Dorosoma cepedianum*. *Morone* was more abundant during the day, while *Brevoortia*, *Dorosoma* and the ichthyo-plankton were more numerous in the night collections.

(66)

The Life Cycle of *Orconectes neglectus chaenodactylus* Williams (Crustacea: Decapoda: Cambaridae)

JAMES O. PRICE AND JAMES F. PAYNE
Memphis State University

Studies of the life cycle of *Orconectes neglectus chaenodactylus* were conducted in North Sylamore Creek in northcentral Arkansas. Ovipigerous females ranged from 14 mm (first year) to 28 mm (second year) carapace length and were taken during April from shallow depressions in sand or gravel beneath large stones, along the creek margins. Juveniles hatched in April and May and reached a mean carapace length of 14.3 mm by the end of September. From July through September only juvenile and form II males were found; molt to form I began in October, when 68% of the males were form I and mean carapace length had increased to 14.9 mm. In December, 94% of the first year males were form I and mean carapace length was 15.4 mm.

(41)

Mercury, Cadmium, Lead and Arsenic in Sediments, Plankton and Clams from Lake Washington and Sardis Reservoir, Mississippi

RICHARD E. PRICE
*U.S.D.A. Sedimentation Laboratory,
University of Mississippi*

Mercury, cadmium, lead and arsenic concentrations were measured in clams, plankton and sediments from Lake Washington, an oxbow lake off the Mississippi River, and Sardis Reservoir, a flood control reservoir on the Little Tallahatchie River. Mercury, cadmium and lead were measured by atomic absorption spectrophotometric methods and arsenic by the silver diethyldithiocarbamate method. A *t* test used to compare concentrations of the four metals in the sediments of the two bodies of water exemplified a significant difference in arsenic concentration. Correlation coefficients for concentrations of metals in the sediments, plankton and clams were derived. Comparisons between relative clam size and trace metal concentrations revealed higher concentrations of mercury in the smaller clams. Bio-magnification occurs from sediments to plankton but very little, if any, from plankton to clams.

(71)

Compensation for Low Temperature: Oxygen Consumption by the Crayfish *Cambarus acuminatus* (Faxon)

NANCY L. PRUITT AND RONALD V. DIMOCK, JR.
Wake Forest University

The effect of thermal acclimation on the rate of oxygen consumption of the crayfish *Cambarus acuminatus* was investigated by closed chamber respirometry. Following cold acclimation, the rate-temperature curve for oxygen uptake undergoes rotation to the right (Prosser Type III) relative to that of warm acclimated animals. Acutely measured metabolic rates of 4C acclimated animals are increased at 5C and 10C, decreased at 20C and 25C, and not significantly different at 15C from those

of 25C acclimated animals. Cold acclimation decreases temperature sensitivity as evidenced by a significantly lower Q_{10} for 4C acclimated crayfish throughout the range of experimental temperatures at 5C to 25C. No significant differences in metabolic rate occurred between males and females. Eyestalk ablation and injection studies are being conducted to assay the role of neural secretion in thermal acclimation.

(122)

The Development of a Classification System for Natural Ecosystems

ALBERT E. RADFORD AND R. DAVID WHETSTONE
University of North Carolina—Chapel Hill
(No abstract received)

(294)

Vegetation Analysis of an Experimental Watershed on the Cumberland Plateau

GEORGE S. RAMSEUR
The University of the South

The Air Quality Research Section of the Tennessee Valley Authority established an experimental watershed in Fall Creek Falls State Park, Bledsoe County, Tennessee. The Watershed of about 94 ha (233 acres) ranges from 518.3 m (1700 ft) to 597.5 m (1960 ft) elevation. Most of the watershed is covered by oak forest dominated by scarlet oak, post oak, and black oak, but about ten percent is upland bog dominated by red maple, black gum, and white oak. As a base for a description of the dominant vegetation, 6 1-ha plots were sampled and analysed.—*This study was supported by the Tennessee Valley Authority.*

(126)

Legal Aspects of Land Protection

DANIEL RASKIN
The Nature Conservancy
(No abstract received)

(163)

Indigofera (Papilionaceae) — An Historical Review

DAVID H. REMBERT, JR.
University of South Carolina

Until the 20th century, plants in the genus *Indigofera* supplied the markets of the world with the valuable dye stuff indigo. A review of the literature, museum records, and herbaria reveals that of the 300 or so species of this cosmopolitan genus only 9 have been important in commerce. It is significant that all 9 have pinnately compound leaves with numerous leaflets, pods with several seeds, and erect habit. Five are African or Indian in origin, 3 are Central or South American, and 1 is a North American species. With the discovery in the 19th century of methods of production of aniline dyes, the demise of the natural dyes as a commercial endeavor was insured and hence the rather rapid decline in cultivation of *Indigofera* as a profitable activity.

(183)

A Comparative Study of Gametophyte Structure and Development in the Anthocerotes

KAREN RENZAGLIA

Southern Illinois University

The Anthocerotes provide an excellent and unique opportunity to examine and compare variations in the morphology of a group of closely related taxa. A comparative developmental study of the gametophyte generation of representatives of the five genera of Anthocerotes has been made using the technique of serial microtome sectioning at the light microscope level. Particular emphasis is placed on sporeling patterns, apical cell form and early division patterns. Included also in this investigation are comparisons of gametangia, mucilage cavity and *Nostoc* colony structure and development. With this information, relationships within the group have been clarified.

(11)

Effects of Temperature and Pressure on the Excretion Rates of ⁶⁵Zn in the Brine Shrimp (*Artemia salina*)

JOHN C. RHODERICK

*Long Island University and
University of Maryland Chesapeake
Biological Laboratory*

C. E. STYRON

St. Andrews Presbyterian College

Studies of the excretion rate of ⁶⁵Zn by the brine shrimp, were conducted at temperatures of 10, 15, 25, and 30C and pressures up to 200 ATM's for 144 hr. The greatest accumulation of the radionuclide, ⁶⁵Zn, occurred when both food and ambient seawater served as sources for incorporation rather than the food or water alone. Excretion of ⁶⁵Zn showed two rates of loss, assimilated and nonassimilated pools. Sublethal hydrostatic pressure had a profound effect upon *Artemia's* retention of ⁶⁵Zn as measured by excretion losses. Low temperature, as an external parameter, was found to reduce the rate of elimination and respiration thereby enhancing the storage of ⁶⁵Zn by *Artemia*. High temperatures appeared to partially overcome the retarding effect of high pressure by increasing the metabolic rate. Thus, monitoring the excretion rate using a radionuclide provides a good qualitative way of studying sublethal pressure and temperature effects on the metabolism of zooplankton.

(14)

Effects of Chlorination to the American Oyster, *Crassostrea virginica* at Two Temperatures

JOHN C. RHODERICK, RONALD M. BLOCK,

KLAUS G. DROBECK AND WILLIAM H. ROUSENBURG
*University of Maryland, Chesapeake
Biological Laboratory*

Continuous flow bioassays were conducted on oysters exposed to chlorine produced oxidants (CPO) at both

15C and 25C for up to 120 hours. The EC50 for shell deposition at 25C was 86% less than for oysters exposed to chlorine at 15C (0.01 mg/l vs 0.07 mg/l). Chlorine was more toxic to oysters at lower CPO concentrations than at higher concentrations. This phenomenon was indicated by various biochemical parameters such as mantle carbonic anhydrase, muscle glutamate dehydrogenase and glutamic pyruvate transaminase activities and muscle free amino acids. Shell closure at higher chlorine concentrations was also observed using force transducers attached to the shell. These results show that oysters are able to close their shells to avoid stressful conditions since they are facultative anaerobes.—
This research was supported by the State of Maryland Department of Natural Resources, Power Plant Siting Program under contract number 25-75-04.

(170)

Anatomy and Ultrastructure of the Primary Haustorium of Witchweed (*Striga asiatica*) (Scrophulariaceae)

STEVEN D. RICH

Old Dominion University

The primary haustorium of Witchweed is similar in internal organization to that of secondary haustorium of other parasitic Scrophulariaceae with a well defined vascular core, central parenchymatous core, and other features. Transition sieve tube elements, considered to represent an arrested stage in sieve tube element maturation, are reported from a haustorium of the Scrophulariaceae for the first time. These are located on the periphery of the axial strands which form the xylem link between host and parasite. Preliminary observations on the fine structure of cells in the region of host penetration show large, irregularly shaped mitochondria.

(70)

The Effects of Rapid Temperature Changes on Oxygen Consumption Patterns of Amphipods (*Gammarus* sp.) and Juvenile Blue Crabs (*Callinectes sapidus*) Acclimated to Constant and Cyclic Temperatures

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Oxygen consumption patterns were determined for amphipods (*Gammarus* sp.) and juvenile blue crabs (*Callinectes sapidus*) acclimated to a series of constant temperatures (amphipods: 5C, 15C and 25C; crabs: 15C and 25C) and symmetrical fluctuating temperature cycles with a 12-hour ascending and descending phase. The amplitude of each phase was 10C which was divided equally into 5C segments above and below each constant acclimation temperature. All cyclic acclimated organisms were studied when they passed through the midpoint of the ascending phase, i.e., at the same temperature as the constant acclimated animals. Baseline metab-

olism was determined at 15-min intervals for 90 min before thermal exposure. Experimental animals were then exposed to a rapid 10C thermal increase, held at the elevated temperature for four min and returned to constant acclimation temperature over a 15-min decay period. Measurements were then continued at 15-min intervals for 90 min to evaluate the organisms' response to the thermal exposure. The weight specific oxygen consumption (Q_{O_2}) of amphipods at all constant and cyclic acclimation temperatures was significantly higher 15 to 30 min following thermal exposure but returned to initial levels 30 to 45 mins later. The same response was observed in both constant and cyclic 15C blue crabs; no changes occurred at 25C. No significant differences in oxygen consumption responses were found among species acclimated to either constant or cycling temperatures when tested at the same temperature. — *This research was supported by the Baltimore Gas and Electric Company, Baltimore, Maryland.*

(81)

Ultrastructure of Morphogenesis in *Drosophila melanogaster*: The Mutant *Mat(3)6*

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mat(3)6 is a female sterile embryonic lethal mutant in which cell formation and subsequent events of gastrulation are abnormal. This mutant was isolated and described by T. B. Rice and A. Garen (*Dev. Biol.* 43: 277-286, 1975). An ultrastructural analysis of this mutant has been done. At least some of the cells of the posterior midgut rudiment, which constitute almost all of the cells formed in the posterior region of the embryo, retain cytoplasmic continuity with the primitive yolk sac during early extension (Rickoll, W. L. *Dev. Biol.* 49:304-310, 1976). In *mat(3)6* embryos, the posterior midgut rudiment and the pole cells migrate together in an anterior direction along the dorsal surface for a distance of approximately one-half the length of the embryo. These observations support the hypothesis that the yolk system itself plays a role in morphogenesis in insects, and that in *Drosophila melanogaster* the persisting cell-yolk sac connections may be a part of this morphogenetic mechanism.

(102)

Efficacy of Thienium Closylate-Piperazine Phosphate Combination Against Immature and Mature Stages of *Ancylostoma braziliense* (Nematoda: Strongylida) in Weaned Pups

EDWARD L. ROBERSON
University of Georgia

Two-month-old hookworm-free Beagle pups each were inoculated orally with 1200 larvae of *A. braziliense*. To determine efficacy of the experimental drug for 4th stage larvae, the drug was administered to 10 pups and a placebo to 5 control pups on day 7 postinfection. The pups were necropsied 4 days later. Another two groups totaling 15 pups were treated similarly on day 17 postinfection and necropsied 4 days later to determine efficacy against young adult worms. Activity of the drug combination was good for both 4th stage larvae (91%) and adult worms (97%).

(242)

Chemically Mediated Reversal of Phototaxis in a Symbiotic Water Mite (Acarina: Unionicolidae)

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Wake Forest University

Adult female *Unionicola formosa*, symbiotic with the mussel *Anodonta imbecilis*, are positively phototactic when immersed in lake water. Reversal of this phototaxis occurs when the mites are exposed to water from the mantle cavity of the host, to water within which the host mussels have been maintained, or to millipore filtered homogenate of host mantle tissue. Nymphs also exhibit this reversal of phototaxis. Adult male mites are positively phototactic in the absence of any host influence, but whether this response is affected by host effluent is at present unknown. Induction of the reversal of phototactic sign is species specific; the response of these mites to effluent from other species of mussels differs significantly from that to effluent from their own hosts. The nature of this reversal of phototaxis and its possible role in the initiation and maintenance of this symbiosis are being examined.

(112)

The Effects of Thyroid Inhibition on Ovarian Function and on the Concentration of Estradiol-17 β in Reproductive and Pituitary Tissues of the Golden Hamster

LARRY M. ROBINSON AND W. B. KEITH
University of Mississippi

The effect of decreased thyroid function on the ability of estrogen target tissues to concentrate estradiol 17 β -6, 7-H³ was examined along with ovarian function in thyroid inhibited animals. Decreased thyroid function inhibited follicle maturation, ovulation, and corpora lutea formation. The data obtained further indicated that estrogenic target tissues of thyroid inhibited animals have a diminished ability to concentrate this hormone. Finally, these data suggest a mechanism accounting for the observed inhibition of ovarian function through the interruption of the normal LH-estradiol positive feedback relationship.

(45)

Analyses of Aufwuchs Communities

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KENNETH L. DICKSON AND JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University

Artificial streams which received water directly from the New River, Glen Lyn, Virginia were used to study responses of Aufwuchs communities on glass microscope slides to additions of glucose, sucrose, phosphate, copper, dichromate, and intermittent and continuous chlorination. Analyses were performed at the end of the colonization period and included dry weight, ash-free dry weight, ATP, and chlorophyll *a* content. In addition, primary productivity (carbon-14) and assimilatory sulfate-35 reduction were measured using light and dark chambers and *in situ* incubations. The ratio of chlorophyll *a* to viable organic carbon calculated from ATP concentrations and the ratio of light to dark sulfate assimilation were useful in assessment of functional responses of

these communities. Primary productivity and its relationship to solar energy input and chlorophyll *a* provided additional information that aided in evaluation of these perturbations.

(142)

The Influence of Chlorine Produced Oxidants on Larval Stages of the Soft Shell Clam

Mya arenaria

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University of Maryland, Chesapeake Biological Laboratory

Two sets of continuous flow bioassays were conducted on both trochophore-straight hinged and umbo-setting larvae. A concentration-time matrix was developed to test the effects of exposure to chlorine produced oxidants (CPO). Trochophore larvae were exposed for 2, 4, 8, and 12 hr at 0, 0.05, 0.1, 0.2, and 0.3 mg/l CPO. Results of these experiments showed that mortality of larvae decreased with respect to time at the lower chlorine concentrations while at higher concentrations mortality increased. This observation was probably due to optimal bactericidal CPO concentrations which did not affect the clam larvae. In the second series of experiments umbo stage clams were allowed to set on a glass substrate prior to chlorine exposure. Samples were taken at various time intervals up to 72 hr in the same chlorine concentrations described above. Results indicated that total mortality of clam larvae increased concomitant with exposure time and CPO concentrations. — *This research was supported by the State of Maryland Department of Natural Resources, Power Plant Siting Program under contract number 25-75-04.*

(327)

New Records of Tropical Fishes Collected on Reefs in Onslow Bay, North Carolina

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Institute of Marine Sciences
University of North Carolina

Since February, 1976, 140 SCUBA dives totalling 68.4 hr have been made observing and collecting fishes on reefs in Onslow Bay, North Carolina. Two inshore jetties and six offshore locations were studied. Offshore depths ranged from 16.7-33.5 m while jetty depths ranged from surface to 14.3 m. Fishes were collected using ichthyocides, nets, spears, and hook and line. To date, 92 species in 36 families have been observed or collected. The following are new records for North Carolina: *Ahlia egmontis* (Ophichthidae); *Liopropoma eukrines* (Serranidae); *Astropogon stellatus*, *Phaeoptyx pigmentaria* (Apogonidae); *Holacanthus tricolor* (Chaetodontidae); *Abudefduf taurus*, *Chromis scotti*, *Eupomacentrus fuscus*, *Eupomacentrus partitus*, *Eupomacentrus variabilis* (Pomacentridae); *Bodianus pulchellus*, *Halichoeres garnoti*, *Halichoeres maculipinna* (Labridae); *Eumleptura atlantica* (Chaenopsidae); *Coryphopterus punctipetophorus*, *Gnatholepis thompsoni*, *Gobiosoma xanthiprora*, *Lythrypnus nesioties*, and *Lythrypnus spilus* (Gobiidae). Specimens have been deposited at the University of North Carolina's Institute of Marine Sciences. Further research will attempt to determine the seasonality and abundance of fishes for various reefs in Onslow Bay.

(86)

Differentiation of White Clover Species and Hybrids from Callus and Cell Suspension Cultures

EARLENE A. RUPERT AND AIKO SEO

South Carolina Agricultural Experiment Station and
Clemson University

Callus growth on nutrient agar medium was induced from stem apices and young embryos of *Trifolium* species and hybrids. Portions of this callus were then subcultured simultaneously on agar and liquid media containing similar organic and inorganic nutrients and regulators. Cultures were examined at two week intervals for differentiation of specialized cell types. Vascular structures were more frequent in callus continued on solid medium. Meristematic colonies of dividing cells were more frequent among the dispersed aggregates in liquid cultures. Plant regeneration was obtained on agar based medium with high cytokinin content from tissue containing meristematic colonies.

(85)

The Effect of Kanamycin on the Development of Several Organs in Fetal Mice

LINDA K. RUSSELL

Georgia Southern College

Kanamycin is an antibiotic known to inhibit protein synthesis. This study was to determine if this antibiotic when injected to pregnant females affected the development of fetuses. Virgin white mice were divided into 2 groups each with 3 subgroups. The mice in each subgroup were the same age and from the same litter when possible. Each subgroup received a 0.5cc injection, i.p., of kanamycin at one of three concentrations: 15mg/kg, 30mg/kg, or 150mg/kg. One group received injections from day 1 to 10 of gestation and the other group received injections from day 10 to birth. The litters of the females were weighed and killed. The liver, kidneys, spleen, and adrenal glands of each fetus were removed, weighed, and prepared for histological analysis. Statistical analysis revealed that weights of organs of the experimentals and controls differed significantly. The difference was greater in the group receiving injections during day 1 to 10 of gestation than in those receiving injections from day 10 to birth.

(72)

Aspects of the Measurement of Photoperiod by Crayfish

STEVEN G. SADEWASSER

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This study examined photoperiod interpretation by *Orconectes immunis* (Hagen) as indicated by molt frequencies. Uncoupled light and dark periods (24:0 and 0:24), natural extreme photoperiods (8:16 and 16:8), and non-diel photoperiods (8:8 and 16:16) were tested at different intensities using multivariate environmental chambers with the following results: Crayfish molted at the highest levels in total darkness (0:24) and at the specific condition 16:8 low (3 f.c.) light intensity. Molt was lower at all other conditions. Crayfish kept at 8:8 molted less than those at 16:16. Crayfish did not refer exclusively to either light or dark periods nor to ratios between them. It appeared, instead, that a coin-

vidence model, dependent upon the length of each period, would apply. Other results suggested that light intensity influenced molting but not in a manner dependent upon total dose, males and females responded similarly, and responses were not dependent upon the reception of specific spectra of light.

(282)

Morphology and fine structure of the Operculate Ascus (suborder Pezizineae)

DON A. SAMUELSON
University of Florida

During recent times ascus structure has been recognized as a fundamental diagnostic character in ascomycete classification. The nature of this investigation is primarily concerned with morphological and cytochemical features of the apical apparatus within the Pezizineae. Included is a conspectus of apical apparatus found within the suborder on family, sub-family and tribe levels using a major representative from each taxon. A comparison of sequential development of operculate apical apparatus between several species are made. Phylogenetic considerations within the Pezizales are also made.

(105)

Effects of Delta-9-Tetrahydrocannabinol on *Tetrahymena Pyriformis* GL ATCC #30006

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AND D. O. ABBOTT
Murray State University

Previous studies have shown that delta-9-tetrahydrocannabinol, the major euphoric principle in marijuana, has an inhibitory effect on the division process in some prokaryotic and eukaryotic cell systems. This study was designed to gather quantitative data on the effects of THC on the ciliate *Tetrahymena pyriformis*. Treated and control cultures were analyzed in terms of cell morphology, division rates, DNA, RNA, and protein. The minimum lethal THC dose was found to be dependent upon the initial inoculum density. With large inoculum cultures (900 cells/ml) THC dosages above 60 ug/ml were lethal, while with small inoculum cultures (7 cells/ml) the minimum lethal dose was 20 ug/ml. Microcultures containing 5 cells/25 ul showed a lethal effect at 5 ug THC/ml. Sublethal THC challenge resulted in an increased generation time and a depression in macromolecular synthesis.

(212)

The Effect of Stream Channelization on Populations of *Fundulus stellifer* (Pisces: Cyprinodontidae)

JAMES D. SATTERFIELD
Georgia State University

Populations of the southern studfish, *Fundulus stellifer* (Jordan), studied over a ten year period in Alabama and Georgia have fluctuated widely due to apparent predation by centrarchids and changes in habitat. The primary habitat of *F. stellifer* is still water along stream margins, especially the shielded areas on the down stream side of sand bars where the fish feed largely on the benthos. Stream channelization destroys much habi-

tat and simplifies ecosystems but creates large areas of slow moving water with a fine sand or silt bottom in which studfish thrive. The largest populations of studfish are associated with recently channelized areas.

(184)

Development of the Archegonium and the Embryo in the Leafy Hepatic *Lophocolea heterophylla* (Schrad.) Dumort.

MARLEEN SCHERTLER
Southern Illinois University

Details of archegonium formation and embryo development are absent for many leafy hepatics. The ontogeny of the archegonium and embryo development was studied in the leafy hepatic *Lophocolea heterophylla* using the techniques of serial microtome sectioning at the light microscope level. Attention was given to initial stages of growth and subsequent differentiation and maturation. The patterns follow the general trends reported in other leafy hepatics, although modifications in this taxon were noted.

(106)

The Goblet Cell Cavity Matrix: Its Role in the Short Circuit Decay Profile of the Larval Lepidopteran Midgut

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The University of Tennessee

The larval lepidopteran midgut epithelium is composed of at least two cell types: a goblet cell which normally contains a cavity matrix plug and a more typical columnar cell. When studied *in vitro* this tissue exhibits a characteristic short circuit decay profile consisting of a 30 min period of rapid decay followed by a longer and slower decay period. This profile reflects the rate of active transport of K⁺ from hemolymph to lumen side of the midgut and is thought to be via the goblet cells. Evidence is presented that the initial rapid decay is caused by rapid extrusion of the cavity plugs from the goblet cells, while the slower decay is the product of tissue degradation and cell death. Additional evidence for this is that extensive release of plugs accompanies CO₂ anesthesia, a treatment which causes an immediate loss of 95-100% of the transport capacity both *in vitro* and *in vivo*.

(135)

A Previously Unreported Gland and Associated Structure Found in the Genus *Hydropsyche*

GUENTER A. SCHUSTER
University of Tennessee

A lobe-like structure was found to be present on the fifth sternite of males belonging to the *bifida* group in the genus *Hydropsyche*. This structure is associated with an elongated gland found in the fourth, fifth and sixth abdominal segments. The females of the *bifida* group lack the lobe, but possess the gland. The gland in the females, however, is much reduced, being about one-tenth the size of the gland in the male. The species of the other three groups in the genus all lack the lobe, but possess the gland. This may indicate that the gland is of phylogenetic importance, suggesting that all the

species within the *bifida* group arose from a common ancestral line. This being the case, all species in the *bifida* group are therefore more closely related to each other than to any other species in the genus. Adult genitalia and larval characters also suggest the monophyletic origin of the *bifida* group. The function of the gland and the lobe-like structure is not yet known, but it is hypothesized that they function as scent glands.

(136)

A Preliminary Report on the Study of the Larval Taxonomy of the Genus *Hydropsyche* in Eastern North America

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University of Tennessee

There are approximately 50 nominal species of *Hydropsyche* in the eastern United States. Forty of these species were associated with the adult forms. Five new species were discovered and the larvae of these were also associated. Larval-adult associations were made using the metamorphotype method. Morphological characters used to develop a workable key to the larvae include the following: color pattern on the frontoclypeus, spines at the base of the anal hooks, presence or absence of scale-like hairs on the dorsum of the abdomen, chaetotaxy on the various other parts of the body. The larvae of the species of the *bifida* group are easily separated from the other species groups within the genus due to the lack of black scale-like hairs on the dorsum of the abdomen. There is greater variation of the color pattern on the frontoclypeus of the *bifida* group species than in other *Hydropsyche* species. The larvae of only 12 species were previously known. Presented here for the first time are the larvae of approximately 30 species. Also presented are color pattern variations of widely distributed species that may be commonly encountered.

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Effects of Sharksucker, *Echeneis naucrates*, Disk on Scaled and Scaleless Fishes and Sea Turtles

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Recently Cressey and Lachner (1970) substantiated that most diskfishes (Echeneidae), long known mutualistic associates of sharks, rays, jewfish, billfishes, whales, and sea turtles, are parasite pickers rather than associates riding along and dependent on food scraps from the feeding host. No one has studied the external effects of the disk on the host. Observations of these effects by juvenile to adult sharksuckers, *Echeneis naucrates*, held in large outdoor 125,000 l tanks, on all sizes of 48 species of fishes in the families Carcharhinidae (3), Squalidae (1), Squatinidae (1), Rajidae (1), Dasyatidae (3), Myliobatidae (1), Congridae (1), Synodontidae (1), Batrachoididae (2), Gadidae (2), Serranidae (4), Pomatomidae (1), Rachycentridae (1), Carangidae (3), Sparidae (3), Sciaenidae (8), Ephippidae (1), Mugilidae (2), Triglidae (3), Bothidae (2), Balistidae (4), and on sea turtles (3) confirm that some species are seriously affected. *Echeneis* maintains its association with the host by the constant agitation of prolonged or repeated disk attachment. *Rhinoptera bonasus* and *Mugil*

cephalus are shown to have skin or scales worn away most readily. Death results once erosion proceeds through the skin to the muscles. Other test species were non-hosts (16), unaffected by prolonged disk attachment (10), out swam/maneuvered the *Echeneis* (19), or did not present a proper body surface for attachment (4).

(42)

Temporal Recovery of the Lower South Fork of the Shenandoah River as a Result of the Construction of a Secondary Waste Treatment Plant at an Industrial Site

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Virginia Polytechnic Institute and State University

The South Fork of the Shenandoah River receives several major industrial outfalls. One important pollution source is Avtex Corporation (formerly FMC), a fibers factory at Front Royal, Virginia. Since 1972, eight benthic surveys have been conducted at four stations (one above the outfall and three below) to assess the impact of Avtex's effluent on the benthic community. Single surveys in 1972 and 1973 indicated a severe impact on the aquatic community as a result of this effluent. Diversity values (Wilm, J. L. and T. C. Dorris, 1966, *Am. Mid. Nat.* 76: 467-449) at affected sites were low (0.24-2.32), number of taxa and organisms were reduced and one sample had no animals at all. In early 1974, FMC constructed a secondary treatment plant to replace the primary plant that had formerly treated their waste. Since that time, semi-annual surveys have shown considerable improvement. The previously affected sites became more stable, exhibiting greater diversity values (1.19-3.36) and increased number of taxa and organisms.

(240)

Cold-Adapted Metabolism and Slow Growth Rates of the Antarctic Limpet *Patinigera polaris* in Relation to its Evolutionary History

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Limited studies of polar poikilotherms suggest the existence of two distinct faunal elements. The first consists of relict species characterized by rapid growth rates and low metabolism which have evolved mechanisms which permit efficient metabolism at low temperatures. Organisms of the second group are characterized by slow rates of growth and high metabolic rates. The latter group is considered to be metabolically cold-adapted which implies that more of the organisms' energy is directed towards maintenance. It has been suggested that cold-adapted metabolism is a pre-requisite to polar immigration or characteristic of species which have recently colonized this cold, highly stable environment and are thus imperfectly adapted. A study of the natural history of the Antarctic limpet *Patinigera polaris* revealed that this large patellid can live in excess of 100 years. In addition, *P. polaris* exhibits cold-adapted metabolism demonstrated by an elevated standard respiration. This limpet is not endemic to the antarctic ecosystem and was probably physically and thus genetically separated from a South American parental stock approximately 20 million years ago after the break-up of

Gondwanaland in the vicinity of the Scotia Arc. These life history features of *P. polaris* lend support to the hypothesis that cold-adapted species with protracted life histories are recent colonizers of the antarctic marine ecosystem. It is suggested that *P. polaris* is one of the oldest invertebrates described to date and that its life history features may be characteristic of species inhabiting physically predictable environments such as caves, the deep sea, and the antarctic benthos.

(200)

Studies of Genetic Variation in *Typha*
(Typhaceae)

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Savannah River Ecology Laboratory

Populations of three species of *Typha* (*T. latifolia*, *T. domingensis* and *T. angustifolia*) have been examined using starch gel electrophoresis techniques to determine genetic differences and to relate ecotypic variation to genotype. Analysis of 10 proteins encoded by 26 genetic loci consistently indicated species specific banding patterns. All individuals, however, were homozygous at each of the loci considered. Although significant enzyme polymorphisms have been found in *T. latifolia* and *T. domingensis* collected across broad latitudinal gradients, only a small percentage of the isozymes were variable. The evolutionary strategy of *Typha* in providing for plasticity in adapting to diverse habitats is discussed.

(174)

Analysis of the Botanical Remains from an
Archaeological Site in the Normandy Reservoir,
Coffee Co., Tennessee

ANDREA BREWER SHEA
University of Tennessee

The Banks V site was occupied by Woodland and Mississippian cultures from approximately 90 B.C. to A.D. 1300. The botanical remains were recovered by flotation methods from excavations of features such as roasting, trash, and storage pits. Many herbaceous and arboreal seeds and fruits were preserved in a carbonized state. In some instances, the embryos are present and can be used as a key character for identification. Wood charcoal was recovered and identified to genus and, if possible, to species. Identification of seed, nut, and wood remains were made by systematic and anatomical comparisons with current reference collections. These identifications make possible predictions about adjacent vegetation, subsistence economy and environmental exploitation by the inhabitants of this site during this time period.

(243)

New Xystodesmid Milliped Genera from
Piedmont North and South Carolina
(Polydesmida)

ROWLAND M. SHELLEY
North Carolina State Museum

Except for the fall zone region of North Carolina, the milliped fauna of the Piedmont and Coastal Plain physi-

ographic provinces of the southeastern United States is as poorly known as that of any comparable region of the world. The known xystodesmid fauna is sparse in comparison to that of the southern Appalachians, and is characterized by species of *Apheloria*, *Cleptoria*, *Pachydesmus*, and *Sigmoria*. During the summers of 1975-1976, three new xystodesmid genera, comprised of at least eight species, were discovered from the Savannah River region of piedmont South Carolina to the Kings Mountain area of North Carolina. These genera appear to have originated in the vicinity of McCormick Co., South Carolina, and spread eastward to the coastal islands and northward to Lincoln Co., North Carolina. They are similar to *Cleptoria* and suggest a scheme of possible phylogenetic relationships in the "Apheloria Group" of the family Xystodesmidae.

(245)

Towards a Resolution of the *Sigmoria-Sigiria*
Enigma (Diplopoda: Polydesmida:
Xystodesmidae)

ROWLAND M. SHELLEY
North Carolina State Museum

The milliped genera *Sigmoria* and *Sigiria* were proposed for forms from the mountains of North Carolina in which the telopodite of the male gonopod is bent distally into a sigmoid curve, and are currently comprised of eight and three species, respectively. Their identities have never been established, and there has never been any attempt to distinguish between them or define generic limits. Inability to correctly allocate sigmoid forms is, therefore, a major problem in the taxonomy of North American diplopods. Compounding this difficulty are the monotypic genera, *Falloria* and *Hubroria*, which are of questionable validity and may contain related forms. Recent examinations of museum specimens have revealed new taxonomic characters which partially resolve this problem. Major nomenclatorial changes are necessary, including new synonymies and at least two new genera. Additional material is needed from five areas in the southern Appalachians to resolve other aspects.

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The Effect of Thermal Effluents on the
Germination and Growth of Water Tupelo and
Baldeypress under Laboratory Conditions

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Savannah River Ecology Laboratory

On the Savannah River Plant, three streams have historically received thermal effluents. The impact of the effluent (elevated water temperature, increased silt-ing and raised stream level) have killed many trees in the swamp forest, but also created new and different habitats. The invasion of arboreal vegetation on the newly created mud flats and islands of the thermal streams has been very slow if at all. Possible explanations for the slowness are lack of propagules or intolerance to thermal conditions. This research investigates one of these: the effect of the thermal effluent on the germination and growth of water tupelo and baldeypress. The results of two different laboratory methods to create thermal conditions are also discussed.

(237)

Circadian Rhythm of Oxygen Consumption in the Marsh Periwinkle, *Littorina irrorata* (Gastropoda)

THOMAS C. SHIRLEY AND ANN M. FINDLEY
Louisiana State University

Measurement of oxygen consumption of the salt marsh periwinkle, *L. irrorata*, with Gilson respirometry demonstrated the presence of a daily rhythm. Snails maintained on a 12L:12D photoperiodic regimen exhibited highly significant increased respiration rates during skotophase for six continuous days. A decrease of both magnitude and amplitude of the respiration rhythm occurred with time. The rhythm persisted in constant darkness for at least 50 hr but not for 6 days. The rhythm was entrained to an inverted photoperiod of 12D:12L after 64 hr exposure to the new photoperiod. Highly significant increased respiration rates still occurred during skotophase as compared to photophase with the inverted photoperiod. Possible explanations are: 1) the rhythm may be a manifestation of homeostatic mechanisms that produce a stable metabolic rate in a rhythmically fluctuating environment, or 2) increased snail activity may occur during darkness when visually oriented predators would be less active.

(139)

Effects of Heated Effluent on the Distribution and Abundance of Benthic Insects in a South Carolina Reservoir

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Clemson University

The effects of station location, season, depth, substrate, and temperature on the density and diversity of benthos in Lake Keowee were examined monthly from 1974-1976. Samples were taken both before and after the release of heated effluent from the operation of nuclear generators. Both diversity and density of benthos decreased with increasing depth and were affected by location of sampling site within the reservoir, being lower at two stations near the discharge canal than at intake canal and control stations. Preoperational data also revealed a similar pattern of benthos, with diversity and density lower in the vicinity of the discharge canal. The percentage organic matter in the substrate was lower in the discharge area, probably resulting from preimpoundment construction and dredging operations. Both organic content of the substrate and the post-operational elevation of temperature in the discharge area are apparently important in determining the distribution and abundance of benthos.

(108)

Changes in Isozyme Pattern and Comparative Thermal Stabilities of Lactate Dehydrogenase in Heat-acclimated *Lepomis macrochirus*

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Furman University

Heat-acclimated and control *Lepomis macrochirus* showed the same lactic acid dehydrogenase (LDH) patterns upon cellulose acetate electrophoresis of muscle, heart, liver, and blood tissue homogenates. A four band

pattern was found generally with muscle containing bands 1, 2, and 3 with predominately band 3. Heart tissue also containing bands 1, 2, and 3 but showed predominately band 1. Liver tissue had three bands also, including bands 1 and 3 plus a faster moving band 4 specific to liver. Blood contained bands 1 and 3. Differences were noted in the quantities of isozymes between heat-acclimated and control groups. Electrophoresis after heating of LDH at different temperatures showed differences in band lability between heat-acclimated and control groups. Band 3, which was predominant in muscle tissue was most heat labile in all tissues and appeared less heat resistant in the heat-acclimated fish than in the control fish. The liver-specific band (4) was also more heat resistant in the heat acclimated fish.

(274)

Some Interesting and Infrequently Encountered Slime Molds from Georgia (Myxomycetes)

RAY SIMONS
Fernbank Science Center
LAFAYETTE FREDERICK
Howard University

Field collections in the forest of the Fernbank Science Center and from other localities in the state of Georgia have revealed the presence of several interesting and infrequently encountered species of slime molds. Notable in these collections are the species *Cribraria oregana*, *Didymium ovoideum*, an unusual form of *Metatrielia vesparium*, *Physarum superbum* and *P. venum*, and a collection tentatively identified as *Symphytocarpus herbatica*. *Didymium ovoideum* and *Physarum superbum* have been collected frequently in several localities. The unusual form of *Metatrielia vesparium* has separate, short-stalked, clustered, elongate to sausage-shaped sporangia that dehisce along a median groove instead of along a circumscissile ring. The collection identified as *Symphytocarpus herbatica* is stemonitoid in general surface appearance but the sporophores are heaped, convoluted bodies that show no evidence of a sporangial type of organization.

(38)

Annual Periphyton Community Dynamics in the Clinch River, Anderson Co., Tennessee

JEFFREY D. SINKS AND ERIC L. MORGAN
Tennessee Technological University

The periphytic or "aufwuchs" communities from several locations in the Clinch River were sampled for one year beginning September 1975. Replicate substrates, suspended 0.5 m deep, employing plate glass slides were utilized as surfaces for attachment. Following a 30 day accrual period, these substrates were removed from the river for analysis which included algal cell enumeration, chlorophyll *a* concentrations and total community biomass. Concurrent monitoring of selected physical-chemical parameters was conducted throughout this study so possible correlations could be established with the biotic response. Definitive trends were well established with respect to total community biomass, phytopigment concentrations and cell densities. The results from this study will be discussed in light of seasonal physical-chemical variations.

(190)

The Effect of Chronic Ozone Exposure on the Biomass Total Nonstructural Carbohydrates, and Starch Content of Ladino Clover (Fabaceae)

GARY SMITH AND UDO BLUM
North Carolina State University

Ladino Clover (*Trifolium repens*, L., cv. Tillman) of different ages was grown in a carbon-filtered-air greenhouse and simultaneously exposed to ozone at a concentration of 196 ug/m³ (10 pphm) / 6 hr/day for 5 days. The plants were harvested 1 wk after exposure to obtain dry weight, total nonstructural carbohydrates, and starch content of the roots and the shoots. The effect of the ozone treatment on the dry weight, total nonstructural carbohydrates, and starch content of clover will be discussed.

(46)

Monitoring of Groundwater Along an Estuary After Introduction of Bacteriophage into Septic Tanks

H. W. SMITH, S. D. CUNNINGHAM, D. B. JEFFREYS,
G. J. DAVIS AND J. C. ANDERSON
East Carolina University

During the summer of 1976, MS2 bacteriophage (ATCC No. 15597-B) was introduced into two septic tanks at waterfront homesites along the Pamlico River estuary. Groundwater from seven shallow test wells at each site was assayed for phage after 1, 2, 3, 5, 6, 8, 12, 13, and 51 days. Flow of groundwater at Site 1 was from the effluent source toward the estuary. Wells were about 1.5 m deep with one upgradient well, five downgradient paralleling the nitrification line, and one well between the line and the estuary. Phage, which was detected in four of six downgradient wells, moved rapidly at first and was present 16 m downgradient (18 m from the estuary) after 51 days. At site 2, which had received some dredge spoils and where groundwater flow was complex, phage was detected only on day one and only from one well near the tile line. — Supported in part by the National Science Foundation Undergraduate Research Participation Program.

(83)

Levels of Biochemical Polymorphisms in Turtles (Chelonia: Reptilia)

MICHAEL H. SMITH
Savannah River Ecology Laboratory

Biochemical variations in one species of freshwater turtle and two species of marine turtle were studied using horizontal starch-gel electrophoresis. The species showed levels of variability that were significantly different and both higher and lower than those found in vertebrates in general. There was no correlation between body size and heterozygosity. Turtle populations appear to be spatially subdivided as are most vertebrate populations. This subdivision is not surprising considering the highly disjunct nature of their habitats and/or the tendency for site specificity in their breeding behavior. None of the current theories used for explaining different levels of heterozygosity seem appropriate for an explanation of the interspecific differences observed in this study.

(141)

Influence of Organism Size, Species and Sediment on Metal Accumulation by Benthic Macroinvertebrates

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University of North Carolina, Chapel Hill

Neutron activation analysis was used to determine Co, Cr, Fe, Mn, Sb, Sc and Zn concentrations in benthic macroinvertebrates collected from eight locations on the Haw and New Hope river systems in North Carolina. Concentrations were determined for approximately forty species collected from both clean and polluted areas. Sediment, filtrable (< 0.45u) and suspended particulate metal concentrations were also determined for the same sampling sites and periods. Concentrations of Cr and Sb reflect industrial inputs of these metals into the Haw River. Organism metal concentrations generally increased with decreasing median organism size, possibly indicating the importance of the surface to volume ratio on metal accumulation. The degree of association a species has with the sediment was shown to influence its accumulation of metals, strict detritivores generally having higher concentrations than carnivores, filter feeders or sediment associated species. Sediment particle size was also shown to influence metal concentrations in these organisms.

(26)

Heavy Metal Accumulation in Selected Tree Species Grown on Sewage-Sludge Amended Strip Mine Spoils

GENE A. SMOUT AND GEORGE T. WEAVER
Southern Illinois University, Carbondale

Anaerobically digested sewage-sludge from the Greater Metropolitan Chicago Sewer District was applied to the 312 acre Palzo site in southern Illinois. High levels of certain heavy metals in this sludge are potential contaminants of a nearby watershed and to plants and animals in the food chain leading to humans. As part of the overall objective to reclaim by revegetation the acid spoils at Palzo, the accumulation patterns of six heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) were observed in green ash (*Fraxinus pennsylvanica* Marsh.), and river birch (*Betula nigra* L.). Tissue concentrations of these metals were compared between nursery planting stock withheld from treatment and trees planted on site and harvested after one growing season. Similar analysis on other species and subsequent growing seasons will aid in the selection of species best suited for planting under these conditions.

(263)

Reproductive Biology of *Ranunculus abortivus* Complex: (Ranunculaceae)

KATHY COCHRAN SOBEL
University of North Carolina, Chapel Hill

Breeding studies were undertaken to determine the existence, or extent, of reproductive isolation between the morphologically similar plants in different taxa in the *Ranunculus abortivus* complex: *R. abortivus* L., *R. micranthus* Nutt. ex Torr. & Gray, *R. allegheniensis* Britt. and *R. harveyi* (A. Gray) Britt. Populations

throughout the range of each species were sampled and individuals transplanted to the North Carolina Botanical Garden. Intraspecific crosses were attempted between members of the same, neighboring and distant populations. Interspecific crosses were attempted between individuals from allopatric and sympatric populations of each species. Seed set and percent germination were recorded for each cross. Seedling establishment data indicates that species in the complex are both self-fertile and cross-fertile within and between populations of the same species and between populations of allopatric and sympatric species. Such a breeding system helps explain the morphological intergradations that occur in vegetative and reproductive characters among the taxa. Although each of the taxa in the complex may generally be recognizable by a combination of vegetative and reproductive characters (any one of which may be taxonomically unreliable), the designation of species limits in this group is strictly arbitrary.

(249)

The Organization and Behavior of
the Sex Chromosomes

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Duke University

In heterogametic male organisms the sex chromosomes are heteropycnotic during meiotic prophase, and they form an intranuclear body which in mammalian spermatocytes is called the X-Y body (sex vesicle). A regular pattern of the chromosomal axes exists inside the X-Y body. The axis of each sex chromosome has a characteristic length and kinetochore location. The axes of the X and Y chromosomes are partially paired forming a stretch of synaptonemal complex that extends up to one of the axial ends (common end). These partially synapsed axes may remain paired or disjoin precociously during prophase. Generally the axes remain joined in a short region near the common end, and in that region ultrastructural changes occur that suggest the formation of a nearly terminal chiasma. At least in one exceptional species, this axial pattern has been replaced by end-to-end connections between the X and Y axes. The single X chromosome of male grasshoppers behaves in a way similar to that of the exceptional mammal. Labeling studies have shown a very low level of transcription in the X-Y body. — *Supported by a Hargitt Fellowship from the Department of Zoology, Duke University, and Grant #GB-40562 from N.S.F.*

(109)

A Comparative Study of the Antibacterial
Activity of two Lysozyme Isozymes of
Rana pipiens

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Furman University

Previous research has demonstrated the existence of isozymes of lysozyme, an enzyme known to be antibacterial, in *R. pipiens* (leopard frog). These isozymes were found to be tissue specific, and the total concentration of lysozyme was high compared to that of other Amphibia. A possible function of this multiplicity of forms may be to yield a wide spectrum of antibacterial capabilities. To test this, two forms of the enzyme were enriched and isolated by acid extraction, heat treatment, gel filtration chromatography and preparative electro-

phoresis. An assay was then developed for quantification of antibacterial capabilities. The isozymes were each tested against bacteria obtained from commercial sources and from internal organs of the frogs. Results obtained with each form were compared with reference to previously published data on the activity of chicken egg white lysozyme.

(218)

Evolutionary Trends in Acoustic Signaling of
Phaneropterine Katydid (Orthoptera:
Tettigoniidae)

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University of South Carolina, Aiken

Acoustic signaling in the Phaneropterinae is in stark contrast to the signaling found in other subfamilies of Tettigoniidae and in the Gryllidae (crickets). Phaneropterine signaling involves female sound production and reduced redundancy and complex sounds. Recent investigations indicate that the ability of predators and parasitoids to locate orthopteran prey by moving toward the prey's sound may be a significant selection pressure resulting in abbreviation and complication of acoustic repertoire.

(287)

The Plant Communities of St. Phillips Island,
Beaufort County, South Carolina

RICHARD STALTER
St. John's University

There are four primary plant communities of St. Phillips Island: the salt marsh community, live oak-slash pine community, brackish marsh community, and the sand dune community. The salt marsh community covering almost 90% of the island is the most extensive and is dominated by *Spartina alterniflora*. Soil salt concentration and depth of flooding are responsible for the zonation of salt marsh species. *Quercus virginiana*, *Quercus laurifolia*, and *Pinus elliotii* are the dominant trees of the live oak-slash pine forest which occupies the higher ridges of the island. Salt spray governs the distribution of dune species. *Uniola paniculata* dominates the ocean facing dunes, while other dune species populate the back dunes where salt spray is minimal. Impenetrable stands of *Cladium jamaicense* thrive in the brackish sloughs of the island. The species composition in each community is similar to communities of other barrier islands on the South Carolina coast.

(214)

Feeding Behavior of Wild and Laboratory Held
Pinfish *Lagodon rhomboides* (Pisces: Sparidae)

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*Institute of Marine Sciences
University of North Carolina*

The feeding behavior of three size classes of pinfish (0-50, 51-100, 101-150 mm standard length) *Lagodon rhomboides*, was observed under laboratory conditions. Pinfish feeding aggregates were common in the wild and in captivity. Aggregate splitting occurred during joint and continuous feeding experiments. Preferential food selection of feeding aggregates, by size classes, was de-

terminated utilizing vegetation, shrimp, fish, and polychaetes as food. Polychaetes were selected first 80% of the time by the medium and large specimens. This agrees with food analyses studies but not with recent chemical extract experiments reported by others. Feeding angle at all test depths was 25° from the horizontal. Size of fish can determine aggregate response as well as size dominance can deter aggregate formation.

(54)

Winter Decomposition and Macroinvertebrate Colonization of Four Species of Leaves in a Spring-Fed Stream

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National Park Service and
University of North Carolina at Chapel Hill

The *in situ*, winter decomposition and macroinvertebrate colonization of allochthonous material was studied in a South Carolina spring-fed stream. Studies were performed both above and below a low volume, intermittently discharging sewage treatment plant. Leaves from *Fagus grandifolia*, *Cornus florida*, *Acer rubrum* and *Kalmia latifolia* were formed into leaf packets which were removed from the stream on a weekly basis and analyzed for weight loss and macroinvertebrate colonization trends. Degradation trends, as percent weight loss, were variable but generally increased for all species over a six week period. A concurrent laboratory study of leaching from these four species indicated a rapid initial loss of total organic nitrogen, total phosphorus and soluble carbon. Macroinvertebrate colonization did not begin until the third week. Species of Orthocladiinae (Diptera: Chironomidae) were the dominant colonizers. A greater number of individuals were found on the leaf packets situated below the sewage effluent discharge.

(27)

First Year Heavy Metal Accumulation by Tree Seedlings Grown on Sludge Ameliorated Strip-Mine Spoil

DANIEL SVOBODA AND GEORGE T. WEAVER
Southern Illinois University, Carbondale

Heavy metal accumulation of Cu, Mn, Zn, Ni, and Cd in six woody species: loblolly pine, Virginia pine, white pine, silver maple, autumn olive, and European black alder was determined by atomic absorption spectrophotometry. Base line data was determined from samples of the planting stock before being planted on the mine spoils. After one growing season on the sludge treated spoils, seedling samples were harvested from plots treated with 291, 364, 390, and 590 dry tons/acre. The plant samples were dissected into root, stem, and foliage components, oven dried and weighed, wet ashed in HNO₃ + HClO₄, and diluted to constant volume in deionized water before A. A. analysis. Comparative tests were then made between the base line and first season data using Analysis of Variance (ANOVA) to determine the effects of sludge treatment levels, species combinations, and component distribution of metal ions.

(211)

Mortality of Bluegills, *Lepomis macrochirus*, Exposed to Successive Doses of Copper and Zinc

JAMES SWIGERT AND ERIC L. MORGAN
Tennessee Technological University

The purpose of this study was to test the hypothesis that subjecting an organism to a toxic substance for two consecutive days, then exposing the organism to an equivalent toxic level of a second substance for two days, will exhibit similar action as if the organism had been exposed to the single toxicant for four days. The assumption was made that the two toxicants display similar modes of action. To test the null hypothesis, three 96 hr bioassays were conducted; one for each of two toxic substances tested separately and one test employing both toxicants successively for 48 hr. The heavy metals copper and zinc were employed in equivalent toxic concentrations test chambers holding 10 bluegill each. Carbon-filtered tapwater was used as dilution water, maintained at room temperature (20 ± 1C) and routine water chemistry and bioassay procedures followed those recommended by Standard Methods for the Examination of Water and Wastewater, 13th Ed. (1971). Metal concentrations were measured by atomic absorption spectrophotography. Results are discussed in light of combined action processes and toxicity index assumptions.

(138)

Ecological Life History and the pH Tolerance of a Pond Sialid, *Sialis itasca* Ross, from West Virginia (Insecta: Megaloptera)

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AND DIANA ASHLEY
Marshall University

The ecological life history of the alderfly, *Sialis itasca* Ross, from a small farm pond near Shoals, West Virginia, was studied in detail, and the pH tolerance was determined under laboratory conditions. Alderfly larvae were found to require one year to complete their development. The greatest increase in growth occurred in August and October, and a decrease in growth was found in December. Larval alderflies were found to feed almost exclusively on ostracods (*Cyclocypris* sp.). Feeding activity decreased in January and again in April just before pupation. Larvae were tolerant to low pH with a 96-hour TL₅₀ value of 3.1. Egg counts averaged 539 per female and eggs measured 0.31 mm in length and 0.14 mm in width. Adults lived 4-6 days in the laboratory.

(316)

Physiological Factors Affecting Leaf Susceptibility to Sulfur Dioxide

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Agnes Scott College

The study of plant response to sulfur dioxide has experienced a shift in emphasis from descriptive symptomatology to physiological explanations and ecological ramifications. Physiological investigations of sulfur dioxide-induced morbidity have focused on the primary and secondary sites of altered leaf metabolism and structure. These studies range from organismal physiology — trans-

piration, respiration and photosynthesis — to biochemistry of membrane integrity and enzyme activity, and each has provided insight into how sulfur dioxide affects chronic and acute leaf damage. This report attempts to provide an organizational framework for these diverse investigations by utilizing Levitt's revision (1972) of the stress phenomenon in plants. The result is a logical scheme of alternative factors mediating the response of plant foliage to sulfur dioxide.

(280)

Fine Structure of Swimming and Encysting Zoospores of *Haliphthoros milfordensis*

T. P. THARP AND C. E. BLAND
East Carolina University

Ultrastructural observations of swimming and encysted zoospores of *Haliphthoros milfordensis* have revealed several features which are relatively uncommon among other members of the class Oomycetes. These unique features include organelle arrangement, vesicle morphology, and a mechanism whereby striated spines form within the external cyst wall. On the basis of these observations encystment may be divided into three stages which parallels closely those described previously for *Phytophthora parasitica*.

(150)

Influence of Day/Night Temperature on Morphology and Reproductive Development of *Glycine max* (L.) Merrill

JUDITH F. THOMAS
North Carolina State University

Optimal temperatures for optimal growth were determined for soybean plants, cv. 'Ransom', which were grown under 25 day/night thermoperiods in phytotron growth chambers. Growth was maintained for 50 days under the respective thermoperiod regimes, during which all plants received a 9 hr photoperiod suitable for floral induction in soybeans. Typical of many of the other higher plants, different stages of the growth of the soybean were observed to require different optimal thermoperiod regimes. Yet, contrary to theory, optimal growth did not always occur in conjunction with a day temperature 4-10C greater than the night temperature. Vegetative growth was observed to be competitive with reproductive growth, and conversely. Optimal reproductive development was obtained in conjunction with high night temperatures, whereas optimal vegetative growth (e.g. weight, leaf area) occurred under lower night temperatures.

(115)

The Effects of Copper Acetate and Mixed Aflatoxins on Male Syrian Hamsters

ELLEN THOMEN AND GERALD C. LLEWELLYN
Virginia Commonwealth University

Possible anticarcinogenic activities of the cupric ion against aflatoxin were investigated in this study. Weanling, male Syrian hamsters were divided into four groups receiving a diet of either 1) ground meal 2) ground meal + 22.9 ppm mixed aflatoxins (9.2 ppm AFB₁, 0.4 ppm AFB₂, 12.8 ppm AFG₁, 0.5 ppm AFG₂) 3) ground

meal + 0.5% copper acetate (by weight) and 22.9 mixed aflatoxins or 4) ground meal + 0.5% copper acetate. Experimental parameters measured included: food and water consumption, body weight responses, mortality and gross histopathological changes. Although the animals in Group 3 eventually approached food consumption levels nearly equal to the controls, all the animals receiving aflatoxin showed a greatly reduced rate of weight gain. Gross histopathology showed that the livers of all animals received aflatoxin were slightly yellow around the periphery. Animals receiving the copper acetate in addition to the aflatoxin remained alive until sacrifice dates (with one exception) and those animals receiving only aflatoxin did not. Copper may have been a protective agent against the toxic carcinogen.

(68)

Chemical Communication and Agonism in the Crayfish *Procambarus acutus acutus*

JAMES H. THORP AND KAREN S. AMMERMAN
Savannah River Ecology Laboratory

Agonistic responses of mature (Form 1) male *Procambarus acutus acutus* (Girard) to water conditioned by the presence of other male or female crayfishes were recorded with a video tape system and quantitatively analyzed. Individual males were observed in aquaria for ½ hr before conditioned water was added. Behavioral responses in this ½ hr period were compared with those in the following ½ hr inflow period. Observation tank males were exposed to water taken from head tanks containing either, 1) 2 males or 2 females in a single tank, 2) 2 males each in separate tanks, or 3) no animals in the head tank (control). The amount of time spent meral spreading, dactyl spreading, chelae waving, grooming, and searching was recorded. Chemical communication (possibly a stress or alarm pheromone) is suggested by a statistically significant difference between treatments (2 males or 2 females) and controls in the agonistic meral spread response.

(103)

Morphology, Histology, and Gametogenesis in *Ornithodoros parkeri* (Acari: Ixodoidea)

P. G. TILLMAN AND J. H. OLIVER, JR.
Georgia Southern College

The male reproductive system includes paired testes, vasa deferentia, seminal vesicle, and accessory gland. The accessory gland consists of 2 unpaired lobes and 8 paired lobes. The female reproductive system consists of vestibular and cervical vagina, accessory glands, uterus, oviducts, ampullae, and ovary. Elongated spermatids are present in unfed, unmated adult males. Eggs are laid by fed females as early as 8 days post-mating. Males revealed 2n = 20 consisting of 18 autosomes and XY chromosomes.

(146)

The Relationship between Rainfall and Nematodes in Finished Water

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Clemson University

Free-living nematodes are known to be present in finished water of various municipalities throughout the

nation. Previous investigators suggested that the nematodes were breeding within the rapid sand filter thus providing a continuous and constant supply of juveniles to the finished water. Our studies indicate that the nematodes are coming from the raw water source (surface water). As the water moves through the treatment process (chlorination, flocculation, settling basin, and sand filter) an estimated 95% of the nematodes are removed. In dry seasons approximately one nematode per gal of finished water is observed but the density increases after a mild to heavy rain to between 10 and 15 nematodes per gal. Several genera have been identified and the majority of nematodes are between 250 and 350 μm long. — Supported by EPA grant No. R804292010.

(265)

Plant Sex in the *Arisaema triphyllum* Complex
Sensu Huttleston (Araceae)

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Investigations, both observational and experimental, of plant sex and plant sex change in *A. triphyllum* (L.) Schott were performed under field and controlled environment conditions. Although Schaffner has shown that sex in *A. triphyllum* is purely epigamous, plant sex determination is viewed as a complex ectoendogenous phenomenon. A single individual may express all of the following sexual states during its life cycle: staminate, monoecious and carpellate. These sexual states have been observed to change from year to year under field conditions and have been demonstrated to be susceptible to artificial manipulation. Field studies indicate that plant sex change during a given year is not synchronous in a particular population, but rather approaches a random condition. Corm size (diameter) and corm size changes are demonstrated to have predictive value in plant sex change; however, it is suggested that plant sex is conservative with respect to change.

(52)

Detrital Accumulation in Sinking Creek, Virginia

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Virginia Polytechnic Institute and State University

Large particulate detritus (particle size greater than 2.5 cm) must remain in the stream to be an energy contributor for stream ecosystems. The amount of detritus trapped in a given section of stream bottom (delineated by a 2.0 m by 1.2 m frame) is a function of velocity, depth, stream bottom complexity, and concentration of detritus in the water. Bottom complexity is calculated by estimating the actual surface area of the rock substrate within the frame, then dividing this surface area by 2.4 sq m (rectangular area of the frame). During the autumn leaf fall (1976), bottom complexity and depth was highly correlated with detrital biomass. Stream bottom accumulation of detritus is greater with a decrease in depth. By understanding the interactions of velocity, depth, and bottom complexity, a carrying capacity with respect to detrital biomass can be estimated for a given section of stream.

(267)

Comparative Floral Development in *Peperomia*
(Piperaceae) and *Saururus* (Saururaceae)

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Louisiana State University

Peperomia and *Saururus* are members of closely related families of the order *Piperales*. Species of these genera have spicate inflorescences of numerous perfect flowers, lacking perianth but each subtended by a bract. In both, an inflorescence apical meristem produces structures in acropetal succession. The nature of the structures, however, differs in the two. They are bract primordia in *Peperomia*, and each later subtends an axillary floral apex. The structures produced by the inflorescence apex in *Saururus* are anomalous "common" primordia, each of which later dichotomizes to form a floral apex above, and a bract primordium below. This difference, occurring early in development, is a significant one, since it suggests one way in which important familial differences may have become established during evolution. Floral ontogeny also differs considerably in the two genera. Developmental studies are being extended to species of *Piper* and *Pothomorphe* as well, in order to understand floral organogenesis in a broader and more representative range of Piperaceae.

(238)

Phylogenetic Relationship of Three Genera of
Southeastern Louisiana Freshwater Limpets
(Pulmonata: Ancyliidae) as Suggested by Septum
Formation and Other Aspects of Anatomy

HUGH M. TURNER

Louisiana State University

Three genera of ancyliid snails, each represented by a single species, occur in southeastern Louisiana. *Hebetancyclus excentricus* has a Caribbean-northern Gulf Coast distribution and was only recently reported from the state. *Ferrissia fragilis* and *Laevapex fuscus* are both widely distributed in the U.S. east of the Rocky Mountains. *H. excentricus* shares some features of its "soft-parts" anatomy with *Ferrissia* and others with *Laevapex*. As concerns shell structure, only *Ferrissia* reportedly forms a septum, or a thin, horizontal, calcareous shelf partially closing the shell aperture. Polymorphism was noted among Louisiana populations of *H. excentricus*, in that during late fall some individuals formed septa. In late winter shell deposition was from the edges of the constricted aperture resulting in the post-septate condition, similar to that reported for *Ferrissia*. This observation, taken with published descriptions of comparative "soft-parts" anatomy, suggests an ancestral role for *Ferrissia* with an evolutionary sequence leading through *Hebetancyclus* to *Laevapex*.

(8)

Phylogenetic Relationship of Three Genera of
Southeastern Louisiana Freshwater Limpets
(Pulmonata: Ancyliidae) as Suggested by Their
Larval Digenetic Trematode Parasites

HUGH M. TURNER AND KENNETH C. CORKUM

Louisiana State University

Three genera of ancyliid snails, each represented by a single species, occur in southeastern Louisiana. *Hebet-*

ancyclus excentricus and *Ferrissia fragilis* were collected from emergent vegetation in shallow streams and ponds, while *Laevapex fuscus* occurred on vegetation and floating and submerged debris in ponds. Over 20,000 ancyliid specimens were collected and screened for larval trematodes. Collections were taken twice monthly, for over 13 months, from five ecologically diverse habitats. Nineteen different digenetic trematodes, including species of *Spirochis*, *Stichorchis*, *Megalodiscus*, *Haematoloechus*, *Lissorhis*, *Allocreadium*, *Posthodiplostomum*, and possibly *Pharyngostomoides*, were found to use one or more of these ancyliid species as first intermediate hosts. Differences and similarities, among limpet species, in trematodes hosted suggest a phylogenetic relationship for the limpets involved.

(156)

Photoperiodic Time Measurement in the Male
Lizard Anolis carolinensis

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North Carolina State University

The gonadal responses to various light cycles were measured to determine whether *Anolis* utilizes an endogenous daily (circadian) rhythm of photosensitivity to measure photoperiod time. In the summer, 25 days' exposure to LD 14:10 allowed maintenance of mature testes whereas exposure to LD 8:16, LD 8:28, LD 8:40 and LD 8:52 did not. In the fall, 24 days' exposure to LD 14:10 elicited testicular growth whereas exposure to LD 6:12, LD 6:14, LD 6:16, LD 6:18, LD 6:20 and LD 6:22 did not. In the fall experiment the circadian rhythm of locomotor activity was also monitored to determine the phase relationships between the entraining light cycle and the circadian system. These results indicate that the lizards are not using a circadian photosensitivity rhythm but are using an "hour-glass" or interval timer which is forced by the environmental light cycle and lacks endogenous rhythmicity. Exposure to LD 16:20 elicits testicular growth in the fall showing that this hour-glass timer is measuring the absolute length of the day rather than the absolute length of the night.

(254)

A Preliminary Analysis of Phylogenetic
Relationships of the Ranunculaceae

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A number of characters present in 25 genera of the Ranunculaceae were analyzed and a Wagner Tree was constructed. Certain groups of genera are fairly stable with respect to position in spite of addition or deletion of various characters. However, other groups of genera change position somewhat depending on the characters which are used. The genera are being examined for

additional characters so a more stable phylogenetic tree can be generated. In order to determine the proper position of the genera various phenetic methods of analysis are also being applied.

(19)

Effects of Ammonia on Channel Catfish,
Ictalurus punctatus

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Memphis State University

Channel catfish, *Ictalurus punctatus*, were exposed to ammonia concentrations of 20-75 ppm. The pH of test aquaria was varied to produce similar levels of non-ionized ammonia at each concentration to evaluate the relative toxicity of the ionized and non-ionized forms of ammonia. The 48-h LD₅₀ of non-ionized ammonia was 1.96, 1.86, 1.43, 1.53, and 1.24 ppm in the 20, 30, 40, 50, and 75 ppm concentrations of ammonia, respectively. The toxicity of ammonia is primarily due to the amount in the non-ionized form, but the ionized form apparently has some toxic effect at high concentrations. The effect of ammonia on plasma and tissue electrolytes was also evaluated.

(241)

New Host Records for Two Water Mites
(Acarina: Unionicolidae)

MALCOLM F. VIDRINE
University of Southwestern Louisiana

New host records for *Najadicola ingens* (Koenike) include these mussels (Bivalvia: Unionacea): *Lampsilis hydiana* (Lea) (Calcasieu River, Rapides Parish, Louisiana), *Unio merus tetralanus* (Say) (Bayou Teche, Evangeline Parish and Calcasieu River, Vernon Parish, Louisiana), *Lampsilis ovata* (Say) (Arkansas River, Faulkner County, Arkansas) and *Fusconata flava* (Rafinesque) (Scioto River, Union County, Ohio). New host records for *Unio nicola acuelata* (Koenike) include these mussels: *Elliptio (Cauthyria) spinosa* (Lea) (Altamaha River, Wayne County, Georgia), *Elliptio complanata* (Lightfoot) (Maurice River, Cumberland County, New Jersey), *Carunculina parva* (Barnes) and *L. hydiana* and *L. teres* (Raf.) (Grand River, Iberville Parish, Louisiana), *Anodonta suborbiculata* Say (Atchafalaya Basin, St. Martin Parish, Louisiana), *A. imbecilis* Say (Savannah River, Aiken County, South Carolina), *A. implicata* Say (Chester River, Queen Annes County, Maryland), *Quadrula cylindrica* (Say) (Clinch River, Hancock County, Tennessee), and *Ligumia nasuta* (Say) (Nanticoke River, Sussex County, Delaware). Preliminary work has demonstrated that these two unionicolids occurring in nearctic mussels are the only ones known to lack host specificity. — *The author wishes to acknowledge the use of lots of mussels from the Academy of Natural Sciences of Philadelphia, Ohio State University Museum, and Delaware Museum of Natural History.*

Preliminary Lists of Species from Recent Collections of Fresh-water Mussels (Bivalvia: Unionacea) in Three southwestern Louisiana River Drainages

MALCOLM F. VIDRINE
University of Southwestern Louisiana

AND

DANIEL J. BEREZA
Academy of Natural Sciences of Philadelphia

Southwestern Louisiana is drained by three rivers: Mermentau, Calcasieu, and Sabine. Despite extensive damage to portions of these drainages (including paper mill wastes, impoundment, channelization, and agrarian siltation), recent collecting yielded the following mussels in all these systems: *Quadrula nodulata* Rafinesque, *Q. pustulosa* (Lea), *Q. apiculata* (Say), *Plcctomcrus dombeiana* (Valenciennes), *Tritogonia verrucosa* (Raf.), *Unionmcrus declivus* (Say), *U. tctralasmus* (Say), *Anodonta imbecilis* Say, *Proptera purpurata* (Lamarck), *Glebulu rotundata* (Lam.), *Villosa licnosa* (Conrad), *Carunculina parva* (Barnes), *Lampsilis hydiana* (Lea), and *Lampsilis teres* (Raf.). Additionally, *Fusconaia askewi* (Marsh), *Amblema perpicata* (Conrad), *Obliquaria reflexa* Raf., *Leptodca amphichacna* Frierson, *Obovaria (castena complex)*, *Lampsilis (ovata complex)*, *Strophitus radiatus* (Conrad), *Anodonta grandis* Say, *Megaloniais gigantea* (Barnes), and *Truncilla truncata* Raf. occur in the Sabine (Calcasieu harbors all of the above except the latter three, plus *T. donaciformis* (Lea)). *F. undata* (Barnes), *S. undulatus* (Say), *L. fragilis* (Raf.), and *Ligumia subrostrata* (Say) have also been found in the Mermentau. Calcasieu River (22 spp) and Sabine River (24 spp), adjacent sandy-bottomed rivers, have similar faunas while Mermentau River (18 spp), a mud-bottomed river, has fewer species.

(13)

The Effects of Chlorination on the Osmoregulatory Ability of the Blue Crab, *Callinectes sapidus*

SHEILA M. VREENEGOR, RONALD M. BLOCK,
JOHN C. RHODERICK AND STEVEN R. GULLANS
University of Maryland,

Chesapeake Biological Laboratory

Lethal (LC50) and sublethal bioassays were conducted on adult blue crabs exposed to various concentrations of chlorine produced oxidants (CPO) in 10⁶/₁₀₀ Chesapeake Bay water at 25C. The LC50 values obtained were 0.75 mg/l at 48 hr, 0.70 mg/l at 96 hr and 0.63 mg/l at 144 hr. Sublethal studies after 48 hr exposure at 0.81 mg/l CPO showed that chlorine stress to crabs produced a 35% decrease in muscle free amino acids (NPS) while blood NPS increased 40-fold. Blood osmolarity decreased 38% concomitant with a 49% loss of blood chloride, 28% decrease of blood sodium and 20% decrease of blood potassium. Preliminary investigations reveal an inhibition of ammonia excretion by crabs exposed to chlorine. A mechanism for subsequent degradation of osmotic integrity in crabs exposed to chlorine is postulated. — *This research was supported by the State of Maryland Department of Natural Resources.*

(120)

The National Natural Landmarks Program

GARY WAGGONER
National Park Service

(No abstract received)

(69)

A Comparison of Oxygen Consumption Rates of Juvenile Blue Crabs (*Callinectes sapidus*) Acclimated to Constant and Cyclic Temperatures

W. WALDO WAKEFIELD, PHILIP R. ABELL,
DENNIS T. BURTON AND STUART L. MARGREY
Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory

Oxygen consumption rates were determined for juvenile blue crabs (*Callinectes sapidus*) acclimated for a minimum of two weeks to a series of constant temperatures (20, 25 and 30C) and a symmetrical fluctuating temperature cycle with a 12 hr ascending (20C to 30C) and descending (30C to 20C) phase. Crabs acclimated to the fluctuating cycle were studied at minimum phase (20C), mid-ascending phase (25C) and maximum phase (30C). A cyclic photoperiod of 16L:8D with a 45-min transition between light periods was used throughout the study. All oxygen consumption measurements were made during daylight for both the constant and cyclic acclimated 20C, 25C and 30C organisms at 0600, 1200 and 1800 hours, respectively. Partial to complete temperature compensation was found for all constant temperature acclimated crabs. The Q_{10} between 20C and 25C, 25C and 30C, and 20C and 30C was 1.6, 1.0, and 1.3, respectively. Oxygen consumption of the cyclic acclimated animals varied with temperature. The Q_{10} between 20C and 25C, 25C and 30C, and 20C and 30C was, respectively, 3.6, 2.0, and 2.7. This study suggests that different mechanisms of temperature adjustment may exist for blue crabs exposed to constant and cyclic temperature regimes. — *This research was supported by the Baltimore Gas and Electric Company, Baltimore, Maryland.*

(332)

A Study of the Cave Salamander (*Eurycea lucifuga*) in Trigg County, Kentucky

LARRY L. WALSTON AND C. D. WILDER
Murray State University

The activities and distribution of populations of *Eurycea lucifuga* were observed in five limestone caves (Mississippian: St. Genevieve and St. Louis formations) on weekly trips for one year. Individuals were marked, measured, sexed, and released. Temperature, humidity, and light measurements were made in selected sections of each cave at each visit. Recaptures included only three of a total of 102 marked animals in four of the caves (46, 30, 21, and 5 respectively). Another approximately 100 individuals were observed in inaccessi-

ble crevices. The fifth cave was used as a control with observations but no handling of salamanders. Information on microhabitat, distribution, seasonal abundance, and behavior is included.

(302)

Hardwood Forests of Virginia's Central Coastal Plain

STEWART WARE, RIDGE DEWITT, AND SUSAN GLASCOCK
The College of William and Mary

Twenty-seven upland hardwood stands and seventeen small stream bottoms in the central Coastal Plain of Virginia were sampled by Bitterlich or point-centered quarter methods, and arranged in separate Bray-Curtis type ordinations. White oak, beech, tuliptree, or southern red oak ranked first and second in nearly all upland stands. The segregation of species in this ordination did not correlate with soil fertility (top 15 cm) or direction or degree of slope. In general the structural relationship of these upland forests is with the Southern Mixed Hardwood Forest of the southeast rather than with the oak-hickory forests of the Piedmont. Most stream bottom forests were dominated by red maple, ash, and elm in some combination. Outliers on the bottomland ordination were dominated by willow or water oak, or had high importance of American hornbeam. Sweet gum and tuliptree occurred throughout the ordination. Many typical swamp species were rare or absent.

(43)

The Effects of Reclamation Activities on Limnological Properties of an Acid Mine Arm of a Reservoir

KAREN E. WARK, G. B. HALL,
AND GEORGE M. SIMMONS, JR.

Virginia Polytechnic Institute and State University

Lake Anna is a 13,000 acre reservoir and lagoon complex located in Louisa County, Virginia. The lake was created to provide cooling water for a nuclear power station presently under construction near the lake. Contrary Creek, which drains into the reservoir, has been subjected to acid mine drainage from old pyrite mines for almost 100 years. Previous studies have shown elevated heavy metal concentrations, lower pH, and lower alkalinity levels in the Contrary Creek arm of the reservoir. Phytoplankton collections from Contrary Creek have exhibited low densities and diversity in comparison to other areas of the reservoir unaffected by the acid mine drainage. In June, 1976, sewage sludge was applied to the spoil banks of Contrary Creek in efforts to reclaim the area. Collections made at stations in the arm following reclamation efforts showed a change in certain limnological properties. The most notably affected parameters were transparency, nutrient levels, chlorophyll *a* concentrations, and phytoplankton communities. Enumeration of phytoplankton density and species composition showed higher densities and greater diversity. Properties unaffected by reclamation activities were temperature, pH, and oxygen levels. Preliminary results also indicate that the effects of the sludge deposits may extend into the reservoir below the entrance of Contrary Creek.

(283)

Ultrastructural Studies on Galls of Red Cedar Induced by *Gymnosporangium juniperi-virginianae* (Basidiomycetes)

BETTY J. WASHINGTON
Atlanta University
AND
LAFAYETTE FREDERICK
Howard University

Transmission electron microscope (TEM) observations have been made on galls of *Juniperus virginiana*, induced by *Gymnosporangium juniperi-virginianae*, in order to elucidate the nature of inter-actions, during gall development, at the host-parasite interface. It has been noted that within galls triple-walled intercellular hyphae commonly occur and a granular, electron dense material accumulates at the hyphal wall-host cell wall interface. Haustoria have been observed regularly in host cells and are present at all stages of gall development. The outer wall of haustoria is separated from the plasmalemma of invaginated host cells by a well-defined encapsulating sheath. Mitochondria, vesicles, and endoplasmic reticulum (ER) are common in haustoria. As galls develop chloroplasts degenerate, ER becomes sparse, vacuolation increases and starch grains and tannin bodies become more abundant. Cytoplasmic organelles within host cells that are in direct contact with fungal hyphae become completely masked by densely stained materials that develop in these cells.

(29)

Forest Floor Dry Matter in Two Southern Illinois Upland Watersheds

GEORGE T. WEAVER AND JEFFREY C. LUVALI
Southern Illinois University, Carbondale
and *Savannah River Ecology Laboratory*

After autumn leaf fall, forest floor dry matter averaged 3576 g/m² in two upland watersheds with mature oak-hickory and mixed hardwood forests. Within plot and between plot variability was high. Differences among 14 site-types classified according to aspect and topographic position were not significant at $P \leq 0.05$, nor were plot groupings discernible with reciprocal averaging ordination. Most of the dry matter standing crop was contained in woody components >10 cm dia. (62.5%) and small twigs, fruits, and leaves (32.5%). Woody components >2.5 cm to ≤10 cm dia. comprised 4.5% and the 02 horizon <0.5% of the standing crop. Failure to include large woody components in forest floor measurements would cause serious underestimates of standing crops in these forests.

(22)

Extraction and Fluorometric Analysis of an Isomer of a Postulated Alarm Substance

L. B. WEEKLEY AND T. D. KIMBROUGH
Virginia Commonwealth University

A laboratory technique has been developed for the partial purification of fish skin extracts for fluorometric assay. The extracts were prepared from several species of *Cyprinid* fish previously described as containing substances causing an alarm reaction in predators and other

animals. The spectral characteristics of one alarm substance isomer, xanthopterin, were studied in detail. Fluorescence studies of xanthopterin have indicated an excitation maximum at 330 nm and an emission maximum of 425 nm. The optimal wavelength for quantitating intensity as a function of concentration was noted at 550 nm with a range of linearity from 10 $\mu\text{g/ml}$ to 2 $\mu\text{g/ml}$.

(252)

The Taxonomy of *Heuchera* (Saxifragaceae) East of the Rockies

ELIZABETH FORTSON WELLS
University of North Carolina

The species of *Heuchera* east of the Rockies fall into two natural groups on the basis of phenology, morphology, genetic compatibility, and developmental morphology. The five spring-blooming taxa are very homogeneous in vegetative morphology, share similar flower and leaf developmental morphology, and give rise to vigorous, fully fertile hybrids when crossed. These taxa are distinct from one another in floral characters, although they intergrade in areas of range overlap. The two summer-blooming species share similar developmental morphology and certain floral characters, but are quite distinct from each other vegetatively. Crossability between these two is somewhat lower than among the spring-blooming taxa, and the ease of hybridization between any spring-blooming species and any summer-blooming species is even lower. A revision in the taxonomy of the species east of the Rockies is proposed.

(300)

Vegetation of the Thompson River Gorge of the Southern Blue Ridge Mountains

THOMAS R. WENTWORTH
North Carolina State University

The Thompson River is one of several streams which drain the southeastern escarpment region of the Blue Ridge Mountains in North Carolina, South Carolina, and Georgia. The escarpment gorges of the southern Blue Ridge are particularly interesting because of their climate (apparently unique in North America), characterized by very high precipitation, mild temperatures, and otherwise moderate conditions. Preliminary results of an intensive survey of the Thompson River watershed vegetation, based on quantitative sampling and analysis through ordination techniques, are described. Two specific areas of investigation are summarized: 1) relationships of vegetational composition and structure to gradients of environmental conditions, and 2) measurement of diversities and floristic affinities of the community-types studied.

(305)

The Effects of Fire on Two Louisiana Marshes

STEPHEN A. WHIPPLE AND DAVID WHITE
Louisiana State University and Tulane University

The effects of fire are reported from two marsh sites in St. Bernard Parish which differ slightly in salinity. The sites were first analyzed in the fall of 1975, then burned in the early spring of 1976 and reanalyzed that fall. The major effect of burning on composition was

to allow the appearance of *Scirpus robustus* in both marshes while the dominant species in both marshes responded primarily by increases in densities, without changes in their orders of importance. The relatively small effects of burning on these marshes may be related to the long history of periodic fire on Louisiana marshes. Although no fires were observed for several years on the study sites prior to the experimental burning, the long history of fire may have modified the marshes until they are little affected by it today. Only long-term exclusion will help to clarify the effects of fire on these marshes.

(177)

Are There Any Rare Freshwater Algae?

L. A. WHITFORD
North Carolina State University

It is suggested that species of freshwater algae are very old and that there are few if any which are not widely distributed. Many are rarely collected because they are stenoeccious, that is, occupy micro-habitats. If one knows when and where to look, many can be collected in considerable numbers. A number of species, long thought rare, are actually widely distributed. Several are discussed and illustrated. It is predicted that a recently described genus, *Eirmodesmus*, known from only one locality, will be found to be widely distributed. Investigators should carefully describe the habitat of "rare" species which they collect.

(186)

Lycopodium Gametophytes in Axenic Culture

DEAN P. WHITTIER
Vanderbilt University

In nature the gametophytes of *Lycopodium obscurum* are disk-shaped, fleshy, white, subterranean prothalli and those of *L. complanatum* var. *flabelliforme* are carrot-shaped, fleshy, white, subterranean prothalli. Earlier workers have been unsuccessful in growing these "wild-type" fleshy, white gametophytes in axenic culture. *L. complanatum* has been reported to form non-fleshy, branched, green prothalli in the absence of the endophytic fungus. The present study demonstrates that white, fleshy, disk-shaped gametophytes of *L. obscurum* and white, fleshy, carrot-shaped gametophytes of *L. complanatum* can be grown in axenic culture on a nutrient medium containing 0.5% sucrose. These gametophytes have the normal morphology of the respective species. Archegonia and/or antheridia are borne on the dorsal surface or apical end and the ventral or lower regions are composed of storage parenchyma, palisade and cortical regions and an epidermis with rhizoids. However, these gametophytes from axenic culture lack the endophytic fungus which is required by these gametophytes in nature.

(204)

The Role of Three-Spot Damselfish (Pomacentridae) in Community Structure

ANN HOUSTON WILLIAMS
University of North Carolina

Density and distributional observations for two species of herbivorous sea urchins, *Diadema antillarum* and

Echinometra viridis, and the territorial Three-spot damselfish, *Eupomacentrus planifrons*, were analyzed for possible competitive interactions among the species. Daily observations were carried out by use of SCUBA in a shallow back reef environment at Discovery Bay, Jamaica during 1975-76. Differing levels of aggression and primary coral substrate preferences by damselfish were strongly correlated with fish sex. After experimental removals of damselfish, significant fluctuations of urchin densities and distributional patterns in the absence of fish point toward community stabilization through fish behavioral mechanisms. Thus, fish distributions, determined by availability of substrate for territorial defense and sexual variation, appear to be primarily responsible for distributions of urchin competitors and community structure.

(306)

A Floristic Study of the "Savannahs" on Pine Plantations in the Croatan National Forest

E. JEAN WILSON

University of North Carolina at Chapel Hill

Nine managed pine plantations representing an age spectrum of 1 to 8 years following clearcutting and burning, were studied during the years 1975 and 1976. Major factors considered were phenological changes throughout the year, floristic changes with time, and floristic variations due to edaphic, topographic and moisture relations within and between and within sites. Species composition and cover were determined from random square meter quadrats taken at intervals during the year of 1976. A varied habitat including xeric sand ridges, dry ditches, mesic ridges, mesic ditches, wet ditches and small pools seemed to produce recognizable and distinct species patterns. Due to the local habitat factors, within-site variations were found to be more important than successional patterns in determining species composition.

(39)

The Effectiveness of High Density Benthic Macroinvertebrate Subsampling

WILLIAM M. WINN AND ERIC L. MORGAN

Tennessee Technological University

High density populations of benthic macroinvertebrates are frequently associated with the sampling of aquatic ecosystems affected by high pollution loads. Considerable problems are encountered when rapid assessments of biological conditions using macroinvertebrates are complicated by time consuming and expensive sorting and identification of the large numbers of organisms collected in benthic faunal samples. A subsampler has been constructed to alleviate this problem by dividing the sample into seven subsample units with the removal of very coarse material the only preparation necessary. The subsampler was used both prior to sorting of organisms and prior to mounting of organisms for identification. A description of the operation and an analysis of the results obtained will be discussed in light of previously published material.

(201)

Cell Length and Wood Specific Gravity as Ecotypic Characters in *Acer negundo* L. (Aceraceae)

JOE E. WINSTEAD

Western Kentucky University

Laboratory germinated seedlings of *Acer negundo* (boxelder) grown under controlled environmental conditions showed patterns of decreasing cell length (tracheids) with increase in latitude of origin. Measurements of wood specific gravity indicated increases in specific gravity with increase in latitude. Populations tested represented a range in latitude of 15° (Texas to Canada) and the results indicate genetic potential for possible wood quality manipulation in managed plantations.

(251)

Behavior of an Interchange Quadrivalent in Living Cells of *Melanoplus differentialis* (Orthoptera, Acrididae)

DWAYNE WISE AND GEOFFREY K. RICKARDS

Duke University

A single grasshopper was discovered which was heterozygous for an interchange involving two of the largest chromosomes of the complement. The resulting quadrivalent occurred as a ring-of-four, chain-of-four, and, rarely, as two heteromorphic bivalents. Metaphase orientation and anaphase disjunction of some of these complexes were recorded with time-lapse movie equipment on 16 mm film. The chain-of-four was stable in the linear orientation and anaphase disjunction was normal. The U-shaped, adjacent-2 orientation was not seen *in vivo*, but evidence from fixed cells indicated that it occasionally occurred. The unbalanced 3:1 configuration of the chain was stable during prometaphase and was followed by a normal anaphase. In the 3:1 orientation, the quadrivalent was shifted somewhat toward the spindle pole to which three kinetochores were oriented.

(229)

Notes on *Strombomonas vepei* n. sp. (Protozoa: Euglenidae) from a Soft Water Appalachian Pond

WILLIAM H. YONGUE, JR.

Virginia Polytechnic Institute and State University

Strombomonas vepei sp. n. is described from Pandapas Pond (near Blacksburg, Virginia), a soft water, neutral to low pH, low primary productivity pond. It has been observed at weekly intervals for three years with peak populations during the November-December and March-April periods. It has been maintained for two to three weeks in the laboratory at 15C. No attempt has been made to culture it. In addition to its distinct lorica morphology its mode of reproduction differs from that reported for *Strombomonas* or *Trachelomonas*. The lorica is a five angled pyramid for the posterior two-thirds and measures 20-24 μ at the broadest. The anterior one-third narrows to form a vase-like at-

tenuation. The total lorica length is 46-50 μ in matured forms. The euglena-like organism is a broad spindle with an attenuated posterior. It has numerous discoidal chloroplast and numerous rectangular paramylum bodies. The flagellum is about 1 $\frac{1}{4}$ times the lorica length. After longitudinal fission both daughter cells leave the old lorica and form new ones. This lorica formation is accompanied by rapid and intense euglenoid movement that decreases as the lorica is formed from anterior to posterior.

(275)

Topographic Features of Some Chytrids From a Sphagnum Bog

WILLIAM C. ZATTAU AND CLYDE J. UMPHLETT
Clemson University

Light and scanning electron microscopy were employed in studying the wall surfaces of several species of monocentric chytrids collected from the environs of a Sphagnum bog in western North Carolina. The walls of some of the species observed are ornamented by the presence of warts, spines, banding and tubercles which are highly characteristic for a given species. In *Blyttomyces helicus* SEM revealed a twisted ultrastructure for the spiral bands on the zoosporangium. The same technique showed the finely tuberculate nature of the wall of the resting spore of *Septosperma rhizophydii* which appears smooth with light microscopy; in *S. multiforma* the RS wall configuration proved to be highly consistent and not extremely variable as was noted in the original description of the species. Included also are micrographic accounts of some ornamented forms which appear to be undescribed.

(181)

Phenology of Selected Bryophytes in Southern Illinois

DOUGLAS ZEHR
Southern Illinois University

Maturity indices of *Atrichum angustatum* (Brid.) B.S.G., *Diphyscium foliosum* (Hedw.) Mohr, *Trichocolea tomentella* (Ehrh.) Dum., *Nowellia curvifolia* (Dicks.) Mitt., and *Lophocolea heterophylla* (Schrad.) Dum. populations in southern Illinois are discussed. Indices are based on biweekly observations made over a period of a year and are correlated with vapor pressure deficit, temperature, light quality and quantity, and day-length. Depending upon the species, these microenvironmental factors variously affect the vegetative growth, gametangial formation, fertilization, and subsequent growth of the sporophytes.



Guest Lecturer for the 38th Annual Meeting of the Association of Southeastern Biologists Thursday Evening, Room 2

The guest speaker for the general session on Thursday is Dr. Frederick B. Bang, Professor and Chairman, Department of Pathology, School of Hygiene and Public Health, Johns Hopkins University.

Dr. Bang received his A.B. and M.D. degrees at Johns Hopkins. He has held various appointments at the Rockefeller Institute and Johns Hopkins, and was for several years the Director of the International Center for Medical Research

and Training, Calcutta, India.

His research interests cover a variety of topics such as behavior of anopheles, treatment and suppression of malaria, experimental chemotherapy of schistosomiasis, growth of viruses in embryos and tissue culture, electron microscopy of viruses and cells, comparative pathology of infections, and pathogenesis of virus infections.

The title of Dr. Bang's talk will be "The Role of Invertebrate Pathology in Biological Research."

SREL Symposium **on** **Energy and Environmental Stress in Aquatic Systems** **November 2-4, 1977** **Augusta, Georgia, USA**

The Savannah River Ecology Laboratory, in cooperation with the University of Georgia's Institute of Ecology, will sponsor the fifth in a series of symposia on ecological research. Session topics will include: thermal ecology, heavy metal pollution, contamination from fossil fuels and their by-products, natural stressors and environmental fluctuations, synergistic stresses, and modeling environmental stress. Plenary meetings will be scheduled for invited speakers to review pertinent research on each of the six session topics. At the completion of each session a selected panel and the audience will discuss the papers presented and consider future avenues of research.

Papers for oral presentation and publication will be selected on the basis of quality of content, applicability to the proposed sessions, and balance within each session. Informative abstracts are due by July 15, 1977, and speakers will be notified of acceptance by August 1. Authors who desire to publish their work should submit their manuscripts no later than September 1, in order to guarantee consideration for publication in a volume of selected papers. For further information on abstract and manuscript preparation, lodging, registration, etc., contact: Dr. James H. Thorp, Chairman, Symposium Committee, Savannah River Ecology Laboratory, Drawer E, Aiken, South Carolina, 29801, USA.

ASSOCIATION AFFAIRS

CANCELLED AND NO SHOW PAPERS

ASB program sessions have been increasingly plagued in recent years by papers that are scheduled and then not delivered. Such gaps in the schedule disrupt the program, disconcert those scheduled later in the session, and disappoint the audience. Professional courtesy requires a person who submits a paper to accept the obligation to see that the paper is presented. If one cannot be present because of unforeseen circumstances, it is usually possible to arrange for a colleague to read the paper. If this is not feasible, it is incumbent upon the author to notify the Program Chairperson and the person chairing the session at the earliest possible moment.

Please call the attention of your graduate students and colleagues to this matter. The Executive Committee hopes that no further action will be necessary to remedy the situation.

PAYING DUES AT ANNUAL MEETING — PLEASE DON'T

In past years, much confusion has arisen when members paid dues when they registered at the Annual Meeting. Therefore, at the Blacksburg and New Orleans Meetings, dues were not accepted at the registration desk. The Executive Committee staffed a booth in the exhibit area where extra copies of the Bulletin and other materials explaining the purpose and activities of ASB were available. New members were encouraged to fill out application forms and pay their dues there. Old members were urged to mail their dues directly to the Treasurer, Dr. Raymond O. Flagg, Carolina Biological Supply Company, Burlington, North Carolina 27215.

This procedure will be continued at the Raleigh Meeting. Suggestions for improvement of the ASB booth display and operation will be gratefully received by the Executive Committee.

TIME AND PLACE OF FUTURE MEETINGS

1977	April 13-16	University of North Carolina, Raleigh
1978	April 13-15	University of Alabama, University, Alabama
1979		University of Tennessee, Chattanooga
1980		University of South Florida

EMERITUS MEMBERSHIP

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, Dr. Raymond O. Flagg, Carolina Biological Supply Company, Burlington, N.C. 27215.

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.

Please PRINT new address below:

Name:

New Address:

City:

State:

Zip code:



Raymond O. Flagg



Margaret Y. Menzel

ASB Candidates for Office — 1977

The Nominating Committee, composed of David Cotter, C. Willard Hart, and Chairman Grover C. Miller, selected the following slate of nominees for the various ASB offices that will be vacated this year. Voting will take place at the Business Meeting, Friday, April 15, 1977. Additional nominations may be made from the floor.

- President-Elect:* — Raymond O. Flagg, Carolina Biological Supply Company
Margaret Y. Menzel, Florida State University
- Vice-President:* — Dolores S. (Dee) Dundee, University of New Orleans
Clarence E. Styron, Mound Laboratory, Monsanto Research Corporation
- Treasurer:* — J. Whitfield Gibbons, Savannah River Ecology Laboratory, University of Georgia
Joseph C. O'Kelley, University of Alabama
- Executive Committee:* — Thomas P. Copeland, East Tennessee State University
Jon R. Fortman, Mississippi State College for Women
George H. Simmons, Jr., Virginia Polytechnic Institute and State University
James C. Wilkes, Jr., Troy State College

Biographical sketches of the candidates follow.

Raymond O. Flagg
(President-Elect)

Director of Botany at Carolina Biological Supply Company, Dr. Flagg received his A.B. degree from Shepherd College and his Ph.D. from the University of Virginia where he was a Blandly Farmer under Walter S. Flory. He studied Russian at the Army Language School and Middlebury College, taught high school mathematics, and was a Research Associate at the University of Virginia.

His interest in the use of living materials in teaching has led to diverse developments such as inexpensive monochromatic light filters, Instant Drosophila Medium, ATP-bioluminescence kits, and the Fern Mini-Marsh. His basic research interests center on rainlily systematics and endangered plant species.

Ray joined the ASB as a graduate student, has served on various committees, and is the current Treasurer (1971-77). Some other professional memberships include AAAS, Botanical Society of America, IAPT, Fairchild Tropical Garden, North Carolina and Virginia Academies of Science, and Sigma Xi.

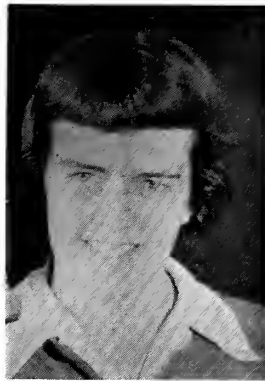
Margaret Y. Menzel
(President-Elect)

Professor of Biology at Florida State University, Dr. Menzel received the B.A. degree magna cum laude from Southwestern University and the Ph.D. from the University of Virginia, where she was a Blandly Fellow studying under Dr. Orland E. White. She was an instructor in Agronomy at the Beasley Cotton Laboratory at Texas A & M and a research geneticist with the Agricultural Research Service, U.S.D.A., before joining the Florida State Faculty in 1963. A member of several professional societies, among them the Genetics Society of America, Botanical Society of America, Association for Tropical Biology, and Society for the Study of Evolution, she was president of the Florida State University Chapter of the Society of the Sigma Xi 1971-73. She is the author of 50 research papers, mostly on the cytology, cytogenetics, and biosystematics of cotton and Hibiscus.

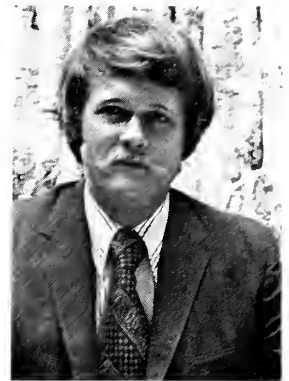
Margaret joined ASB in 1950 and was the recipient of the ASB Research Award that year. She served ASB as Secretary (1964-66) and Vice-President (1967), and as a member of several committees. She arranged the invitation paper sessions on Chromosome Structure and Function for the 1977 Annual Meeting. She has just completed, with this issue, five years as Editor of the ASB Bulletin.

Dee S. Dundee
(Vice-President)

Dr. Dundee, who organized and coordinated the 1976 ASB meeting in New Orleans, is Professor of Biological



Dundee



Styron

Sciences at University of New Orleans (a member of the Louisiana State University system). She holds a Ph.D. from University of Michigan. She is active in local, regional, national, international affairs involving her research interests (malacology). She has numerous publications in that field and is currently Editor of the American Malacological Union publications. Over the years she has received various grants from agencies for the study of molluscs. She served as President of A.M.U. in 72-73.

Dee is also involved in other activities: currently she is a member of the Board of Trustees of the Louisiana Nature Center; has served on the Southern Association Visiting Committees for Accreditation of Claflin College, Vanderbilt, University of South Florida, Baylor University within the past 5 years; is an active pilot and flight instructor; does community service work such as talking to groups, serving on panels and seminars, doing local TV and radio programs. When time permits she puts on her real estate salesman hat. She does take time out of a very busy schedule for tennis matches and foreign travel with her husband who is Professor of Biology at Tulane University.

She has been associated with ASB since her arrival in the south 19 years ago. She has served on several committees in addition to chairing the 1976 Local Arrangements Committee.

C. E. Styron
(Vice-President)

Dr. Styron, Senior Ecologist at the Mound Laboratory of Monsanto Research Corporation, received his B.S. degree from Davidson College in 1963 and M.S. and Ph.D. degrees from Emory University in 1965 and 1967. He received the Master's and Doctoral research awards from the Emory chapter of Sigma Xi. Awarded a post-doctoral appointment in the Environmental Sciences Division of Oak Ridge National Laboratory (1967-69), Dr. Styron has continued as a consultant to the Division in radiation ecology. Joining the faculty of St. Andrews Presbyterian College as Assistant Professor of Biology

in 1969, he served as chairman of the Biology Program in 1976 and was elected a National Teaching Fellow (1969) and Outstanding Educator of America (1972 and 1974-75).

He is a member of the American Institute of Biological Sciences, American Society of Limnology and Oceanography, Ecological Society of America, Marine Biological Association of the United Kingdom, Society of the Sigma Xi, and the Association of Southeastern Biologists. Dr. Styron has served the ASB on the Travel Award Committee (1970-73), Executive Committee (1974-75), and Conservation Committee (1974-76). As chairman of the Conservation Committee, he organized the "Symposium on Rare, Endangered and Threatened Biota of the Southeast" for the New Orleans meeting and edited the proceedings for the ASB Bulletin.

Dr. Styron's research interests in radiation ecology include effects of ionizing radiation on freshwater and terrestrial arthropods and cycling of trace elements in marine systems. He recently joined Monsanto to develop an ecological research program for the laboratory.

J. Whitfield Gibbons (Treasurer)

Dr. Gibbons is Associate Director of the Savannah River Ecology Laboratory of the University of Georgia. He presently holds adjunct faculty appointments with the Zoology Department at the University of Georgia and the Biology Department at Wake Forest University. Dr. Gibbons received his B.S. (1961) and M.S. (1963) at the University of Alabama and completed his doctoral work at Michigan State University in 1967.

A member of several scientific societies, Dr. Gibbons has served as the National Executive Secretary-Treasurer of the Herpetologists' League from 1972-75. He has also held office with the Southeastern Division of the American Society of Ichthyologists and Herpetologists — Secretary-Treasurer (1972), Vice-President (1973), President (1974 and 1975). ASB experience includes serving as Chairman of the Research Award Committee for 1974-75.

Research interests have centered around the population ecology of vertebrates, particularly reptiles and amphibians. Dr. Gibbons has also carried out thermal studies involving the effect of reactor effluents on aquatic environments. He and Dr. Rebecca R. Sharitz organized the first national symposium on thermal ecology and edited the proceedings in 1973-74.

Joseph C. O'Kelley (Treasurer)

Dr. O'Kelley, Professor of Biology at the University of Alabama, has been a faculty member of that institution since 1951. He received his B.A. and M.A. degrees from the University of North Carolina and his Ph.D. from Iowa State University. In 1953-54 he was an NSF



Gibbons



O'Kelley

Postdoctoral Fellow at the University of Wisconsin and in 1965-66 an NIH Special Fellow at the Johns Hopkins University. His main research interests are in the areas of photobiology and cellular biology.

He joined ASB in 1951 and is a member of a number of other professional societies. He is a Fellow of AAAS. He has served as Chairman of the Southeastern Section of the Botanical Society of America and as Chairman of the Southern Section of the American Society of Plant Physiologists. He is co-holder of the Award for Meritorious Research given by ASB in 1970. He has previously served on the Goethe Travel Awards and the Research Awards Committees of ASB, and is currently a member of the Executive Committee.

Thomas P. Copeland (Executive Committee)

Dr. Copeland is Professor and Chairman, Department of Biology, East Tennessee State University. He received the B.S. degree from Ouachita Baptist College, the M.A. degree from George Peabody College and the Ph.D. from the University of Tennessee. He has been on the Faculty of East Tennessee State University since 1950 and has served as chairman of the Department of Biology from 1963.

His teaching interests are in general biology and entomology. His research interests are the taxonomy and ecology of the insectan orders Protura and Collembola. He is a member of several professional organizations and is a Fellow in the Tennessee Academy of Science.

Jon R. Fortman (Executive Committee)

Dr. Jon R. Fortman is Associate Professor of Biology at Mississippi University for Women. He received his B.S. degree from the University of Florida, a M.Ed. and M.A. in biology from Louisiana State University and Southern Methodist University respectively, and his Ph.D. from Mississippi State University. Dr. Fortman

taught high school biology at Maynard Evans High, Orlando, Florida for 7 years and in 1967 was selected for the Outstanding Biology Teacher Award in Florida and the Southeast by the National Association of Biology Teachers. Other teaching positions include Valencia Community College, Orlando and Florida State University, as an adjunct professor.

Dr. Fortman has been a member of ASB since 1968 and is currently serving as News Editor for *The ASB Bulletin*, a position he has held for the past three years. He is also on the Editorial Board of the National Association of Biology Teachers and a member of Herpetologists League. Dr. Fortman serves as school sponsor for *Beta Beta Beta*.

His research interests are in the area of larval amphibian behavior, where he is currently working on bio-social aggregation in tadpoles.

George M. Simmons, Jr.
(Executive Committee)

Dr. Simmons is an associate professor of zoology at V.P.I. & S.U. He received the B.S. degree in Biology from Appalachian State University in 1964 and the Ph.D. in Zoology from V.P.I. & S.U. in 1968. He was an assistant professor of biology at Virginia Commonwealth University in Richmond, Va. from 1968-1971. He has taught at the University of Virginia's Mountain Lake Biological Station for several summers. Dr. Simmons, a member of ASB since 1966, also holds membership in such other professional societies as the International Association of Theoretical and Applied Limnology, North American Benthological Society, and Sigma Xi. He served on the ASB local arrangements committee at V.P.I. & S.U. in 1975 and has served in various capacities in the Biology Section of the Virginia Academy of Science. His research interests are limnological in nature and have focused on such areas as the evolution of aquatic communities in a new reservoir system, the contribution of periphyton on artificial reefs to the growth rate of associated game fishes and the trophic properties of Mountain Lake, Virginia.

James C. Wilkes
(Executive Committee)

Professor of Biology at Troy State University, Dr. Wilkes received his B.S. degree from Troy State, his M.S. from the University of Tennessee, and his Ph.D. from the University of Alabama; Post-doctoral work was done at the University of Wyoming, Tulane University, and Oak Ridge.

Dr. Wilkes has served as professor and department chairman at the following institutions: Jacksonville State University (1954-56); Huntingdon College (1957-60); Mississippi State University for Women (1960-66); and Troy State University (1968-76). He is currently President-Elect, Alabama Academy of Science, and is presi-



Copeland



Fortman



Simmons



Wilkes

dent of the local chapter of Phi Kappa Phi. He served as faculty advisor to chapters of Beta Beta Beta at Huntingdon College, Mississippi State University for Women, and Troy State University.

Dr. Wilkes joined the Association of Southeastern Biologists in 1951, and has served as ASB correspondent for Alabama since 1967.



News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Vacant

Georgia — Fred K. Parrish, Georgia State University

Illinois — George T. Weaver, Southern Illinois University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Maurice Whittinghill, University of North Carolina

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Dr. Paul C. Bailey, Dean of Birmingham-Southern College is resigning his position as Dean effective June 1, 1977 and will return to the Department of Biology of Birmingham-Southern College as Chairman of the Department and as Professor of Biology, a position he held before being appointed Dean of the College.

Dr. R. Rodriguez-Kabana, plant nematologist in the Department of Botany and Microbiology, Auburn University, presented an invitational seminar address entitled "Definition of Pathogen-Antagonist Systems in Soil through Enzyme Activities" at the Department of Plant Pathology, University of Florida, on November 23, 1976.

The following botanists at the University of Florida have received promotions: **Dr. Henry C. Aldrich** and **Dr. James W. Kimbrough** from Associate Professor to Professor; **Dr. John J. Ewel**, **Dr. Terry W. Lucansky**, and **Dr. Ariel E. Lugo** from Assistant Professor to Associate Professor. **Dr. Willard W. Payne**, Chairman of the Department of Botany has been named Director of the Division of Biological Sciences for 1976-77. **Dr. Payne** has also been appointed Chairman of the Scientific Advisory Committee of Fairchild Tropical Garden. **Dr. David S. Anthony** was honored by the Florida Audubon Society by being chosen "Conservationist of the Year" for 1976. **Dr. Anthony** has been very active for a number of years in preservation of natural areas and was one of the leaders in opposition to construction of the Cross-Florida Barge Canal.

Dr. Martin Young, research professor in the College of Veterinary Medicine, University of Florida and former President and Secretary-Treasurer of ASB, has been selected as this year's recipient of the LePrince Award from the American Society of Tropical Medicine and Hygiene. The award is given every three years for "outstanding accomplishment in the field of malaria." **Dr. Young** was presented with a medal and certificate at the annual meeting of the Society in Philadelphia.

The following grants have been awarded to faculty of the Department of Biological Sciences, Florida State University: **Dr. Lorau C. Anderson**, National Science

Foundation, "Systematics and Anatomy of *Chrysothamnus*"; **Dr. Don Tucker**, National Institute of Neurological Diseases and Stroke, "Relation of Neural Responses to Odor Properties"; **Dr. J. Herbert Taylor**, National Foundation March of Dimes, "Chromosome Structure: Units of Replication and Genetic Function"; **Dr. Robert J. Livingston**, Franklin County (Florida) Board of County Commissioners, "Analysis of the Effects of Pollution on Apalachicola Bay".

Dr. David Staszak, Associate Professor of Biology at Georgia College, has been appointed Acting Director of Research Services. **Dr. Staszak** will continue to teach in the Department of Biological and Environmental Sciences in addition to his new administrative duties.

Ms. Jennifer Davis, a protozoologist, has joined the faculty of the Department of Biology and Earth Sciences, Shorter College, Rome, Georgia.

Dr. W. Clark Ashby, Professor of Botany, Southern Illinois University, has been re-appointed for a continuing year to the Biology Committee of the Argonne Universities Association — Argonne National Laboratory. **Dr. Ashby** has received grants of \$33,000 from the U.S. Forest Service for a resurvey of strip-mine plantings, and of \$38,088 from the Illinois Institute for Environmental Quality for a project titled, "A Bulletin: Trees for Recreation, Wildlife, and Timber on Surface-Mined Lands in Illinois."

Dr. Roland R. Abegg has retired from his position as Professor and Head of the Department of Zoology, Louisiana Tech University. His replacement is **Dr. Margaret H. Peaslee** (Ph.D. Northwestern University) formerly Professor of the Department of Biology, University of South Dakota, Vermillion, S.D. **Dr. Paul R. Ramsey**, Assistant Professor, of the Department of Zoology, Louisiana Tech University, was awarded a National Science Foundation Instructional Scientific Equipment Program Grant in the amount of \$7,900.

Dr. I. C. Kitchin, Professor Emeritus of Biology at the University of Mississippi, will return to active teaching for the Spring semester. **Dr. Kitchin** will teach Embryology, his area of expertise.

Dr. Terrance Marsh, Associate Professor of Biology at North Central College, Illinois and eleven students spent two weeks at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi working on the course, Estuarine Ecology. The course was offered during the interim between quarters on the campus of the college which is located 30 miles west of Chicago. **Dr. Marsh** presented a special seminar on the Sonoran Desert and Adjacent Life Zones, showing slides made during a student field trip to Arizona.

Dr. George C. Robertson (Ph.D. North Carolina State University) has been appointed Assistant Professor in the Department of Biology, Campbell College, North Carolina. He replaces **Mr. Robert A. McIntyre** who died August 27, 1976. **Dr. Robert Soots**, Chairman Biology Department, Campbell College, was elected to the Board of Directors of Fayetteville Area Health Education Foundation, Inc.

The faculty of the Department of Zoology at Clemson University has recently been joined by Associate Professor **James E. Schindler** (Ph.D. Oxford University) and Assistant Professors, **Jack B. Waide** (Ph.D. University of Georgia), **Alfred P. Wheeler** (Ph.D. Duke University) and **John P. Wourms** (Ph.D. Stanford University). These new faculty add great strength to the environmental biology, developmental and physiological-cell biology programs of the department.

Dr. Gordon E. Hunt, Professor of Botany, The University of Tennessee, Knoxville, died on October 26, 1976. A native of New York City, **Dr. Hunt** received his B.S. degree in Zoology and his Ph.D. in Botany from Cornell University. He had been at the University of Tennessee since 1951. He taught undergraduate and graduate courses in various aspects of plant physiology. His research interests centered around cannavanine metabolism in jackbean.

The following faculty changes at Southwestern at Memphis are reported: **Dr. Arlo I. Smith** will retire in June 1977 after 31 years of teaching in the Biology Department. **Dr. John N. Mugaas**, who received his graduate degree from Washington State University, has joined the faculty and will teach courses in animal physiology. He replaces **Dr. James D. Witherspoon**, who has taken an extended leave. **Mrs. Joyce Stone** has been added to the faculty to teach courses in genetics and cell biology. She replaces **Dr. Bobby R. Jones**, who is on sabbatical leave.

Gary S. Sayler, Assistant Professor, Graduate Program in Ecology, The University of Tennessee, Knoxville has received the following grants: "Assessment of the microbial degradation of polynuclear aromatic hydrocarbon contaminants arising from coal conversion processes", Union Carbide Subcontract, Oak Ridge National Laboratory; "Bacterial degradation of PCB: consequences and effects", National Institutes of Health; "Factors affecting the survival and physiology of *Salmonella* spp. in aquatic environments", National Institute of Health Biomedical Sciences Support Grants.

Dr. Charles Neal has joined the Department of Biology at Radford College, Virginia as Assistant Professor of Biology. **Dr. Neal** was previously employed at Merrimack College, Andover, Massachusetts.

About Institutions

Shorter College has initiated a new program designed to prepare professional environmental scientists at the Bachelor level. Candidates for the program will follow a curriculum of courses in Biology, Chemistry, Earth Sciences, Natural Sciences and Physics. These courses are designed to provide competence in measurement and evaluation of environmental factors and students will serve a one semester internship with an agency or industry involved with environmental problems.

The first phase of the roof-top greenhouse has been completed atop the Biology building at the **University of Mississippi**.

The Department of Mathematics and Physical Science at **Delta State University** will occupy their new 47,000 sq. foot facility on or before January 1977. The new structure has, in addition to the usual facilities, a sixty student capacity planetarium. This represents a first in the state supported universities and colleges.

Anyone whose research involves modeling, circadian rhythms, prediction of field response, population genetics, whole plant physiology, and the impact of complexes of environmental factors on physiological response, will now have available the growth and laboratory facilities of the Southeastern Plant Environment Laboratories located on the **Duke and North Carolina State University** campuses. These controlled environmental facilities are supported in part by the National Science Foundation, the respective universities and rental fees. Several sources of funds are available for those wishing to avail themselves of these extraordinarily versatile facilities. Potential phytotron users from off campus may apply for money for travel by contacting **Dr. Henry Hellmers**, Department of Botany, Duke University, Durham, N.C. 27706, telephone (919) 684-4262 or **Dr. R. J. Downs**, Phytotron, North Carolina State University, Raleigh, N.C. 27607, telephone (919) 737-2779. Graduate students may apply for grants to work in the phytotrons by writing to NSF's Division of Environmental Biology, Washington, D.C. 20550. Faculty and students who wish to travel to these facilities and seek funding for their research, should write the Southern Education Board, 130 Sixth Street, N.W., Atlanta, Georgia 30313.

Winthrop College, S.C. will now offer a B.S. in biology to replace the B.A. degree.

The Department of Biology, Presbyterian College, Clinton, S.C., was recently awarded a National Science Foundation Instructional Scientific Equipment grant in the amount of \$11,000. Equipment to be purchased will include a physiograph, electrophoresis unit and an ultracentrifuge. **Dr. James D. Stidham**, Chairman of Biology, is the program director.

Clemson University announces the opening of Jordan Hall, a facility housing laboratories for the Departments of Biochemistry, Botany, Microbiology and Zoology. This new building was made possible through the efforts and donations of *Mr. and Mrs. F. Marshall* and *Evelyn Jordan*.

Site preparation plans for the projected 1982 World Energy Exposition in Knoxville, Tennessee include demolition of the newly remodeled **University of Tennessee** Ecological Laboratories. The Exposition Site Committee considers the area which includes the Ecology Building an industrial slum and states that the demolition of this neighborhood will greatly benefit the city. Ecology students and faculty eagerly await the construction of a new facility on or adjacent to the main campus of **The University of Tennessee**, Knoxville. Possible sites for the new Ecology facility include areas which afford views overlooking Neyland Stadium, Knoxville's largest sewage treatment plant, Fort Loudon Reservoir, or the

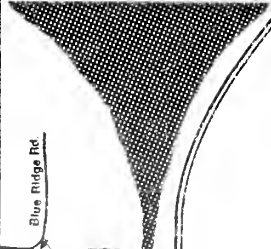
Poultry Science farm of the University of Tennessee Institute of Agriculture.

Biology In The Blue Ridge: The Next 50 Years, a symposium marking the 50th anniversary of the **Highlands Biological Station**, will be held on June 25, 1977 in Highlands, North Carolina. The daytime program will include addresses by invited participants on current research and future prospects in selected areas of biogeography, ecology, and systematics, with particular reference to the biota and ecosystems of the Appalachians. Speakers at the evening session to follow will consider more generally the historical standing, contemporary role, and future outlook of the Station in advancing biological study in the southern mountains. Persons interested in attending the symposium can obtain a program and registration form by writing *R. C. Bruce, Executive Director, Highlands Biological Station, P.O. Drawer 580, Highlands, N.C. 28741*.

NORTH ↑

NCSU

FACULTY CLUB



Blue Ridge Rd.

US 70

US 401
US 1

US 401

US 1

US 64

US 401

US 70

STATE FAIRGROUNDS



Wade Ave.

Glenwood Ave.

Hillsborough St.

Oberlin Rd.

Western Blvd

Dixie Trail

Dorn Allen Dr.

N.C. STATE UNIVERSITY

Pulliam Rd.

New Bern Ave.

US 1

US 64

German St.



Arment Perry Rd.

ASB

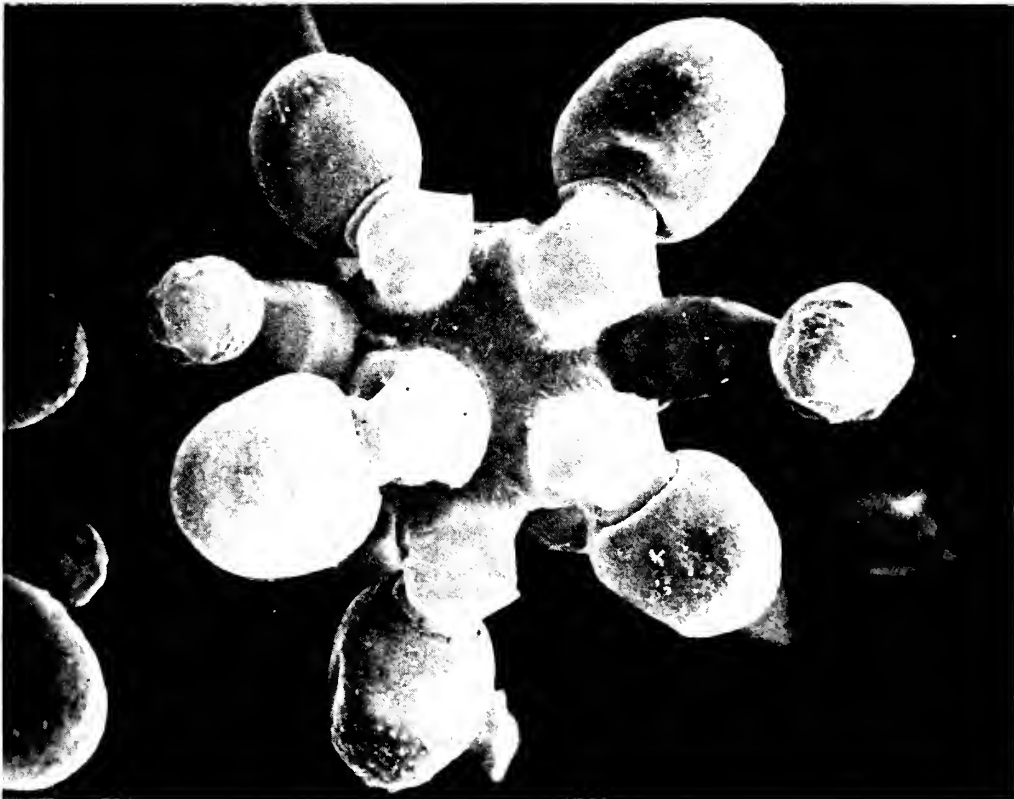
Raleigh

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The ASB

BULLETIN

Volume 24, No. 3

July 1977



Cephaleuros virescens Kunze

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The Association of Southeastern Biologists*

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GARY E. DILLARD
EDITOR

JERRY M. BASKIN
Associate Editor

JON FORTMAN, News Editor
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Dept. Natural Resources

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Louisiana State College

J. Frank McCormick (1979), University of Tennessee

Rudolph Prins (1979), Western Kentucky University

Jon R. Fortman (1980), Mississippi

University for Women

George M. Simmons, Jr. (1980), VPI & SU

AAAS Representative, Section G -

Franklin F. Flint (1978)

ABS Representative -

John M. Herr, Jr. (1978)



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COVER

Scanning electron microscope photograph of zoosporengia of the parasitic green alga, *Cephaleuros virescens* Kunze, which grows on the leaves of *Magnolia grandiflora* L. and many other higher plant hosts in the southern United States. Courtesy of **Russell L. Chapman**, Louisiana State University.

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (preferably 5 × 7) and brief descriptions to the Editor for consideration.

COPY DEADLINES

October Issue: August 15
January Issue: November 15
April Issue: January 1
July Issue: May 15

The ASB Gavel*

PERRY HOLT

Professor of Biology, VPI & SU, Blacksburg

Every organization of respectable duration and some importance in the affairs of men develops its traditions, rituals and symbolic objects. The Association is distinguished in its traditions and has as much ritual as is good for it, but is lacking in symbolic objects, having as such only a logo composed of an outline of the southeastern states. To remedy this latter lack, the writer, as one of the Past Presidents of the Association, has made with his own hands a gavel for the use of his successors. There is an extensive lore of gavels and their uses of which we remain mostly ignorant and are content to remain so: this gavel is intended to be used gently, to symbolize the minimum of power (hence, its small size) and to express something of the nature of the Association and its region.

The Association is composed of biologists, expansive in spirit, open minded, friendly people lacking in the narrow parochialism of the little-souled ones who proudly claim an obscure corner of their great field as theirs and do not see the beauty of the whole for concentrating so single-(?simple) mindedly on the not always beautiful piece of biology they so hubristically claim as their own specialty. The Founders were not as the latter. They studied algae and tapeworms, but their interests did not stop there. It seems appropriate, then, that one officially labeled as an invertebrate zoologist, using the simplest of tools, mainly his pocket knife, the only instrument he claims to wield with skill, should choose the wood of two plants (for the uses intended) as the materials of which the ASB gavel is made.

The head is of yellowwood, *Cladrastis lutea* (Michx. f.) K. Koch, which is a rare relict species of disjunct occurrence from the southern Appalachians to the Ozarks. The other four

species of its genus are in eastern Asia. It is a member of the great family of the legumes. The maker knew it as a child, learning the beauty of its wood, its smell, its feel, as his father taught him the craft of the woods and their nearly always gentle creatures. The precise tree from which this piece of wood came was one of a group that grew around the maker's family spring. It was cut by his brother-in-law before the Endangered Species Act was promulgated.

The handle is of sassafras, *Sassafras albidum* (Nutt.) Nees, of the almost equally great family of the laurels, with again only one species in eastern North America and two in China and Formosa. In our area, we all remember, unless we are unfortunately too young or are escapees from less fortunate regions, the fragrant and refreshing drink — sassafras tea — made by steeping the roots of the tree and sweetening the brew. This piece came, again by way of Odell Long, the maker's brother-in-law, from a fence post emplaced decades ago by Herman Eubanks.

One need say little of his brother-in-law; this one is as he should be, a child of the woods and hills of the Eastern Highland Rim of Tennessee. Of one's father one properly says little; the father's merits may so easily, and unjustifiably, be unknowingly appropriated to the son by the son's talk. Herman Eubanks was a tough little man who farmed the fields carved from the hillsides above the head of Eagle Creek. Famous, no, but notable in his neighborhood.

The Association needs traditions, rituals and symbols, as do all societies of people. The hope is that the woods of this gavel, characteristic of, almost unique to, and well known in the region of the Association, beautiful in themselves without the skill of an artificer, with their own provenance, may always remind us of the close relationship of so many of our members with wood and stream and simple rustic background and the good people who call such places home.

* *The above treatise was read to the Officers of the Association on April 14, 1977, on the occasion of the presentation of our official gavel by Perry Holt. Editor.*

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Vacant

Georgia — Fred K. Parrish, Georgia State University

Illinois — George T. Weaver, Southern Illinois University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Maurice Whittinghill, University of North Carolina

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

The following University of Alabama Department of Biology faculty members have recently been awarded Fellowships, Grants or Contracts: **Dr. Ronald Lindahl** has been awarded the first University-wide Faculty Summer Research Fellowships from the Graduate School. **Dr. Lindahl** will use the Fellowship's \$3,500 stipend to continue his work on the nature and origin of new aldehyde dehydrogenases in chemically-induced tumors. **Dr. Joseph F. Scheiring** has received part of a contract from the U.S. Army Corps of Engineers to the Alabama State Geological Survey in the amount of \$54,000. **Dr. Scheiring** and his group will conduct a base-line management study of biological water quality parameters of Jones Bluff, William Dannelly and Clairborne Lakes on the Alabama River. **Dr. Robert Haynes** and **Dr. Jeffrey Zeikus**, Postdoctoral Research Associate in the Department, will be the consultants for the project. **Dr. Harriett Smith** has received \$2,850 from the University Research Grants Committee for the "Identification of structures which perform the functions of a Golgi apparatus in the cells of *Pyrsonympha*."

Ms. Margaret L. McCrackin, a recent graduate of Huntingdon College, Montgomery, Alabama has been appointed as a teaching assistant in microbiology at Auburn University. **Dr. Paul A. Backman** and **Dr. Gerald R. Wilt** have been promoted to the rank of Associate Professor. **Dr. Urban L. Diener** is the 1976-77 President of the Alabama Academy of Sciences. **Dr. R. Rodriguez-Kabana** was elected Editor-in-Chief of the Journal *Nematropica* at Lima, Peru, in March 1977. **Dr. Bryan Truelove** was elected Editor of the Southern Weed Science Society for a 3-year term.

Dr. Donald J. Barrar was appointed Chairman of the Biology Department, Troy State University, on December 1, 1976. **Dr. Barrar** replaced **Dr. J. C. Wilkes**. **Ms. Margaret Browder** was appointed instructor for the 1976-77 academic year. **Dr. Wayne F. Adams**, Director of Environmental Science and Marine Biology received a \$125,000 CAUSE grant.

The Department of Natural Sciences of the Florida

State Museum anticipates some vacant office space in the coming year that could be used by a scientist on sabbatical leave. Telephone and clerical assistance would be available. Interests in systematics or ecology in the broad sense would perhaps equip a visitor for a more successful visit. Write the Departmental Chairman if you are interested. Applicants should have the Ph.D. degree or equivalent.

Thomas C. Emmel (Chairman, Department of Zoology, University of Florida) has been appointed Director of the Division of Biological Sciences. Seven new Assistant Professor appointments became effective during 1976-77: **H. Jane Brockmann** (animal behavior), **Stephen A. Bloom** (marine ecology), **Martha L. Crump** (amphibian biology), **Boyce A. Drummond III** (tropical community ecology), **Peter Feinsinger** (evolutionary ecology), **Michael C. LaBarbera** (functional morphology of marine invertebrates), **Pauline O. Lawrence** (host-parasite relationships).

Dr. David J. Cotter, Georgia College, has received a National Science Foundation Undergraduate Research Participation Program grant for \$11,500 for 6 students. This is the ninth summer program of this type to be received at Georgia College.

Margaret Stones, a leading botanical artist of the world, will be at work on the Louisiana State University campus through May on a project described as a modern equivalent of the "Birds of America" series by naturalist **John James Audubon**. "The Native Flora of Louisiana" is to be depicted in 200 botanical drawings in watercolor by **Ms. Stones**, and will be kept in a permanent collection for the state on the LSU campus. **Ms. Stones** is considered one of the world's leading botanical artists. She lives near the Royal Botanic Gardens at Kew, England.

Northwestern State University (Louisiana) hosted the 24th annual meeting of the Southwestern Association of Naturalists (SWAN) on April 21, 22, 23. **Ken Williams** coordinated the event assisted by **Tom Burns** and **Dick Stallings**. **Dick Stallings** recently completed all require-

ments for the Ph.D. degree from the University of Oklahoma in Mammalogy. **Dwayne Kruse** and **Jimmy Stothart** of Northwestern State University are holding a workshop/short course in Alpine Flora and Fauna. Up to 6 hrs. credit may be arranged. The course will include 2 weeks of packing in the Colorado Rockies. It is scheduled for August, 1977. Information may be obtained by contacting either person, Biology Dept., NSU, Natchitoches, LA 71457.

Dr. Joe B. Black, Professor of Zoology at McNeese State University in Lake Charles, Louisiana, has accepted a position as Head of the Department of Biology at Louisiana College in Pineville.

Dr. James F. Jackson has accepted a position as Assistant Professor of Biology in the Department of Biology, University of Southwestern Louisiana. **Dr. Jackson** received his Ph.D. from the University of Florida, worked in the Peace Corps in Brazil and did postdoctoral work in Sao Paulo. **Dr. Roy Curtiss Brown** (Ph.D. Arizona State University) has been appointed Assistant Professor at Southwestern Louisiana. He taught two years at the University of Lagos, Nigeria, and recently taught at Whitman College, Washington.

Dr. James I. Jones has assumed the duties of the Director of the Mississippi-Alabama Sea Grant Consortium which comprises nine universities and research facilities in the two states. Prior to accepting this new post, **Dr. Jones** was special projects officer with the Florida Division of State Planning and science advisor to the Governor of Florida. His research areas include coral reef geology and ecology. A total of \$20,622 in grants has been awarded to **Dr. Edwin Cake, Jr.** (principal investigator), **Dr. David W. Cook** and **William Demoran** (co-investigators) to determine the feasibility of establishing a commercial depuration plant designed to cleanse oysters taken from areas now closed to harvesting due to domestic pollution. **Drs. Cake, Cook** and **Demoran** are associated with the Gulf Coast Research Laboratory in Ocean Springs, Mississippi. **Mr. Robert Wells**, a senior chemistry major at Millsaps College, Jackson, Mississippi, has been selected to receive a scholarship paying all of his expenses for a summer of study and/or research at the Gulf Coast Research Laboratory. **Dr. Robin M. Overstreet**, head of the Parasitology Section, Gulf Coast Research Laboratory, has received a "sea grant" in the amount of \$6,500 to be matched with \$5,000 in State funds and used to prepare a handbook of marine parasites of the northern Gulf of Mexico. **Charles Eleuterius**, Head of the Physical Oceanography Section is the principal investigator for a \$22,267 project to conduct a project entitled "Mississippi Sound: High Energy and Hazardous Area Identification by Wave Refraction Analysis." The National Oceanic and Atmospheric Administration's Office of Sea Grant provided \$11,600 through the Mississippi-Alabama Sea Grant Consortium, and this was matched by \$10,667 from the State of Mississippi.

Dr. John G. Vandenberg has been appointed Head of the Zoology Department, North Carolina State University at Raleigh.

James N. Siedow (Ph.D. Indiana University) has been appointed Assistant Professor of Botany, Duke University. **Richard A. White**, Professor of Botany, Duke University, will assume the departmental chairmanship in January, 1978, replacing **Professor Robert L. Wilbur** who is returning to full time teaching and research. **T. W. Johnson, Jr.**, Department of Botany, has received a National Science Foundation grant for the collaborative writing, with **R. L. Seymour**, Ohio State University, of a monograph of the Saprolegniaceae (biology and systematics). **Dr. Johnson** will be on sabbatical during 1977-78 at Ohio State University. Other sabbatical leaves have been awarded to Professors **Richard A. White**, **Robert L. Wilbur**, and **Janis Antonovics**. Professor **Norman L. Christensen**, Department of Botany, Duke University, has been awarded a grant from the Duke Endowment. This award, the first at Duke University, is given to a young faculty member who has demonstrated superior teaching ability. The award provides a salaried leave of absence to enable the person to continue research and to strengthen his involvement in research.

Luckett V. Davis, acting chairman, has been appointed chairman of the Department of Biology, Winthrop College, South Carolina.

The University of the South announces the appointment of **Dr. Larry H. Jones** as Assistant Professor of Biology beginning September 1977.

Dr. Benjamin P. Stone, Professor of Biology at Austin Peay State University, has been appointed chairman of the department. **Dr. Stone** received his Ph.D. in botany from the University of Tennessee-Knoxville.

Dr. John J. Wielgus (Ph.D. Northwestern University) joins the Washington and Lee University, Department of Biology, as Assistant Professor of Biology. His teaching responsibilities will include Cell Biology and Developmental Biology.

The Department of Biology, Virginia Polytechnic Institute and State University, announces the following faculty appointments: **Stephen A. Scheckler**, Assistant Professor of Botany, Paleobotanist, Ph.D. Cornell, currently at the University of Alberta; **W. Carter Johnson**, Assistant Professor of Botany, Plant ecologist, Ph.D. North Dakota State University, currently at Oak Ridge, Tennessee; **John J. Tyson**, Assistant Professor of Zoology, Theoretical Biologist, Ph.D. University of Chicago, currently at Institut f. Biochemie, Universitat Innsbruck.

Drs. John Cairns, Jr., K. L. Dickson and **G. F. Westlake** of Virginia Polytechnic Institute and State University recently edited a publication entitled: "Biological Monitoring of Water and Effluent Quality." **Dr. Cairns** and **Dr. Dickson** along with **Dr. Edwin E. Herricks** have also edited "Recovery and Restoration of Damaged

Ecosystems" published by the University Press of Virginia.

New faculty additions to the Department of Biological Science, Marshall University, are: **Dr. Mary E. Hight**, Ph.D. Wayne State University, Mammalogy; **Dr. Wayne Elmore**, Ph.D. Vanderbilt University, Botany.

Dr. Dorothy Fisher, Professor of Zoology at Marshall University, retired on May 15, 1976. **Dr. Donald Tarter** has received a grant from American Electric Power Service for a project entitled "Gallipolis Hydro Project."

About Institutions

The Department of Biological Sciences at the **Mississippi University for Women** has received a grant from Research Corporation to establish the **Elizabeth Lee Hazen Microbiology Laboratories**. *Dr. Hazen*, a 1910 graduate of MUW, and *Dr. Rachel Brown* (now of Albany, N.Y.) were co-discoverers of nystatin (mycostatin), the first antibiotic effective against fungal infections. The discovery and isolation of the antifungal substance occurred while both were associated with the New York State Department of Health, Division of Laboratories and Research. *Dr. Hazen* died in May, 1975. The grant from Research Corporation included \$50,000 for equipment and a \$250,000 endowment for Hazen scholarships. The laboratories were dedicated April 16.

On April 26, 1977, ground was broken for the construction of an aquatic microbiology laboratory adjacent to the Miles Horton properties near Mountain Lake, Virginia. This laboratory will be used by faculty and students of **Virginia Polytechnic Institute and State University**.

The Biology Department, **Winthrop College**, has received a grant from Local Course Improvement Program of the National Science Foundation in support of a project entitled "Establishment of a Biology Learning Center Primarily for Nonscience Majors." Also the biology department now offers the Bachelor of Science degree, replacing the Bachelor of Arts degree.

A portion of **Duke University's** Commonwealth Grant (for improvement of undergraduate education in the health sciences fields) will go to the Department of Botany for facility renovation and development to improve the undergraduate offerings in microbiology.

The College of Pure and Applied Sciences at **North-east Louisiana University** has purchased a Scanning Electron Microscope with funds contributed by local individuals and industries. The microscope will be housed in Garrett Hall, the Biology Building, on the NLU campus and will be available to all departments within the college.

Construction will begin within one year on an addition to the present biology building, Billeaud Hall at **University of Southwestern Louisiana**. Estimated completion date for the total project is December 1979 with \$2.123 million allocated for the project.

Under a new contract with the National Marine Fisheries Service, the **Gulf Coast Research Laboratory** has begun to collect three years of field data on the fishery resources of the northern Gulf of Mexico. Called the "Fishery Monitoring and Assessment Project," the investigation will cost \$340,000. *J. Y. Christmas* is the principal investigator and serves as head of the Fisheries Research and Development Section at the Laboratory.

Update on Wes Jackson*

One of the highlights of the 1976 ASB meeting in New Orleans was the address on environmental ethics given by Dr. Wes Jackson. At the time, Wes was on leave as Director of the Center for Environmental Studies at California State University, Sacramento, and was living with his wife, Dana, and their children on a farm near Salina, Kansas.

Last summer Wes resigned his position at CSU and founded the Land Institute on the Jackson farm. The following quote from the first issue of **The Land Report** explains the purpose of the Institute:

The Land Institute is devoted to a search for alternatives, alternatives in agriculture, energy, shelter, and waste disposal. But it is more than that. . . . We are also devoted to a search for alternative world views, alternative thinking.

The first semester at the Institute opened with seven students on September 13. On October 17 the building which housed the classroom, workshop, and library was destroyed by fire. Fortunately, no one was injured and the activities of the Institute continued. A new building is under construction and a second semester, beginning probably in April, is planned.

Wes' professional library, both books and reprints, was a complete loss. Friends and colleagues across the country are now helping to rebuild his library. You may help by sending any books and reprints you wish to donate to: Dr. Wes Jackson; The Land Institute; Route 3; Salina, KS 67401. Contributions are tax deductible.

* Communicated by Dr. & Mrs. C. E. Jenner, UNC, Chapel Hill.

ASSOCIATION AFFAIRS

OFFICERS, EXECUTIVE COMMITTEE AND OFFICIAL REPRESENTATIVES ASSOCIATION OF SOUTHEASTERN BIOLOGISTS: 1977-78

- PRESIDENT** — Madeline P. Burbanck, Emory University, Atlanta, Ga. 30322
- PRESIDENT ELECT** — Raymond O. Flagg, Carolina Biological Supply Company, Burlington, N.C. 27215
- VICE PRESIDENT** — Clarence E. Styron, Monsanto Research Corporation, Miamisburg, Ohio 45342
- RETIRING PRESIDENT** — John M. Herr, Jr., University of South Carolina, Columbia, S.C. 29208
- SECRETARY** — (1976-79) Jerry M. Baskin, University of Kentucky, Lexington, Ky. 40506
- TREASURER** — Joseph C. O'Kelley, Box 1927, University of Alabama, University, Alabama 35486
- EDITOR, ASB BULLETIN** — Gary E. Dillard, Western Kentucky University, Bowling Green, Ky. 42101
- EDITOR, NEWS AND NOTES** — Jon R. Fortman, Mississippi University for Women, Columbus, Miss. 39701
- ARCHIVIST** — Madeline P. Burbanck, Emory University, Atlanta, Ga. 30322
- EXECUTIVE COMMITTEE MEMBERS-AT-LARGE** — (1978) John R. Bozeman, Georgia Department of Natural Resources, Game & Fish Division, Box 1097, Brunswick, Ga. 31250
(1978) Beryl C. Franklin, Northeast Louisiana State College, Monroe, La. 71201
(1979) J. Frank McCormick, University of Tennessee, Knoxville, Tenn. 37916
(1979) Rudolph Prins, Western Kentucky University, Bowling Green, Ky. 42101
(1980) Jon R. Fortman, Mississippi University for Women, Columbus, Miss. 39701
(1980) George M. Simmons, Jr., Virginia Polytechnic Institute and State University, Blacksburg, Va. 24061
- AAAS REPRESENTATIVE (SECTION G) (1978)** — Franklin F. Flint, Randolph-Macon Woman's College, Lynchburg, Va. 24504
- AIBS REPRESENTATIVE (1978)** — John M. Herr, Jr., University of South Carolina, Columbia, S.C. 29208
- RESOLUTIONS COMMITTEE (1978)** — **Chairman:** John M. Herr, Jr., University of South Carolina, Columbia, S.C. 29208; Tom M. Graham, University of Alabama, University, Ala. 35486; John H. Mullahy, Loyola University, New Orleans, La. 70118
- AUDITING COMMITTEE (1977)** — **Chairman:** Robert L. Sullivan, Wake Forest University, Winston-Salem, N.C. 27109; R. L. Wyatt, Wake Forest University, Winston-Salem, N.C. 27109; Raymond E. Kuhn, Wake Forest University, Winston-Salem, N.C. 27109
- NOMINATING COMMITTEE (1978)** — **Chairman:** Perry C. Holt, Virginia Polytechnic Institute and State University, Blacksburg, Va. 24061; Dorothy C. Bliss, Randolph-Macon Woman's College, Lynchburg, Va. 24504; James Dent, University of Virginia, Charlottesville, Va. 22901
- RESEARCH AWARD COMMITTEE** — **Chairman:** (1979) Bruce B. Smith, York College, York, Pa. 17405
(1978) T. Peter Bennett, Academy of Natural Sciences, Philadelphia, Pa. 19103
(1980) Charles E. Jenner, University of North Carolina, Chapel Hill, N.C. 27514
- MERITORIOUS TEACHING AWARD COMMITTEE** — **Chairman:** (1978) George C. Murphy, Middle Tennessee State University, Murfreesboro, Tenn. 37130
(1979) Richard Stalter, St. John's University, Bethpage, N.Y. 11714
(1980) Margaret Gilbert, Florida Southern College, Lakeland, Fla. 33802
- TRAVEL AWARD COMMITTEE** — **Chairman:** (1978) J. Kenneth Shull, Loyola University, New Orleans, La. 70118
(1979) Harry E. Shealy, Jr., University of South Carolina at Aiken, Aiken, S.C. 29801
(1980) John D. Reynolds, Virginia Commonwealth University, Richmond, Va. 23220
- PLACE OF MEETING COMMITTEE** — **Chairman:** (1978) Rudolph Prins, Western Kentucky University, Bowling Green, Ky. 42101
(1979) Gene S. van Horn, University of Tennessee at Chattanooga, Chattanooga, Tenn. 37401
(1980) Ardis L. Cramer, 1431 Cornell Road, N.E., Atlanta, Ga. 30306
- CONSERVATION COMMITTEE** — **Chairman:** (1978) J. Frank McCormick, University of Tennessee, Knoxville, Tenn. 37916
(1979) John R. Bozeman, Georgia Department of Natural Resources, Game & Fish Division, Box 1097, Brunswick, Ga. 31520

(1980) J. Whitfield Gibbons, Savannah River Ecology Laboratory, Aiken, S.C. 29801

LOCAL ARRANGEMENTS AND PROGRAM COMMITTEE
(1978) — **Chairman:** Tom M. Graham, University of Alabama, University, Ala. 35486

PAST PRESIDENTS COUNCIL — **Chairman:** (1978) John M. Herr, Jr., University of South Carolina, Columbia, S.C. 29208

Howard and Keith Win 1977 Research Award

The 1977 ASB Research Award, sponsored by Carolina Biological Supply Company, was won by **B. P. Howard** and **W. B. Keith** of the University of Mississippi for their paper entitled "Specific Binding of Radioactively Labelled Cortisol by Guinea Pig Thymic Preparations: Relationship to Glucocorticoid Resistance."

EMERITUS MEMBERSHIP

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg*, Carolina Biological Supply Company, Burlington, N.C. 27215.

TIME AND PLACE OF FUTURE MEETINGS

1978	April 12-15	University of Alabama, Tuscaloosa
1979	April 25-28	University of Tennessee, Chattanooga
1980		University of South Florida, Tampa
1981		University of Tennessee, Knoxville

Dr. Gilbert Wins Meritorious Teaching Award

This year's recipient of the Association's Meritorious Teaching Award, under sponsorship of Scientific Products Company, was **Dr. Margaret L. Gilbert** of Florida Southern College.



Dr. Margaret L. Gilbert

Dr. Gilbert, a native of Rhode Island, received her B.S. from the University of Rhode Island and Ph.D. from the University of Wisconsin. She became associated with Florida Southern in 1954 and has served as Chairman of the Department of Biology and the Division of Natural Sciences and Mathematics. She has been active in the affairs of ASB serving as Secretary (1970-73) and Chairman of the By-Laws Committee (1973).

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

TREASURER'S REPORT

January 1, 1976 — December 31, 1976

I. SAVINGS ACCOUNT

A. Regular Savings	\$7,545.09		
Interest	414.35	\$ 7,959.44	
Transfer to Checking		<u>1,718.10</u>	\$ 6,241.34
B. Contingence Savings	3,527.54		
Interest	57.72	3,585.26	
Transfer to Checking		<u>3,500.00</u>	<u>85.26</u>
TOTAL SAVINGS			\$6,326.60

II. CHECKING ACCOUNT

Balance on hand — 1 Jan.		\$ 395.71	
A. Receipts			
Dues/Subscriptions	\$8,754.02		
Reprints/Back Issues	1,113.86		
Annual Meeting	923.79	10,791.67	
Transfer from Savings		5,218.10	
Meritorious Teaching Award (SP)		<u>500.00</u>	
TOTAL RECEIPTS & BEGINNING BALANCE			\$16,905.48
B. Disbursements			
Office			
President	\$ 277.06		
Secretary	35.58		
Treasurer	123.70		
Nominating Committee	43.21		
Conservation Committee	100.00	\$ 579.55	
Publishing			
ASB Bulletin 23	\$8,781.95		
Reprints	784.89		
Call for Papers	243.00		
Production/Mailing	1,888.90	11,698.74	
Awards			
Student Travel	1,000.00		
Meritorious Teaching	500.00		
Posters	10.00	1,510.00	
Interim Meeting (Atlanta, 2 Oct. 75)		885.70	
AIBS Adherent Dues		625.00	
Local Arrangements Advance		<u>250.00</u>	
TOTAL DISBURSEMENTS			15,548.99
BALANCE IN CHECKING — 31 Dec. 76			1,356.49
TOTAL ASSETS — 31 Dec. 76			\$7,683.09

Respectfully submitted,
(Signed) R. O. Flagg
R. O. Flagg, *Treasurer*

NECROLOGY

During the past year, the Association lost by death the following members.

MARGARET N. HESS (November, 1976) — Charter Member; President, 1952-53; Meritorious Teacher, 1959; Emeritus, 1974.

BENN H. HILL (August, 1976) — Member, 1946; Emeritus, 1963.

GORDON E. HUNT (October, 1976) — Member, 1960.

E. RUFFIN JONES (September, 1976) — Member, 1947; President, 1963-64.

FRANCES E. SILLIMAN (December, 1976) — Member, 1954; Emeritus, 1975.

NANCY MARGARET WALTON (February, 1977) — Member, 1963.

It's Not Too Soon!

The Association's 50th Anniversary will be celebrated in conjunction with our 48th Annual Meeting in 1987. You are encouraged to correspond with the President regarding ideas you might have to celebrate the occasion.

JEMSS Back Issues

The Herbarium of the University of North Carolina, Chapel Hill, has a number of back volumes and issues of the **Journal of the Elisha Mitchell Scientific Society**. Write *Herbarium; Coker Hall 010-A; UNC-Chapel Hill; Chapel Hill, N.C. 27514* for list.

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.*

Please PRINT new address below:

Name:

New Address:

City: State: Zip Code:

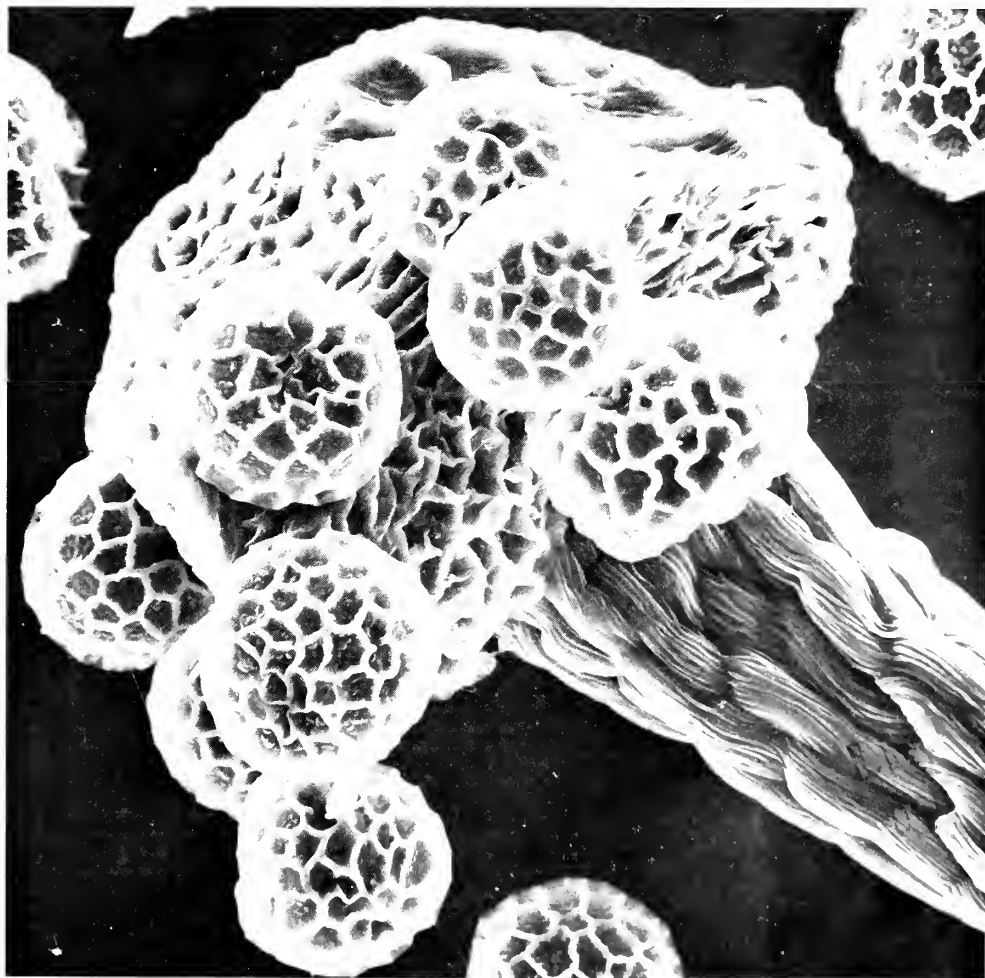


59.06
The ASB

BULLETIN

Volume 24, No. 4

October 1977



Polygonum hirsutum Walt.

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

The ASB BULLETIN is the official quarterly publication of the Association of Southeastern Biologists, Inc., and is published at Philadelphia, Pennsylvania in January, April, July and October. Letters and other contributions, as well as all communications about editorial matters should be addressed to Dr. Gary E. Dillard, Editor, Department of Biology, Western Kentucky University, Bowling Green, Kentucky 42101. News items should be sent to the News Editor, Dr. Jon Fortman, Department of Biological Sciences, Mississippi University for Women, Columbus, Miss. 39701. Inquiries about missing numbers and other circulation matters should be addressed to Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pa. 19103. Subscription orders from institutions should be sent to the Business Manager, Dr. R. O. Flagg, Carolina Biological Supply Co., Burlington, North Carolina 27215. Subscription rate for non-members of the ASB: \$10.00 per year. Printing and typography by the Fulton Press, Inc., Lancaster, Pa.

Second-class postage paid at Philadelphia, Pennsylvania.

GARY E. DILLARD
EDITOR

JERRY M. BASKIN
Associate Editor

JON FORTMAN, News Editor
C. E. STYRON, Conservation Editor
R. O. FLAGG, Business Manager

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Retiring President - John M. Herr, Jr., University of South Carolina, Columbia, S.C. 29208

President Elect - Raymond O. Flagg, Carolina Biological Supply Co., Burlington, N.C. 27215

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Beryl C. Franklin (1978), Northeast Louisiana State College
J. Frank McCormick (1979), University of Tennessee
Rudolph Prins (1979), Western Kentucky University
Jon R. Fortman (1980), Mississippi University for Women
George M. Simmons, Jr. (1980), VPI & SU

AAAS Representative, Section G -
Franklin F. Flint (1978)

AIBS Representative -
John M. Herr, Jr. (1978)



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COVER

Scanning electron microscope photograph of pollen, stigma, and portion of the style of *Polygonum hirsutum* Walt. Courtesy of **Charles B. McDonald** and **James W. Hardin**, North Carolina State University, Raleigh.

COPY DEADLINES

January Issue: November 15
April Issue: January 1
July Issue: May 15
October Issue: August 15

ASSOCIATION AFFAIRS

THIRTY-NINTH ANNUAL MEETING AT THE UNIVERSITY OF ALABAMA TUSCALOOSA, ALABAMA

12-15 April, 1978

In preparing for the 1978 Annual Meeting, please note the following deadlines. Members can facilitate arrangements for the meeting by sending all requested material as far in advance of the deadlines as possible. Because time available for preparation of the program and publication of abstracts is already at a minimum, it is absolutely necessary for the Program Committee and Editor to adhere strictly to the deadlines in order for the programs and April Bulletin to be ready in time for the meeting. **LATE ABSTRACTS AND OTHER MATERIALS CANNOT BE ACCEPTED.** Please remind your secretary and yourself that all material intended for the printer must be neatly typed, double-spaced throughout (this means title, author(s), institutional affiliation(s), text, footnotes, *everything*). Poorly prepared material will be returned to the sender!

DEADLINES

November 15 — Receipt of material to appear in the January Bulletin.

December 1 — Receipt of titles and abstracts of papers to be presented at the Tuscaloosa Meeting (See Call for Papers for detailed instructions).

December 15 — Suggestions for nominations for ASB officers and executive committee members (See Call for Papers for detailed instructions).

January 1 — Receipt of material to appear in the April Bulletin (other than abstracts).

January 15 — Nominations for the Meritorious Award for Teaching (see below).

February 1 — Applications for Travel Awards to Graduate Students (see below).

February 1 — Papers to be considered for the Association Research Prize (see below).

MERITORIOUS TEACHING AWARD NOMINATIONS

For the twenty-seventh time, an ASB member will be recognized for especially meritorious

teaching at the April, 1978, Annual Meeting. The Meritorious Award for Teaching is sponsored by **Scientific Products**, Chamblee, Georgia. The regulations governing the award are as follows:

The recipient must be a member of ASB in good standing. He or she should have taught biology in a southern institution for at least ten years and must be currently teaching. He or she must not be a dean or have regular administrative duties beyond the departmental level. Among evidences of the qualifications of the candidate are the progress of the candidate as indicated by recognition in his or her institution (important assignments and other contributions specifically related to effective teaching) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially those who later received advanced degrees.

Past recipients of the Meritorious Award for Teaching are as follows:

1952 — Dr. Mary S. MacDougall (Agnes Scott)

1953 — Dr. Orland E. White (Virginia)

1954 — Dr. W. B. Baker (Emory)

1955 — Dr. John N. Couch (North Carolina)

1956 — Dr. Hugo L. Blomquist (Duke)
 1957 — Dr. Ezda Deviney (Florida State)
 1958 — Dr. Henry R. Totten (North Carolina)
 1959 — Dr. Margaret Hess (Winthrop)
 1960 — Dr. Ora C. Bradbury (Wake Forest)
 1961 — Dr. Warren Deacon (Vanderbilt)
 1962 — Dr. Septima C. Smith (Alabama)
 1963 — Father Patrick H. Yancy (Spring Hill)
 1964 — Dr. Ruskin S. Freer (Lynchburg)
 1965 — Dr. H. P. Sturdivant (Western Maryland)
 1966 — Dr. Charles Ray, Jr. (Emory)
 1967 — Dr. H. J. Oosting (Duke)
 1968 — Dr. Wade T. Batson (South Carolina)
 1969 — Dr. William L. Mengebier (Bridgewater)
 1970 — Dr. Elton C. Cocke (Wake Forest)
 1971 — Dr. Earl L. Core (West Virginia)
 1972 — Dr. A. J. Sharp (Tennessee)
 1973 — Dr. Horton H. Hobbs (Smithsonian Institution)
 1974 — Dr. Grace Thomas (Georgia)
 1975 — Dr. L. M. Outten (Mars Hill)
 1976 — Dr. Jonathan J. Westfall (Georgia)
 1977 — Dr. Margaret Gilbert (Florida Southern)

Members are urged to nominate outstanding teachers for this award. Nominations are kept on file from year to year; those who do not receive the award when they are first nominated are reconsidered by the Committee in subsequent years. Nominations and supporting documentation should be sent to *Dr. George C. Murphy; Department of Biology; Middle Tennessee State University; Murfreesboro, TN 37130* no later than January 15, 1978.

RICHARD STALTER
 MARGARET GILBERT
 GEORGE C. MURPHY, *Chairman*

TRAVEL AWARDS FOR GRADUATE STUDENTS

Since 1957, funds have been available for partial compensation of travel expenses of graduate students attending the Annual Meeting. Preference is given to those presenting papers and having greater distances to journey.

As prescribed by Association Bylaws, the rules for application follow:

1. Give a conservative, itemized estimate of travel expenses.
2. Give information as to whether or not a paper is being presented by the applicant.
3. In a paragraph, give a brief history of your education to date, indicate how many years you have been — and plan to be — in graduate school, your major field or fields of interest, publications which have appeared or are in preparation, and any other pertinent professional details. Include information on marital status and number of children, if any.
4. Give your source(s) of support while in graduate school, e.g., GI Bill, NSF, NIH, Teaching Assistantship, etc.
5. Have your major professor or departmental chairman provide a letter supporting your application.
6. Applications and supporting materials, **in triplicate**, should be received by *Dr. J. Kenneth Shull, Department of Biology, Loyola University, New Orleans, LA 70118* by February 1, 1978. Applicants will be notified of the decision of the Committee as soon as possible.

HARRY E. SHEALY, JR.

JOHN D. REYNOLDS

J. KENNETH SHULL, *Chairman*

ASSOCIATION RESEARCH PRIZE

If you intend to present a paper at the Tuscaloosa meeting, you are invited to submit your manuscript in competition for the Association of Southeastern Biologists Research Award. The Award, a handsome medallion, is sponsored by the **Carolina Biological Supply Company**, Burlington, North Carolina.

Rules of the competition are as follows:

1. The Research Award is given annually for an especially meritorious paper actually presented by the author(s) at the Annual Meeting. **If the paper is not presented, it will be disqualified.**
2. Only members are eligible to submit papers in competition for the Award. This applies to **all** names on the paper.
3. Papers submitted in competition may be in press but must not have been published prior to the previous Annual Meeting.
4. Papers are judged by eminent scientists selected by the Committee from institutions outside the Southeast. Every effort is made by the Committee to keep the authors of submitted papers anonymous. Criteria for the Award are left to the discretion of the judges who may withhold the Award if no paper is deemed to have sufficient merit.

5. Papers must be submitted in **triplicate** and in their entirety no later than February 1, 1978, to *Dr. Bruce B. Smith, Department of Biology, York College, York, PA 17405.*

Announcement of the winner of the Research Award will be made at the Annual Meeting. The original copy of the award-winning paper will be sent to the sponsor of the prize.

Past recipients of the Association Research Award are as follows:

- 1947 — Clyde E. Keeler (Georgia College)
- 1948 — Shirley H. Taylor (Tennessee)
- 1949 — Helen A. Crumley and Samuel L. Meyer (Tennessee)
- 1950 — Margaret Y. Menzel (Virginia)
- 1951 — Nyra Harrington and Robert Koza (Oak Ridge)
- 1952 — Clyde E. Keeler (Georgia College)
- 1953 — D. L. Billen, G. Stapleton, and B. Strehler (Oak Ridge)
- 1954 — William J. Brett (Millsaps)
- 1955 — Jerome O. Krivanek (Florida)
- 1956 — Asa A. Humphries, Jr. (Emory)
- 1957 — James H. Gregg (Florida)
- 1958 — Charles E. Jenner (North Carolina)
- 1959 — J. A. and F. S. Miller (Emory)
- 1960 — A. V. and J. W. Beatty (Emory)
- 1961 — W. D. Burbanck (Emory)
- 1962 — Burton J. Bogitsh (Georgia Southern)
- 1963 — A. V. and J. W. Beatty (Emory)
- 1964 — A. V. and J. W. Beatty (Emory)
- 1965 — George G. Brown (Miami)
- 1966 — C. E. DePoe (NE Louisiana State) and E. O. Beal (North Carolina State)
- 1967 — R. E. Totten and H. Branch Howe, Jr. (Georgia)
- 1968 — Henry C. Aldrich (Florida)
- 1969 — Paul Yokley, Jr. (Florence State)
- 1970 — Joseph C. O'Kelley (Alabama)
- 1971 — P. Haysman and H. Branch Howe, Jr. (Georgia)
- 1972 — R. E. Gant and E. E. C. Clebsch (Tennessee)
- 1973 — Paul F. Terranova (Louisiana State)
- 1974 — H. R. and P. A. Delcourt (Louisiana State)
- 1975 — D. C. Lagrew, Jr. and J. M. Baskin (Kentucky)
- 1976 — V. M. Norton and K. B. Davis (Memphis State)
- 1977 — B. P. Howard and W. B. Keith (Mississippi)

T. PETER BENNETT
CHARLES E. JENNER
BRUCE B. SMITH, *Chairman*

NOMINATIONS

The Nominating Committee would welcome suggestions from the membership in selecting nominees for offices and executive committee positions. The following positions will be filled at the Tuscaloosa Annual Meeting: **President-Elect, Vice-President**, and two seats on the **Executive Committee**. The Call for Papers will include a form for this purpose to be sent to *Dr. Perry C. Holt; Department of Biology; VPI & SU; Blacksburg, VA 24061* by December 15, 1977.

DOROTHY C. BLISS
JAMES DENT
PERRY C. HOLT, *Chairman*

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.*

EMERITUS MEMBERSHIP

The following were elected to Emeritus Membership at the Thirty-eighth Annual Meeting in Raleigh. The year in which each became a member of the Association is given in parentheses.

Earl L. Core (1947; Meritorious Teacher, 1971)
Elsie Quarterman (1949; Treasurer, 1959-62; Vice-President, 1964-65; President, 1966-67)
Paul S. Reddish (1957)
Elizabeth Sprague (1950)
Jonathan J. Westfall (1953; Meritorious Teacher, 1976)

A biologist who has been a member of the Association for ten or more years and has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. Raymond O. Flagg; Carolina Biological Supply; Burlington, NC 27215.*

HOUSING ACCOMMODATIONS, TUSCALOOSA

No campus housing will be available! It is advisable to make room reservations as soon as possible. Write or call directly to the motel of your choice and indicate attendance at the ASB meeting.

Motels in the area include the following:

Motel	Phone	Rooms	Rate and Location
Best Western Catalina Inn	(205) 339-5200	37	\$12.50-\$22.00 Hwy. 82, Northport
.....			
Holiday Inn North	(205) 759-2511	108	\$16.00-\$22.00 Hwy. 82, Northport
.....			
Holiday Inn South	(205) 553-1550	166	\$18.00-\$25.00 Off I-59
.....			
*Quality — Dill's	(205) 758-7571	38	\$12.60-\$20.00 521 E. Univ. Blvd.
.....			
Rodeway Inn	(205) 556-1000	120	\$13.50-\$21.50 3801 McFarland Blvd.
.....			
Sheraton University Inn	(205) 556-1330	147	\$15.00 + \$3.00 ea additional person 4810 Skyland Blvd.
.....			
Ramada Inn Downtown	(205) 752-8121	130	\$13.00 + \$3.00 ea additional person 22nd Ave. & 9th St.
.....			
Ramada Inn South	(205) 759-4431	108	\$15.50-\$22.00 631 Skyland Blvd.
.....			

*Only motel within walking distance of the campus; does not have an adjoining restaurant.

Camping facilities are available at Lake Lurline State Park, 12 miles NW of Tuscaloosa on US 82. Tents: \$4.00; Trailers: \$4.50 per day. Call (205) 339-1558 between 8:00 am and 5:00 pm, Monday through Friday, after February 15, 1978, for reservation. Also available at Mound State Monument located in Moundville, 15 miles S of Tuscaloosa on US 69. No reservations; charge per night \$4.00.

TOM M. GRAHAM, *Chairman*
LOCAL ARRANGEMENTS

1905-1976



The academic career of E. Ruffin Jones, Jr., Professor Emeritus, ended with his death on September 11, 1976, following a brief illness. He was buried on the campus of the University of Virginia, this being especially fitting since he was born in Charlottesville and received his collegiate degrees from that university; B.A., 1927, M.A. 1928, Ph.D., 1930.

During his academic career, 1930-1976, Professor Jones taught for short periods at several institutions: Dalhousie University, Mt. Lake Biological Station, and the Marine Biological Station, Woods Hole, Massachusetts. His extended service however was to two institutions, The College of William and Mary and the University of Florida. While on the William and Mary faculty, 1937-1944, he rose to full professorship and served as Chairman of the Science Division and as Chairman of the Faculty. In 1946 he joined the faculty of the University of Florida where he invested the remaining years of his professional life. During the latter part of this service he became Assistant Dean of the Graduate School, 1961-1964, and then Assistant Dean of the College of Arts and Sciences, 1964-1970.

Professor Jones was a broadly-trained zoologist with the acoelomate invertebrates as his special area of expertise. As a contributing author to the 1959 revision

of Ward and Whipple's FRESHWATER BIOLOGY, he wrote the section on Alloecocoele and Rhabdocoele Turbellaria. Also, he was author of the sections on Turbellaria in the MCGRAW-HILL ENCYCLOPEDIA OF SCIENCE AND TECHNOLOGY and in the ENCYCLOPEDIA OF THE BIOLOGICAL SCIENCES.

During his graduate years he was a student of Professor William A. Kepner, an eminent Turbellarian researcher and mentor whose numerous students have made significant contributions to the knowledge of North American Turbellaria. Throughout his career Professor Jones was involved in research, not only in directing graduate student studies but also in personal investigations. He was the author of forty papers and abstracts dealing principally with the systematics, morphology and ecology of Turbellarians.

Professor Jones' warm smile and friendly greeting was a welcome and regular feature of the ASB meetings, for he attended most of them. He served the organization once as Chairman of the Meritorious Teaching Award Committee and in 1964 as President. Some of the other fifteen professional organizations of which he was a member are: American Society of Zoologists, American Microscopical Society, Society of Systematic Zoologists, Sigma Xi, and Phi Beta Kappa.

Evidence of his concern for civic welfare was his service to local United Fund campaigns, Salvation Army Funds, and membership in Rotary International. He was a member of the Holy Trinity Episcopal Church in Gainesville, Florida, and served as vestryman for two years. Professor Jones is survived by his wife, Helen Bell Jones, and by two daughters, Mrs. Donald W. Giles of Lynchburg, Virginia, and Mrs. William E. Kerby of Hamburg, Germany.

—JULIAN T. DARLINGTON

TIME AND PLACE OF FUTURE MEETINGS

1978	April 12-15	University of Alabama, Tuscaloosa
1979	April 25-28	University of Tennessee, Chattanooga
1980		University of South Florida, Tampa
1981		University of Tennessee, Knoxville

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University
 Florida — Vacant
 Georgia — Fred K. Parrish, Georgia State University
 Illinois — George T. Weaver, Southern Illinois University
 Kentucky — Gary E. Dillard, Western Kentucky University
 Louisiana — Harry J. Bennett, Louisiana State University

Maryland — Don Windler, Towson State University
 Mississippi — Jon R. Fortman, Mississippi University for Women
 North Carolina — Maurice Whittinghill, University of North Carolina
 South Carolina — G. Thomas Riggan, Jr., Newberry College
 Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
 West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*
 Department of Biological Sciences
 Mississippi University for Women
 Columbus, Mississippi 39701

About People

Dr. William D. Branch (Ph.D., Oklahoma State University) and **Mr. Walter H. Penick, Jr.**, are recent appointees as Research Associates in the Botany and Microbiology Department, Auburn University. **Dr. Branch** will work on physiological studies on peanuts and **Mr. Penick** will conduct basic and applied studies on soybean diseases. The third and final year of a grant by the Environmental Protection Agency in the amount of \$40,000 was awarded to **Dr. Donald E. Davis** as principal investigator on a study of the fate and effects of the herbicide atrazine in salt marsh ecosystems. **Dr. John Webster**, Professor and Head, Department of Biological Sciences, University of Exeter, England, and an internationally-known mycologist, visited the Botany and Microbiology Department, Auburn University, August 11-12 and presented an illustrated lecture on Copriphilous Fungi. **Donald E. Davis**, Professor and Weed Scientist, received the prestigious Distinguished Graduate Faculty Lectureship for 1977-78 at Auburn University. **Dr. Eric W. Simon**, a Distinguished Professor of Botany at the Queen's University of Belfast in Northern Ireland, presented an invitational address on Seed Membranes to the faculty and staff of the School of Agriculture and Agricultural Experiment Station. **Dr. R. Rodriguez-Kabana** was elected Editor-in-Chief of the international journal, *Nematropica*, which is concerned with tropical nematology of plants. **Dr. Urban L. Diener** is the new President-Elect of the Au-

burn University Chapter of the Society of Sigma Xi. The Auburn University Arboretum was dedicated on June 15, 1977. The major thrust for development of this outstanding teaching facility was through the Departments of Botany and Horticulture, notably that of **Donald E. Davis** and his teaching colleagues. **Dr. Charles F. Simmons**, Associate Dean of the School of Agriculture and Assistant Director of the Agricultural Experiment Station, received the Algernon Sydney Sullivan Award as that person exemplifying those characteristics of heart, mind, and conduct in a spirit of love and helpfulness to his fellow man.

Dr. Kenneth Bullock has joined the Department of Biology, University of Alabama-Tuscaloosa, as a Post-Doctoral appointee. **Dr. Bullock** will be working on the National Science Foundation grant of **Drs. Temd R. Deason** and **Joseph C. O'Kelley**. **Drs. Deason** and **O'Kelley** have received a grant of approximately \$50,000 from NSF for "A Study of the Comparative Cytology and Evolutionary Affinities of the Coccoid, Zoospore-Producing Green Algae."

Dr. Bill Boone (Ph.D., Clemson University) has joined the Biology Department at Georgia College to replace **Dr. David Staszals** who has been appointed Director of Research Services.

Dr. Ernest O. Beal has requested reassignment to full-time teaching and research effective January 1, 1978, after ten years as Head of the Department of Biology at Western Kentucky University. **Dr. Jeff H. Jenkins** will

serve as Acting Head until a new Department Head is appointed.

Dr. Willard W. Payne has resigned as Professor and Chairman of the Department of Botany at the University of Florida and has been appointed a Vice-President of the New York Botanical Garden and Director of the Cary Arboretum in Millbrook, New York. He will assume his new duties at the Arboretum about July 1. **Dr. Payne** was recently elected to the Board of Trustees of Fairchild Tropical Garden in Coral Gables, Florida. He is President-Elect of the American Society of Plant Taxonomists.

Dr. David S. Anthony, Professor of Botany, University of Florida, has been named by the Florida Audubon Society as "1976 Conservationist of the Year." The National Wildlife Federation has presented **Dr. Anthony** a Conservation Service Citation "for outstanding and distinguished service in natural resource management."

Dr. George Bowes, Assistant Professor of Botany, University of Florida, will be chairing the session on C_4 photosynthesis at the joint meeting of the American and Canadian Societies of Plant Physiology in Madison, Wisconsin, this August. In conjunction with **Mr. Scott Holaday** (graduate student) he will also present a paper on the photorespiration of aquatic plants. In September, **Dr. Bowes** was an invited symposium speaker at the IV International Congress on Photosynthesis held in England. Recently **Dr. Bowes** obtained a grant of \$53,000 from the Florida Department of Natural Resources to study the physiology and productivity of the aquatic plant *Hydrilla*.

Dr. J. J. Ewel, Associate Professor of Botany, University of Florida, has been awarded a Fulbright Senior Lectureship and will be in Colombia, South America, during the Fall Quarter, 1977.

Dr. Dana G. Griffin, III, Associate Professor of Botany, University of Florida, will spend July in Colombia collecting bryophytes as a member of a Colombian-Dutch expedition. The group plans to scale the northwest face of the Pico Cristobal Colon, highest mountain of the Sierra Nevada de Santa Marta. In August **Dr. Griffin** will teach a course in tropical bryology at the Instituto Nacional de Pesquisas da Amazonia in Manaus, Brazil.

On May 16 and 17, 1977, **Dr. James W. Kimbrough**, Professor of Botany, University of Florida, visited the USDA, U.S. Forest Service Laboratories in Gulfport, Mississippi, to consult with **Dr. Ralph Howard** and other entomologists on the laboratory rearing of subterranean termites. While there he presented a paper on "Fungi Associated with Subterranean Termites in Florida."

Dr. Ariel Lugo, Associate Professor of Botany, University of Florida, was appointed to direct the Center for Wetlands at the University of Florida. The Center for Wetlands conducts research on wetland ecosystems and has over fifteen active research projects. **Dr. Lugo**

also has signed a contract with Academic Press to write a book on the ecology of mangroves and has been awarded a research grant of \$35,000 from the Environmental Protection Agency.

Dr. Indra K. Vasil, University of Florida, has been named Chairman of the Department of Botany for 1977-78. **Dr. Vasil** spent the last week of July and the month of August in Taiwan, supported by a NSF grant under the International Science Cooperation Program.

Drs. J. S. Davis and **Richard C. Smith**, Department of Botany, University of Florida, have been promoted from Associate Professor to Professor.

Professors Anthony C. Clement and **C. G. Goodchild** retired on August 31, 1977, from the Biology Department, Emory University. **Dr. Robert P. Nuttall** (Ph.D., Massachusetts and Postdoctoral Fellow, Stanford University) has been appointed as Assistant Professor at Emory University in the area of Developmental Biology. **Dr. Charles Ray** has received a grant of \$19,400 from the National Science Foundation for development of a computer-based laboratory for an Undergraduate Genetics Course.

Dr. William H. Martin has been appointed Director of the Division of Natural Areas at Eastern Kentucky University. The following areas in Kentucky are presently being managed by the Division of Natural Areas: Lilley Cornett Woods, Maywoods, and the Spencer-Morton Preserve. Lilley Cornett Woods contains one of the few remaining preserved remnants of virgin forests in the Appalachian Plateau physiographic province, and the woods will be managed as an ecological research station.

Mrs. Frances Wysowski has retired from McNeese State University.

The following appointments have been made to the Department of Biology, Towson State University, Baltimore, Maryland: **James C. Hull** (Ph.D., University of California-Santa Barbara), **Nancy V. Hamlet** (Ph.D., The Johns Hopkins University), and **Gerald D. Robinson** (Ph.D., Pennsylvania State University). **Dr. Donald R. Windler**, Associate Professor at Towson State University has received a \$45,804 research grant from the Maryland Department of Natural Resources' Power Plant Siting Program to conduct a comprehensive study of the use of lichens for detecting pollutants from fossil fuel power plants. Chemical studies to determine the actual mechanism by which pollution disrupts normal lichen physiology will be carried out at the University of Maryland's Department of Pharmacognosy. **Dr. Allen C. Skorepa**, a Research Associate at Towson State, will be the principal investigator for field studies on the project, and **Dr. Ralph N. Blomster**, Professor and Chairperson of the Department of Pharmacognosy at the University of Maryland, will be the principal investigator for chemical studies. Also assisting will be **Mr. Arnold W. Nordon**.

Dr. Ann B. Meydrech has joined the faculty of the Department of Biological Sciences at Mississippi College

as an Assistant Professor. **Dr. Meydrech** was formerly Chairman of the Department of Natural Sciences, J. Sargeant Reynolds Community College, Richmond, Virginia.

Dr. William S. Parker, Department of Biological Sciences at Mississippi University for Women, has been promoted to the rank of Associate Professor.

Professor Paul S. Reddish has retired from the Department of Biology at Elon College after 37 years of service. **Professor Reddish** served as Chairman of the Department for most of that period. **Dr. Herbert W. House** (Ph.D., University of South Carolina) has been appointed Assistant Professor of Biology at Elon College and will teach animal physiology and genetics. **Dr. G. Lynn Ryals, Jr.** has been appointed Chairman of the Department. **Dr. Ryals** has been on the staff at Elon College since 1973.

Gerhard W. Kalmus and **Andrew N. Ash** have joined the faculty of the East Carolina University Department of Biology. **Dr. Kalmus** holds degrees from the University of California at Berkeley and Rutgers University and is a specialist in embryology. His research interests are concerned with cellular and biochemical aspects of chick development. **Andrew Ash**, who will assume a lecturer's position, has degrees from Virginia Military Institute and North Carolina State University and is a candidate for the Ph.D. at the University of Toronto. His field of specialization is population ecology and research interests include studies of the effects of environmental changes on the blue grouse.

W. Dwight Billings, James B. Duke Professor of Botany, Duke University, has been elected President-elect of the Ecological Society of America for 1977-78. **Boyd R. Strain**, **John E. Boynton**, and **Janis Antonovics** have been promoted to Professor in the Department of Botany, Duke University. **Donald E. Stone**, Professor of Botany, Duke University, is serving as the Executive Director of the Organization for Tropical Studies. The North American office of OTS is on the Duke Campus. **Professor William Louis Culberson** and **Dr. Chicita F. Culberson**, Duke University, have been awarded a grant by the National Science Foundation for continued research on lichen chemistry and taxonomy.

Dr. Jay D. Hair, Associate Professor and co-ordinator of Wildlife Biology-Fisheries Biology and **Dr. Samuel C. Mozley**, Associate Professor in Limnology have joined the Zoology staff at North Carolina State University.

Ray E. Aston, Jr., has joined the staff of the North Carolina State Museum of Natural History, Raleigh, as Director of Education. He was formerly with the Division of Interpretation of the Florida State Museum. He is Chairman of the Endangered Species Committee of the Society for the Study of Amphibians and Reptiles and will continue his research on endangered herpetozoa of the Atlantic Coastal Plain and north Florida. The North Carolina State Museum of Natural History is conducting contract studies on: the status of the Panther,

Felis concolor, in North Carolina, and the Red-cockaded woodpecker in the Uwharrie National Forest, for the U.S. Forest Service; the status of the Manatee, and vertebrates of the Dan River basin, for the U.S. Fish and Wildlife Service; and the breeding birds of the Falls Lake site, Wake County, for the U.S. Army Corps of Engineers.

Dr. Frederick Harrison, Associate Professor of Anatomy, Albany Medical College of Union University, has been appointed Head of the Department of Biology, Western Carolina University. His research is on the biology of freshwater sponges. **Dr. Roger H. Lamb**, Professor of Biology, Western Carolina University, received a grant of \$121,115 from the Heart, Lung and Blood Institute for a three-year study of the role of phospholipid exchange proteins in lung tissue.

Dr. Jerome P. Miksche assumes the position of Professor and Head of the Department of Botany, North Carolina State University on July 1, 1977. **Dr. Miksche** has been Research Botanist at the Institute of Forest Genetics in Rhinelander, Wisconsin. He is widely known for his work on DNA quantity and radio-sensitivity, nucleic acid studies, and plant cytology and anatomy. He is editor of a recent book on "Modern Methods in Forest Genetics" (Springer-Verlag, 1976), and co-author of "Botanical Microtechniques and Cytochemistry" (Iowa State University Press, 1976). **Dr. G. Ray Noggle**, former Head of the Department, has returned to research and teaching in plant physiology.

Juie E. Krebs has joined the Francis Marion College faculty as Assistant Professor of Biology. She recently completed her doctorate at the Institute of Ecology, University of Georgia.

Dr. Larry T. Wimer, Professor of Biology, has been appointed to a three year term as Chairman of the Department of Biology, University of South Carolina. **Dr. Wimer** will succeed **Dr. Wallace Dawson**, who has been appointed to the George Bunch Chair of Biology. **Dr. Wimer** has served on the South Carolina faculty since 1964. **Dr. F. John Vernberg**, Professor of Biology at South Carolina, is director of an \$840,000 three year project funded by the National Science Foundation to study outwelling in the North Inlet Estuary near Georgetown, South Carolina. **Drs. Bruce C. Coull, Patricia J. DeCoursey, Stephen E. Stancyk, L. Harold Stevenson** and **Richard G. Zingmark** are co-principal investigators on this project.

Dr. Luckett V. Davis, Acting Chairman, Department of Biology, Winthrop College, has been appointed Chairman. **Dr. John B. Shive** (Ph.D., University of Maryland) will join the Department of Biology in August, 1977. **Dr. Shive** is a botanist. A \$6300 grant has been received by **Dr. Davis** from the LOCI program of the National Science Foundation to study "Establishment of a Biology Learning Center Primarily for Nonscience Majors."

Clemson University announces the appointment of **Dr. John P. Wourms** as Associate Professor of Zoology.

Dr. Haskell C. Phillips has retired as Professor Emeritus after 38 years in the Department of Biology, Austin Peay State University.

Beth Mullin (Ph.D., North Carolina State University) has been appointed to the faculty of the University of Tennessee, Knoxville, as Assistant Professor of Botany. She is a plant physiologist with research interests in nucleic acid metabolism. **Mr. Kenneth D. McFarland** who has been Research Assistant in the Mexican Moss Manual Project supported by Richards Foundation and directed by **Dr. A. J. Sharp** at the University of Tennessee, Knoxville, is resigning September 1, 1977, to begin a doctoral program there. He will be replaced by **Mr. James Perry** from Murray State University.

Dr. Robert G. Franke has accepted the position of Head of the Department of Biology at the University of Tennessee, Chattanooga. His most recent appointment was at Iowa State University. **Dr. Patricia Perfetti** has been awarded an NSF Grant through TVA to study water milfoil. The research grant allows her to take a one-year sabbatical leave for her studies.

Dr. Lena Brattsten has been appointed Assistant Professor of Ecology and Biochemistry at the University of Tennessee, Knoxville. **Dr. Brattsten** has held a post-doctoral position in Chemical Ecology and Environmental Toxicology at Cornell University for the previous six years. At Tennessee she will offer courses in the new Environmental Toxicology program within the Graduate Program in Ecology. In addition, **Dr. Brattsten** will participate in introductory biochemistry courses.

New faculty appointments in the Biology Department, Southwestern at Memphis include: **Dr. Curtis H. Freese**, ecologist and recent graduate of The Johns Hopkins University and **Dr. John Olsen**, botanist and recent graduate of the University of Texas.

Dr. Dean P. Whittier, Chairman of the Department of General Biology, Vanderbilt University, has been promoted to Professor of Biology.

New Assistant Professor appointments to the Department of Biology, Virginia Commonwealth University are: **Dr. Peter Giebel**, **Dr. Michael Roper** and **Dr. Stanley Webb**. **Drs. Giebel, Roper** and **Webb** are leaving Post Doctoral positions at the University of North Carolina, University of Colorado and Medical College of Virginia, respectively. Also new to the faculty is **Dr. Robert Jenkins** coming from Roanoke College. **Dr. John M. Sharpley**, Associate Professor of Biology, has retired from Virginia Commonwealth University. **Dr. James R. Reed** has left the Biology Department to form James R. Reed and Associates, an environmental testing and consulting firm in Newport News, Virginia.

Dr. F. Harriet Gray has received a tenured appointment as Associate Professor of Biology at Hollins College in Virginia. **Dr. Gray** received her Ph.D. in Entomology from Ohio State University. Her postdoctoral training was in insect physiology at the University of

Miami. Research interests include hormonal control of molting, behavior, and reproduction in insects as well as the problem of cellular aging.

Dr. John J. Wielgus (Ph.D., Northwestern University) has been appointed Assistant Professor of Biology at Washington and Lee University. His specialties are developmental and cell biology.

Dr. Robert E. Jenkins has left the Department of Biology at Roanoke College, Salem, Virginia to take a position as Associate Professor with the Department of Biology, Virginia Commonwealth University. He is succeeded by **Dr. William J. Matthews**, an ichthyologist. **Dr. Matthews** obtained his Ph.D. from the University of Oklahoma.

James E. Carico has stepped down as Chairman of the Biology Department at Lynchburg College. **Orrie O. Stenroos** has been appointed to succeed him.

The Biology Department at George Mason University has a new chairman, **Dr. Averett S. Tombes**, formerly of the Department of Zoology at Clemson University. Also, four appointments at the Assistant Professor rank have been announced. **Dr. Robert D. Hammond** from Ripon College will be teaching animal physiology. **Dr. Donald W. Stanley** from the University of North Carolina at Chapel Hill will be teaching freshwater ecology. **Dr. Albert P. Torzilli**, formerly of the University of Georgia, will be teaching mycology-phytology. **Dr. James D. Lawrey**, who recently received his Ph.D. at Ohio State University, will be teaching terrestrial ecology.

The Biology Department at Sweet Briar College announces the following changes: **Elizabeth F. Sprague** has retired, after 28 years of teaching at the College; **Ernest P. Edwards** has been appointed the Dorys McConnell Duberg Professor of Ecology; **Jeffrey H. McCormack**, formerly of Middlebury College, has been appointed Visiting Assistant Professor for 1977-78; and **Margaret Simpson** has been appointed Chairman of the Department.

Dr. Steven B. Ackerman, Adjunct Research Associate in the Department of Zoology at the University of Georgia and **Dr. Joseph E. Browne** of Purdue University are recent appointees to the Old Dominion University, Department of Biological Sciences.

About Institutions

The Department of Biology, University of Alabama-Tuscaloosa has established an Undergraduate Honors Program. The two-year program is designed to provide qualified sophomores and juniors the opportunity to follow an individualized curriculum with a major emphasis on independent research. The program, under the direction of *Dr. Harriet Smith*, will maximize the student's opportunities to experience biology through their research and a series of individualized courses and seminars.

AIBS SCIENTIFIC TESTIMONY GUIDE

The 1977 edition of the AIBS publication, **A Guide for Providing Scientific Testimony**, is now available from: **AIBS; 1401 Wilson Blvd.; Arlington, VA 22209**. The 1977 **Guide** is especially designed to assist the individual scientist and the leadership of scientific organizations in sharing scientific information and viewpoints with legislators. Cost: \$2.50 per copy (\$2.00 for AIBS members). Discounts for quantity orders are: 10-100 copies, 10%; over 100 copies, 15%.

A multidisciplinary graduate training program in genetics has been established at **Emory University**. Twenty-five faculty from nine departments offer programs which include both procaryotic and eucaryotic studies. The program is under the direction of *Dr. P. Dennis Smith*, Associate Professor of Biology.

A joint doctoral program between the School of Biological Sciences, **University of Kentucky** and the Department of Biological Sciences, **Eastern Kentucky University** has been approved by the respective universities.

The Louisiana State Legislature has appropriated \$1,771,000 for renovation and air conditioning of Carson-Taylor Hall on the campus of **Louisiana Tech University**. This building houses the Departments of Zoology and Botany-Bacteriology of the College of Life Sciences, the Departments of Chemistry and Physics of the College of Arts and Sciences, and the College of Home Economics.

The Biology Department of **Towson State University**, Maryland, has in the last year expanded into a portion of a new 6.8 million dollar wing addition to Smith Hall.

The Department of Biology, **Western Carolina University**, will occupy a portion of a new Natural Sciences Building in early June, 1977. This facility will house faculty offices and research laboratories, graduate student laboratories and several teaching laboratories.

A B.S. degree program becomes effective in August, 1977, to replace the B.A. degree in biology in the Department of Biology, **Winthrop College**.

With the recent completion of the Walters Life Sciences Building, the **University of Tennessee at Knoxville** has concentrated its biological sciences and experimentally oriented psychological sciences into a complex made up of connecting buildings — the Hesler Biology Building, the Austin Peay Psychology Building, and the new Walters Building. The new building will increase faculty and student research facilities and increase the number of teaching classrooms and laboratories in the Hesler Building after its renovation which is planned for the next several years.

Environmental Toxicology is a recently established degree program within the *Graduate Program in Ecology* at the **University of Tennessee**. This program was established in response to increasing career opportunities in this field and in response to faculty interest in research and teaching in environmental toxicology. Those interested in further details should contact *Dr. H. E. Walburg*, of the **University of Tennessee**, Comparative Animal Research Laboratory.

One of the three "Governor's Schools" of Virginia was held at **Randolph-Macon Woman's College** this past summer. This is the second summer that **Randolph-Macon Woman's College** has hosted this school for exceptionally talented secondary school students. The Martin Science Building is being renovated. Changes and additions to the interior of the building will occur over the next 15 months and cost approximately 2 million dollars.

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The ASB

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Volume 25, Number 1

January 1978



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TIME AND PLACE OF FUTURE MEETINGS

1978 April 12-15 University of Alabama, Tuscaloosa

1979 April 25-28 University of Tennessee, Chattanooga

1980 University of South Florida, Tampa

1981 University of Tennessee, Knoxville

COPY DEADLINES

April Issue: January 1
July Issue: May 15
October Issue: August 15
January Issue: November 15

ABOUT THE TUSCALOOSA MEETING

The Association of Southeastern Biologists will hold its 39th Annual Meeting April 13-15, 1978, at The University of Alabama in Tuscaloosa. Registration, exhibits, and many of the other activities will be in *Ferguson Center*. The Friday night banquet, Retiring President's address, and presentation of awards and new officers will be held at *Indian Hills Country Club* near the University campus. The University of Alabama extends a cordial invitation to all to visit the area and campus and to attend the meetings.

Societies Meeting with ASB

- Beta Beta Beta, Southeastern Region
- Southeastern Division, American Society of Ichthyologists and Herpetologists
- Southeastern Fishes Council
- Southeastern Section, Botanical Society of America
- Southeastern Chapter, Ecological Society of America
- Southeastern Society of Parasitologists
- Southern Appalachian Botanical Club

Tuscaloosa and The University of Alabama

Tuscaloosa is on the banks of the Black Warrior River, at the boundary between the coastal plain and the Appalachian plateau. Land north of Tuscaloosa is mostly forested and has rolling topography. South of Tuscaloosa the coastal plain extends nearly to the city by way of the river valley. April is one of the nicest months of the year with mild weather and a great display of wild and cultivated trees, shrubs, vines, and herbs. Tuscaloosa and its suburbs have a population of about 116,000.

The University of Alabama has an enrollment of more than 15,000 students including almost 3,000 graduate and advanced professional students. It has a faculty of 800. The University is organized into 11 undergraduate schools or colleges and the Graduate School. The College of Arts and Sciences, to which the Department of

Biology belongs, is the largest College of the University; the Department of Biology has the largest number of undergraduate majors in the College. Through the Graduate School, 77 departments and program areas of the University offer the Masters Degree and 30 departments and program areas, including Biology, offer the Ph.D. Degree.

Of particular interest to biologists are the Alabama Museum of Natural History, located in Smith Hall, and the University Arboretum, located approximately 3 miles east of the main campus at the end of 15th Street.

Travel to Tuscaloosa

The major highways passing through Tuscaloosa are I-59-20 and U.S. 82. The following directions are to Ferguson Center on the University campus, site of Registration:

I-59-20: Exit via *Exit 73*. Take *U.S. 82 West* and travel 3.8 miles. Take the *Tuscaloosa via River Road Exit* and travel 1.1 miles on River Road, or immediately beyond the second high-rise apartment on River Road. Turn left onto *McCorvey Drive* and continue on this drive to the first traffic signal. Ferguson Center is at the southeastern corner of this intersection.

U.S. 82: Exit at River Road on the *Tuscaloosa River Road Exit*. Follow directions as above to reach Ferguson Center from River Road.

Air service to Tuscaloosa is by regularly scheduled flights by Southern Airways from Atlanta or Memphis.

Rail service to Tuscaloosa is by Southern Railways from Atlanta or New Orleans.

Bus service to Tuscaloosa is by Greyhound and Trailways.

Dining Facilities

Ferguson Center has a cafeteria. Tuscaloosa has a number of restaurants, some of which are near the campus. A list will be provided at Registration.

Local Alcohol Mores

Alcoholic beverages are served in restaurants weekdays until 12:00 P.M. Bottled beverages are available at State liquor stores in downtown Tuscaloosa on University Boulevard, in McFarland Mall on U.S. 82 East, and in Northport.

Accommodations

No campus housing is available. It is advisable to make motel reservations as soon as possible. Write or call directly to the motel of your choice and indicate attendance at the ASB meetings.

Motels in the area include the following (distance in miles from motel to University is indicated in parentheses):

- Best Western Catalina Inn; U.S. 82, Northport
[205] 339-5200; 37 rooms; Single \$12.50, Double \$22.00; (6).
- Holiday Inn North; U.S. 82, Northport
[205] 759-2511; 108 rooms; Single \$16.00, Double \$22.00; (2).
- Holiday Inn South; Just off I-59
[205] 553-1550; 166 rooms; Single \$18.00, Double \$25.00; (4).
- Quality Motel, Dill's; 521 E. University Blvd.
[205] 758-7551; 38 rooms; Single \$12.60, Double \$20.00; (1).
- Rodeway Inn; 3801 McFarland Blvd.
[205] 556-1000; 120 rooms; Single \$13.50, Double \$21.50; (4).
- Sheraton University Inn; 4810 Skyland Blvd.
[205] 556-1330; 147 rooms; \$15.00, \$3.00 each additional person; (6).
- Ramada Inn Downtown; 22nd Avenue & 9th Street
[205] 725-8121; 130 rooms; \$13.00, \$3.00 each additional person; (3).
- Ramada Inn South; 631 Skyland Blvd.
[205] 759-4431; 108 rooms; Single \$15.50, Double \$22.00; (4).
- Days Inn; 3600 McFarland Blvd.
[205] 556-2010; 152 rooms; Single \$13.00, Double \$17.00; (4).

- Moon Winx Lodge; 3410 University Blvd.
[205] 553-1520; 38 rooms; Single \$9.00, Double \$16.00; (3).
- Shangri-La Motel; 1816 Greensboro Avenue
[205] 758-0475; 33 rooms; \$14.00; (4).
- Travel Inn; U.S. 82, Northport
[205] 339-3900; 39 rooms; Single \$14.00, Double \$16.00; (6).

Only Quality Motel, Dill's, which does not have an adjoining restaurant, is within walking distance of the campus.

Camping facilities are available at Mound State Monument located in Moundville, 15 miles south of Tuscaloosa on U.S. 69. For reservations call [205] 348-7550; \$4.00 per night. Also available at Lake Lurleen State Park, 12 miles northwest of Tuscaloosa on U.S. 82. For reservations call [205] 339-1558 between 8:00 A.M. and 5:00 P.M. Monday through Friday after February 15; Tents, 4.00, trailers, \$4.50 per night.

Registration

Lobby, upper floor of Ferguson Center, 6-9 P.M. Wednesday; 8 A.M.-7 P.M. Thursday; 8 A.M.-11 A.M. Friday. Students \$3.00, others \$5.00.

General Schedule

Thursday: Individual paper sessions, morning and afternoon.

Symposium — *Succession in Southeastern Ecosystems and Recovery Following Perturbations, Part I, Terrestrial Ecosystems* sponsored by ASB, the Southeastern Chapter of the Ecological Society of America, and the U.S. Department of the Interior, Fish and Wildlife Service. Dr. J. Frank McCormick presiding.

Business meetings and luncheons.

Exhibits: 8 A.M.-5 P.M., Ferguson Center.

Placement service: 8 A.M.-5 P.M., Ferguson Center, Room 320.

General Session: 7:30 P.M., Ferguson Center, Theatre.

Smoker: 9-11 P.M., Ferguson Center, Upper Lobby.

Friday: Individual paper sessions, morning and afternoon.

Business meetings and breakfasts.

Exhibits: 8 A.M.-12 Noon, Ferguson Center.

Placement service: 8 A.M.-5 P.M., Ferguson Center, Room 320.

ASB Banquet: 7 P.M., Indian Hills Country Club (tickets available at registration). Retiring President's address by Dr. John M. Herr, University of South Carolina.

Saturday: Executive Committee Breakfast Meeting: 8:30 A.M., Holiday Inn North.

Field trips: Meet in parking lot south of the Biology Building at 7:30 A.M.

Local Points of Interest

1. The Alabama Museum of Natural History, located in Smith Hall, is open 8:00 A.M. to 4:45 P.M. weekdays. No admission charge.
2. The following will be open 8 A.M. to 5 P.M. Thursday and Friday; all are located in the Biology Building:
 - a. The Ichthyological Collection, Room 401.
 - b. The Herbarium, Room 419.
 - c. The Electron Microscope Laboratory, Room 101.

Field Trips

1. The Bankhead Forest, located approximately 100 miles north of Tuscaloosa, is on a dissected old plateau with deep ravines. It is the southernmost extension of the ranges of a number of northeastern and Appalachian species including the Eastern Hemlock. A part of the Bankhead Forest has been declared a Wilderness Area. All day. Leaders: **Robert Kral** and **Robert Haynes**.
2. Dauphin Island Sea Lab (near Mobile). Participants will begin the field trip from Dis-

covery Hall at the Sea Lab at 12:30 P.M. It will encompass beach, dune, salt marsh, and intertidal habitats. Standard sampling gear will be available. Participants will return to the Sea Lab about 5 P.M. and reconvene at 7:30 P.M. for discussion and examination of samples. Participants should be dressed for wet field work and should bring sleeping bags or linens (including towels) for overnight stay at the Lab dormitory. From Tuscaloosa to Tuscaloosa, 1½ days. Leaders: **Will Schroeder**, **Susan Ivester**, and **Judy Stout**.

3. Mound State Monument, a part of the Alabama Museum of Natural History, is located at Moundville, 15 miles south of Tuscaloosa on U.S. 69. The Monument includes a museum (*in situ* burials), re-created Indian villages, and temple. Entrance fee: \$2.00 for adults and \$1.00 for children. Approximately ½ day.
4. Strip-mine reclamation. The trip, sponsored by the *U.S. Fish and Wildlife Service*, will be to Corona Mine, about 55 miles from Tuscaloosa. The mine began operations in 1967; serious attempts at reclamation began only in 1973. A guided tour of the pit and inspection of variously-reclaimed areas will be made. A resumé of mine history, present operational protocol, and future plans will be discussed. Approximately ¾ day. Leader: **Earle Cross**.
5. The University Arboretum, located approximately 3 miles east of the main campus, contains a natural wooded area with trails and a pavilion adjacent to plantings of native and introduced ornamental shrubs. Approximately ½ day. Leader: **Fred C. Gabrielson**.

Local Arrangements Committee

Chairman — Tom M. Graham

Registration — Earle A. Cross

Program — Temd R. Deason, Herbert T. Boschung, Joseph F. Scheiring, Robert R. Haynes

Exhibits and Publicity — Ronald G. Lindahl

Field Trips — David T. Rogers, Fred C. Gabrielson, Louis G. Williams, Robert R. Haynes

Meeting Rooms and Projection Equipment —
Thomas R. Bauman, C. Earle Smith
Transportation — Joan P. Mitchell
Placement Bureau — Ronald D. Hood
Housing — Joseph C. O'Kelley

CANCELLED AND NO-SHOW PAPERS

Please be reminded that failure to present a scheduled paper at the Annual Meeting disrupts the program, disconcerts those scheduled for presentation of succeeding papers, and disappoints the audience. Professional courtesy requires an individual who submits a paper to accept the responsibility of insuring that the paper is presented as scheduled. If, due to unforeseen circumstances, one cannot be present, try to arrange for a colleague to read the paper. If that is not feasible, the author should notify the **Local Arrangements Program Chairperson** and the **Session Chairperson** at the earliest possible moment.

Papers cancelled **before** the April Bulletin goes to press (about the first of February) can be removed from the program and the other papers in the session rescheduled to avoid inconvenience. A telephone call to the Editor — (502) 745-5481 — is suggested.

PAYMENT OF ANNUAL DUES

Individuals who wish to join the Association for the first time while in attendance at the 1978 Annual Meeting may do so by reporting to the ASB Booth staffed by members of the Executive Committee. "Old" members must mail their dues directly to the Treasurer: *Dr. J. C. O'Kelley; Department of Biology; University of Alabama; University, AL 35486.* The Local Arrangements Committee **will not** accept payment of annual dues!

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.



SYMPOSIUM

SUCCESSION IN SOUTHEASTERN ECOSYSTEMS AND RECOVERY FOLLOWING PERTURBATIONS: PART I — TERRESTRIAL ECOSYSTEMS

A symposium is being planned for the 1978 Annual Meeting under co-sponsorship of the Association of Southeastern Biologists, the Southeastern Chapter of the Ecological Society of America, and the U.S. Department of the Interior, Fish and Wildlife Service.

Dr. J. Frank McCormick of the University of Tennessee and the Office of Biological Services, Fish and Wildlife Service will serve as Chairperson of Part I concerning Terrestrial Ecosystems. Preliminary plans are in progress to arrange Part II concerning Aquatic and Coastal Ecosystems for the 1979 Annual Meeting.

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Vacant

Georgia — Fred K. Parrish, Georgia State University

Illinois — George T. Weaver, Southern Illinois University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Maryland — Don Windler, Towson State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Maurice Whittinghill, University of North Carolina

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*

Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

A Public Research and Technology Grant of \$5,650 has been awarded to **Dr. Robert MacGregor**, Department of Biology, University of Alabama, Birmingham. The grant title is: "Quantitative Assessment of the Environmental and Feeding Requirements for the Breeding of Bull Minnows Maintained in Freshwater."

Dr. David H. Nelson has recently joined the Department of Biological Science at the University of South Alabama. He replaced **Dr. Donald W. Linzey**.

Dr. Donald J. Barras has been appointed Chairman of the Biology Department at Troy State University. **Dr. Barras** has received a \$150,000 matching fund grant from John Brown Foundation to upgrade pre-medical, pre-dental, and pre-optometry programs. **Dr. Wayne F. Adams** has received a \$105,000 grant from the National Science Foundation Course Program to upgrade mathematics for science majors.

Dr. M. Eloise Rowland, Associate Professor of Biology, retired in August from the University of Alabama, Huntsville. **Dr. Rowland** came to UAH in microbiology in 1967. She served as Chairman of the Department from 1970-72. She received her Ph.D. from the University of Tennessee at Memphis in 1955. **Dr. Junius M. Clark** has been appointed Associate Professor of Biology at the University of Alabama, Huntsville, in microbiology and immunology. **Dr. Clark** received his Ph.D. from the University of Texas Medical Branch in 1969. He has been an NIH post-doctoral fellow at John Hopkins and comes to UAH from Jefferson Medical College in Philadelphia. **Dr. Zoe Evans** has been appointed Assistant Professor of Biology in microbiology and mycology. Her Ph.D. was obtained from the Medical College of Virginia; she worked as a microbiologist in Public Health and Medical Laboratory Microbiology before coming to UAH. **Dr. Michael H. Eley** received an equipment grant from the National Science Foundation to support the improvement of instruction and research in molecular biology and bio-

chemistry. **Dr. Eley** and **Drs. P. S. Campbell** and **H. J. Wilson** will use the grant to upgrade instruction in courses dealing with molecular and cellular and developmental biology and in biochemistry for junior, senior, and graduate students at UAH.

Two new biologists have joined the Department of Biology, University of Miami. They are: **Dr. Julian Lee** (Ph.D., Kansas-1977), Assistant Professor, with a specialty in herpetology and **Dr. Keith Waddington** (Ph.D., Kansas-1977), Assistant Professor, with specialties in entomology and behavior.

Dr. Thomas Patton, Associate Curator of Vertebrate Paleontology at the Florida State Museum, University of Florida, began a year's leave of absence and has been replaced by Interim Visiting Assistant Curator **Dr. Bruce MacFadden**, who had been on an interim appointment at Yale University. **Dr. Sam Garrett-Jones** of the Australian National University, Canberra, will join the department as an Assistant Research Scientist for a two year period beginning in January, 1978. He will be a research associate of **Dr. Edward S. Deevey**. **Dr. Deevey** has received a three-year National Science Foundation grant for \$160,000 for research entitled: "Late Pleistocene Vegetation and Climate of the Maya Area." The Department of Natural Sciences has initiated a Visiting Scientist program in which the National Wildlife Laboratories of the Smithsonian Institution will provide a series of investigators from their staff to fill this position for periods of one to three months. **Dr. Joe Marshall** was the first representative. **Dr. Marshall** completed work on a monograph on the smaller nocturnal birds of southeast Asia with phonodisc supplement and on a recording of the voices of the Gibbons that will be published in album form. **Dr. Clyde Jones**, Director of the National Laboratories, spent October at the museum.

Dr. Martin D. Young, Research Professor at the University of Florida, was Visiting Professor at the Inter-

national Reference Centre for Avian Haematozoa at the Memorial University of Newfoundland, Canada, during the month of July, 1977.

Dr. David S. Anthony, Professor of Botany, University of Florida, has been appointed to the Florida Council on Conservation and the Environment by **Governor Reubin Askew**. **Dr. James W. Kimbrough**, Professor of Botany, University of Florida, was elected Vice-President of the Mycological Society of America. He will advance to President-Elect in 1978 and to President in 1979.

The following members of the Department of Biology, Emory University, retired August 31, 1977: **Professor Anthony C. Clement**, **Dr. Chauncey G. Goodchild**, and **Dr. Charles Howard Candler**. Newly appointed biology faculty include **John Gladden** (Instructor of Biology) and **Dr. Kenneth A. Krieger** (Ph.D., Emory), Assistant Professor of Biology.

Mr. Ken Saladin has been added to the Georgia College faculty.

Dr. Roy C. Brown, Department of Biology, University of Southwestern Louisiana, is now Curator of the USL Herbarium; **Dr. James F. Jackson** is the Curator of the USL Amphibian and Reptile collections. **Dr. William D. Reese** will be in the state of Acre, Brazil, from January to April, 1978, collecting cryptogamic plants under the auspices of "Projeta Flora Amazonica."

Professor Joseph Ewan has retired from the Department of Biology, Tulane University. He is presently on a three month trip to Britain to study collections and do library research on historical botany. **Dr. Stephen Darwin** has joined the faculty to carry on teaching and research in plant systematics. **Professor Donald E. Cope-land** has also retired and now lives at Woods Hole where he is continuing his research on the teleost swim bladder. **Dr. Stuart Bamforth** is President of the American Microscopical Society, and President-Elect of the Society of Protozoologists.

Mary Ann Dickey has been appointed Instructor in the Department of Botany at Louisiana State University, Baton Rouge. She will coordinate the general botany laboratories and continue the current revision and improvement of the laboratory exercises and resources.

C. E. Dawson, Head of the Section of Systematic Zoology at Gulf Coast Research Laboratory at Ocean Spring, Mississippi, has been invited by the Sears Foundation to author a definitive scientific volume devoted to the large family of world-wide fishes commonly known as pipefishes. The Laboratory has received a study grant from the National Science Foundation extending **Dawson's** study on pipefishes for a third year. The award of \$12,100 was received for the project entitled "Systematics and Distribution of Syngnathid Fishes," making a total of \$39,000 awarded to support the project. About 70 processors and biologists, including two members of the Gulf Coast Research Laboratory staff, **Harriet Perry** and **Sandra Lofton**, took part in the first National Blue Crab Industry Workshop, held recently in Charles-

ton, S.C. **Charles Eleuterius**, head of the Gulf Coast Research Laboratory's Physical Oceanography Section, was recently appointed to the Board of Directors of the Mississippi Mineral Resources Institute. **Dr. Edwin W. Cake, Jr.**, head of the Oyster Biology Section of the Laboratory, has inspected several active commercial oyster leases in the vicinity of Biloxi Bay and has consulted with the lease holders in an effort to learn the causes of mortalities of oysters transplanted from closed reefs onto privately leased water bottoms.

Dr. J. Dan Pittillo has been promoted to Professor of Biology at Western Carolina University. **Dr. Licia Wu** has joined the department in the position of Research Instructor. The following grants have been awarded to biology faculty at Western Carolina University: **Dr. Roger Lumb** and **Dr. George Burnley** (School of Medicine, Duke University), "Phospholipid Exchange Proteins in Lung Tissue," NIH; **Dr. Dan Pittillo**, "Important Plant Communities of the Blue Ridge Parkway," National Park Service; **Dr. Jerry West**, "Trout Embryo Survival and Weight in Selected Streams in North Carolina," U.S. Forest Service; **Dr. Rick Harrison**, "Environmental Status of Seven Species of Freshwater Sponges," U.S. Department of the Interior; and "A Fluorescent Label for Cell Surface Sialic Acids," NIH, with **Dr. Lisalotte Hof**, Albany Medical College, Principal Investigator.

Ray E. Ashton, Jr., has joined the staff of the North Carolina State Museum of Natural History as Director of Education. He is a biologist and comes to the Museum from the Florida State Museum. He will establish new educational programs and continue his herpetological research on several endangered species of the southeast. **Ed VanRiper** and **Mary Ann Powell**, natural history educators, have also joined the Museum's education staff, replacing **Donna E. Scott** and **Eve S. Cleaver** who have moved elsewhere. The Museum has received a \$40,000 contract from the U.S. Fish and Wildlife Service for development of an *Atlas of Freshwater Fishes of North America*. The Principal Investigator is **David S. Lee**; Co-investigators are **Charles H. Hocutt** and **Jay R. Stauffer**, Appalachian Environmental Laboratory, University of Maryland, and **Robert E. Jenkins**, Department of Biology, Virginia Commonwealth University. The Atlas will be published by the Museum. **Rowland M. Shelley**, Curator of Invertebrates, has been awarded a three-year, \$32,000 National Science Foundation grant to help support his studies of southeastern millipeds. **David S. Lee**, Curator of Birds and Mammals, has received the following contracts: \$3,000 to investigate the status of the endangered Cougar in the Uwharrie, Pisgah, and Croatan National Forests and \$4,500 for a survey of the endangered Red-cockaded Woodpecker in the Uwharrie National Forest (**Barbara B. Lee**, Co-investigator) from the U.S. Forest Service; \$9,800 for breeding and winter bird surveys of the Falls Reservoir Project, Wake County, from the U.S. Army Corps of Engineers; a Sea Grant of \$2,000 to study pelagic birds (**J. B. Funderburg**, Co-investigator); and \$700 from the U.S. Fish and Wild-

life Service for a survey of the endangered Manatee in coastal North Carolina (M. M. Browne, Co-investigator).

Dr. Thomas Wolcott, North Carolina State University, received a grant from the National Science Foundation to study "Uptake of Soil Water by Semiterrestrial and Terrestrial Crabs."

Dr. and Mrs. Arnold Krochmal were the guests of the Jardin Botanico "Uribe" in Medellin, Colombia, and the Secretaria de Agricultura, Antioquia, during October and November, 1977. They will continue their studies of the forest understory as a renewable resource and work on conservation of natural areas, part of the continuing research of the Southeastern Forest Experiment Station, Forest Service, U.S.D.A. **Dr. Krochmal** is Principal Economic Botanist and Adjunct Professor of Biology, University of North Carolina, Asheville.

Dr. John Tatschl, from the University of Kansas, has been appointed as Assistant Professor of Biology at Belmont Abbey College. **Dr. Tatschl's** research interest is ornithology. **Mr. Frank Stolte** has joined the Belmont Abbey College as Adjunct Professor of Biology.

Dr. Lynn Moseley has joined the faculty of the Biology Department of Guilford College, North Carolina, as Assistant Professor. **Dr. Moseley** is a graduate of the College of William and Mary and received her Ph.D. in Zoology from the University of North Carolina, Chapel Hill.

Dr. Alan Haney has joined the staff of Warren Wilson College to teach courses in Plant Ecology and Forestry. **Dr. William T. Penfound** retired from the faculty at the end of last year. **Dr. Thomas R. McKinney** has been appointed Chairman of the Biology Department. **Dr. McKinney** has received a National Science Foundation equipment grant to buy equipment needed to establish an Environmental Studies Program at the College.

Dr. James McDaniel, Professor of Biology at East Carolina University, has been appointed Editor of *BIOS*, the quarterly journal of the Beta Beta Beta Biological Society. The journal primarily provides a publication outlet for undergraduates. Students do not have to be members of the Society to have papers accepted for publication. **Dr. McDaniel** invites students from the ASB area to submit manuscripts for consideration. A grant of \$82,000 from the Water Resources Institute of the University of North Carolina and the U.S. Department of Interior has been awarded to East Carolina University biologist **Mark M. Brinson**, to support an environmental study in eastern North Carolina's swamp forests. The purpose of **Dr. Brinson's** study is to determine the rates of nitrogen cycling in eastern North Carolina swamp forests, which are periodically flooded by rivers. **David Bradshaw**, a graduate student in the department, will serve as his technician.

William R. Teska has been appointed as Instructor of Vertebrate Field Biology at Furman University. **Mr. Teska** expects to receive his Ph.D. from Michigan State University in 1978.

Dr. Byron R. Ingram, Associate Professor of Zoology at Clemson University, died on August 3, 1977. **Dr. Ingram** received his A.B. in 1963 and his Ph.D. in 1971 from the University of North Carolina. He joined the Clemson University faculty in 1970. His research interests centered on benthic ecology in general and the effects of environmental factors on development and the biology of odonates specifically. **Dr. Ingram** was on the Board of Scientific Advisors of the Highlands Biological Station, served as Chairman of the Taxa Committee on Crustacea of the South Carolina Endangered Species Committee and had been active in the affairs of ASB.

Dr. Mitchell A. Byrd of the Biology Department of the College of William and Mary will be on research leave second semester of 1977-78 supported by a grant to study shorebird and heron breeding populations. His teaching duties during the semester will be assumed by ornithologist, **Keith L. Bildstein**, of the Ohio State University.

About Institutions

The Department of Biology, **University of Alabama, Birmingham**, has received a Moveable Equipment grant of \$205,480 to purchase equipment for use in new facilities which will be ready January, 1978. The building will house the Departments of Biology and Psychology and several of the Student Service offices.

New computer programming equipment is being installed this fall at the **Florida State Museum, University of Florida**.

On the **Louisiana State University** campus in **Baton Rouge**, five departments have cooperated in restructuring the courses in electron microscopy. The Departments of Botany, Engineering Science, Geology, Microbiology, and Zoology offer a team-taught, cross-listed lecture course which covers the history, theories, and applications of electron microscopy in biological and nonbiological fields.

The Department of Biology at **Western Carolina University** has extensively revised the curriculum offered for graduate and undergraduate credit. Students are offered a core sequence of required courses to obtain a strong base from which more specialized elective areas can be pursued. The graduate degree is being changed from the M.A. in Biology to the M.S. in Biology. Also, the Department of Biology has recently moved into a new science building. While retaining all existing classroom and laboratory space in the connecting old science building, the Department now occupies approximately 28,000 square feet of the new building.

The **North Carolina State Museum of Natural History's** latest book, "*Endangered and Threatened Plants and Animals of North Carolina*," is now available for distribution. The book, edited by *John E. Cooper*, Director of Research and Collections, with assistance from *Sarah S. Robinson* and *John B. Funderburg*, sells for \$8.00 and may be obtained from: Director of Publi-

cations, N.C. State Museum of Natural History, P.O. Box 27647, Raleigh, NC 27611.

The Wildlife and Fisheries program is being revitalized through the joint efforts of the Zoology and Forestry Departments at **North Carolina State University**. A new curriculum is in preparation and an expanded research program has been instituted.

A program in Environmental Science has been established at **Warren Wilson College**. It will utilize the 1100 acre campus as the primary laboratory, looking at various aspects of resource management, environmental education, and the interaction of human society and the environment.

The University of Tennessee, Knoxville, will sponsor a symposium on "*Propagation of Higher Plants Through Tissue Culture: A Bridge Between Research and Application*." The symposium will be held April 16-19, 1978, on the Knoxville campus. The symposium focuses attention on current and potential applications of tissue culture and on research on *in vitro* cell and tissue culture. The keynote lectures will feature speakers from both industry and research. Individual researchers are invited to present their findings in the contributed papers sessions. Abstracts of all contributed papers will be published in the symposium volume. For further information write: Propagation of Higher Plants, Department of Botany, University of Tennessee, Knoxville, TN 37916.

The Departments of Biology, Chemistry and Physics at the **University of Richmond** moved into a new \$8,000,000 Science Center on September 1. The Center more than doubles the usable floor space previously occupied by these departments and includes a centrally located Science Library. Dedication activities are scheduled for March 2 and 3, 1978.

TRAVEL AWARDS FOR GRADUATE STUDENTS

Since 1957, funds have been available for partial compensation of travel expenses of graduate students attending the Annual Meeting. Preference is given to those presenting papers and having greater distances to journey.

As prescribed by Association Bylaws, the rules for application follow:

1. Give a conservative, itemized estimate of travel expenses.
2. Give information as to whether or not a paper is being presented by the applicant.
3. In a paragraph, give a brief history of your education to date, indicate how many years you have been — and plan to be — in graduate school, your major field or fields of interest, publications which have appeared or are in preparation, and any other pertinent professional

details. Include information on marital status and number of children, if any.

4. Give your source(s) of support while in graduate school, e.g., GI Bill, NSF, NIH, Teaching Assistantship, etc.
5. Have your major professor or departmental chairman provide a letter supporting your application.
6. Applications and supporting materials, **in triplicate**, should be received by *Dr. J. Kenneth Shull, Department of Biology, Loyola University, New Orleans, LA 70118* by February 1, 1978. Applicants will be notified of the decision of the Committee as soon as possible.

ASSOCIATION RESEARCH PRIZE

If you intend to present a paper at the Tuscaloosa meeting, you are invited to submit your manuscript in competition for the Association of Southeastern Biologists Research Award. The Award, a handsome medallion, is sponsored by the **Carolina Biological Supply Company**, Burlington, North Carolina.

Rules of the competition are as follows:

1. The Research Award is given annually for an especially meritorious paper actually presented by the author(s) at the Annual Meeting. **If the paper is not presented, it will be disqualified.**
2. Only members are eligible to submit papers in competition for the Award. This applies to **all** names on the paper.
3. Papers submitted in competition may be in press but must not have been published prior to the previous Annual Meeting.
4. Papers are judged by eminent scientists selected by the Committee from institutions outside the Southeast. Every effort is made by the Committee to keep the authors of submitted papers anonymous. Criteria for the Award are left to the discretion of the judges who may withhold the Award if no paper is deemed to have sufficient merit.
5. Papers must be submitted **in triplicate** and in their entirety no later than February 1, 1978, to *Dr. Bruce B. Smith, Department of Biology, York College, York, PA 17405*.



MERITORIOUS TEACHING AWARD NOMINATIONS

For the twenty-seventh time, an ASB member will be recognized for especially meritorious teaching at the April, 1978, Annual Meeting. The Meritorious Award for Teaching is sponsored by **Scientific Products**, Chamblee, Georgia. The regulations governing the award are as follows:

The recipient must be a member of ASB in good standing. He or she should have taught biology in a southern institution for at least ten years and must be currently teaching. He or she must not be a dean or have regular administrative duties beyond the departmental level. Among evidences of the qualifications of the candidate are the progress of the candidate as indicated by recognition in his or her institution (important assignments and other contributions specifically related to effective teaching) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially those who later received advanced degrees.

Members are urged to nominate outstanding teachers for this award. Nominations are kept on file from year to year; those who do not receive the award when they are first nominated are reconsidered by the Committee in subsequent years. Nominations and supporting documentation should be sent to *Dr. George C. Murphy; Department of Biology; Middle Tennessee State University; Murfreesboro, TN 37130* no later than January 15, 1978.

EMERITUS MEMBERSHIP

A biologist who has been a member of the ASB for ten or more years and who has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. J. C. O'Kelley; University of Alabama; University, AL 35486*.

JEMSS BACK ISSUES

The Herbarium of the University of North Carolina, Chapel Hill, has a number of back volumes and issues of the **Journal of the Elisha Mitchell Scientific Society**. Write *Herbarium; Coker Hall 010-A; UNC-Chapel Hill; Chapel Hill, N.C. 27514* for list.

AIBS SCIENTIFIC TESTIMONY GUIDE

The 1977 edition of the AIBS publication, **A Guide for Providing Scientific Testimony**, is now available from: *AIBS; 1401 Wilson Blvd.; Arlington, VA 22209*. The 1977 **Guide** is especially designed to assist the individual scientist and the leadership of scientific organizations in sharing scientific information and viewpoints with legislators. Cost: \$2.50 per copy (\$2.00 for AIBS members). Discounts for quantity orders are: 10-100 copies, 10%; over 100 copies, 15%.

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103*.

Please PRINT new address below:

Name:

New Address:

City: State: Zip code:

**INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND
NATURAL RESOURCES – SURVIVAL SERVICE COMMISSION
FRESHWATER CRUSTACEAN SPECIALIST GROUP**

A meeting of the Freshwater Crustacean Specialist Group of IUCN will be held in conjunction with the 39th Annual Meeting of the Association of Southeastern Biologists at the University of Alabama.

The IUCN is an international organization based in Morges, Switzerland, which aims at maintaining and enhancing the diversity of the biosphere by promoting rational management of the earth's resources. Based on its appraisal of priorities, it formulates policy statements and conservation action programs and promotes their acceptance by the governments and national and international bodies concerned.

Topics of discussion at the meeting will include the following: 1) criteria upon which taxa will be judged for the status of endangered or threatened, 2) development of and criteria for a list of species of "special

concern" which do not qualify for the status of endangered or threatened but may become so in the near future, 3) review of the status of those species which have already been proposed for listing on the United States list of endangered and threatened wildlife and plants, 4) approaches to monitoring of threatened, endangered and special concern taxa, 5) compilation of a list of species whose limited ranges indicate that they may qualify for endangered, threatened, or special concern status, 6) approaches to discerning the actual status of those species with limited ranges, and 7) the kinds of data reported in the IUCN Red Data Book on rare and endangered species.

Anyone interested in freshwater crustaceans is invited to attend the meeting and contribute to the discussions.

— RAYMOND W. BOUCHARD



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The ASB

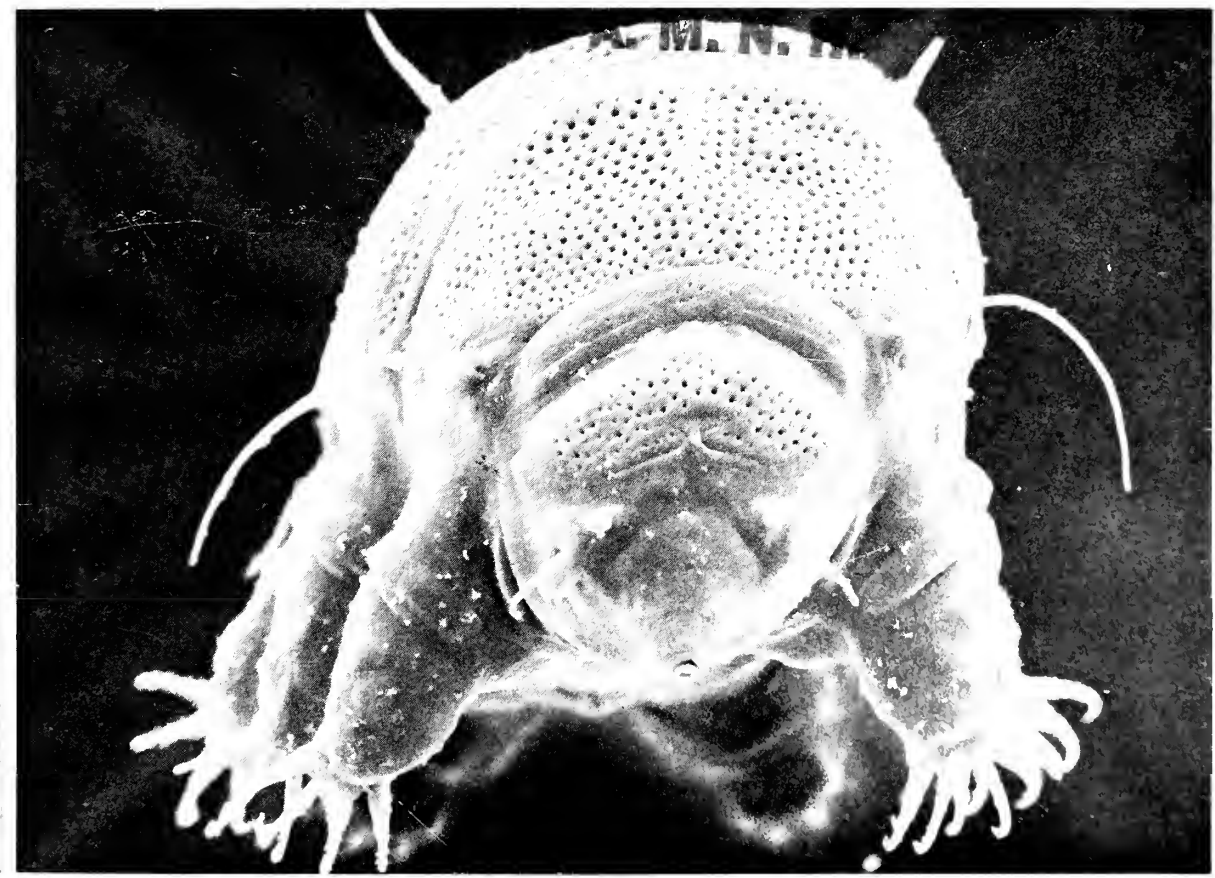
BULLETIN

Volume 25, Number 2

LIBRARY

April 1978

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WATER BEAR

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

The ASB BULLETIN is the official quarterly publication of the Association of Southeastern Biologists, Inc., and is published at Philadelphia, Pennsylvania in January, April, July and October. Letters and other contributions, as well as all communications about editorial matters should be addressed to Dr. Gary E. Dillard, Editor, Department of Biology, Western Kentucky University, Bowling Green, Ky. 42101. News items should be sent to the News Editor, Dr. Jon Fortman, Department of Biological Sciences, Mississippi University for Women, Columbus, Ms. 39701. Inquiries about missing numbers and other circulation matters should be addressed to Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pa. 19103. Subscription orders from institutions should be sent to the Business Manager, Dr. J. C. O'Kelley, Department of Biology, University of Alabama, University, AL 35486. Subscription rate for non-members of the ASB: \$10.00 per year. Printing and typography by the Fulton Press, Inc., Lancaster, Pa.

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GARY E. DILLARD
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Associate Editor

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COVER

Scanning electron microscope photograph of a New Zealand tardigrade, *Echiniscus spiniger*. Courtesy of Diane Nelson, East Tennessee State University.

COPY DEADLINES

- July Issue: May 15
 October Issue: August 15
 January Issue: November 15
 April Issue: January 1



Program of the 39th Annual Meeting of the Association of Southeastern Biologists

Ferguson Center

The University of Alabama, Tuscaloosa

Phone: (205) 348-5960

A joint meeting with the Southeastern Section of the Botanical Society of America, the Southeastern Chapter of the Ecological Society of America, the Southern Appalachian Botanical Club, the Southeastern Society of Parasitologists, the Southeastern Region of Beta Beta Beta National Honorary Biological Society, the Southeastern Division of the American Society of Ichthyologists and Herpetologists and the Southeastern Fishes Council.

REGISTRATION

Ferguson Center Lobby, 3rd Floor

Fees: \$3.00 students, \$5.00 regular

TICKETS FOR SPECIAL MEALS (obtain at registration area)

Southeastern Society of Parasitologists: Thursday luncheon approx. \$4.50 (obtain by 9 A.M. Thursday).

Southeastern Chapter, Ecological Society of America: Thursday luncheon approx. \$4.50 (obtain by 9 A.M. Thursday).

Southern Appalachian Botanical Club and Southeastern Section, Botanical Society of America: Friday breakfast (Participants will go through Ferguson cafeteria line).

ASB Banquet: Friday evening, approx. \$7.00 (obtain by Thursday noon).

PARKING

Unrestricted parking is available at the large Coliseum parking lot (Parking is restricted on the central campus 8 A.M. to 5 P.M.). Beginning 7:30 A.M. a shuttle bus runs at 10 minute inter-

vals from this parking lot to the Main Library on the north side of Main Quad (See the campus map).

PLACEMENT SERVICE

A placement service to be used both by institutions with positions available and by individuals seeking employment is planned. Space is provided in Ferguson, Room 303 (Sparkman Room), for employers to post position notices and for applicants to post vitae. Persons intending to use this service should bring the necessary information with them, in a form ready to post.

LOCAL POINTS OF INTEREST

1. The Alabama Museum of Natural History, located in Smith Hall, is open 8:00 A.M. to 4:45 P.M. weekdays. Admission is free.
2. The following will be open 8:00 A.M. to 5:00 P.M. Friday, April 14.
 - a. The Ichthyological Collection, located in Room 401, Biology.
 - b. The Herbarium, located in Room 419, Biology.
 - c. The Electron Microscope Laboratory, located in Room 101, Biology.

PROGRAM SUMMARY

Wednesday, April 12, 1978

6:00 P.M.- 9:00 P.M. REGISTRATION
SPECIAL MEAL TICKETS

FIELD TRIP REGISTRATION
Ferguson Center Lobby, 3rd Floor

Thursday, April 13, 1978

8:00 A.M.- 7:00 P.M. REGISTRATION, TICKETS,
FIELD TRIPS
Ferguson Center Lobby, 3rd Floor

8:00 A.M.- 5:00 P.M. PLACEMENT SERVICE
Room 303 Ferguson

8:00 A.M.- 5:00 P.M. EXHIBITS
Ferguson Gallery and
Room 232-238 Ferguson

8:00 A.M.-12:00 Noon PAPER SESSIONS (No Smoking)
Succession in SE Ecosystems
(Symposium)
Ferguson Ballroom
Aquatic Ecology I
Ferguson Theatre
Plant Ecology I
Room 205 Smith Hall
Animal Physiology I
Room 304 Ferguson
Invertebrate Zoology I
Ferguson Forum

12:00 Noon

8:30 A.M. BUSINESS MEETING
Room 231 Chemistry
Southeastern Division of the
American Society of Ichthyologists
and Herpetologists

9:00 A.M. BUSINESS MEETING AND
REPORTS
Room 231 Chemistry
Southeastern Fishes Council

11:00 A.M. BUSINESS MEETING AND
LUNCHEON

Southeastern Society of Parasitologists; Room 314 Ferguson (obtain ticket at registration) Speaker: *Dr. J. Teague Self*, Professor Emeritus, The University of Oklahoma. Topic: "Taxonomy and Phylogeny of the Pentastomida."

BUSINESS MEETING AND
LUNCHEON

S.E. Chapter, Ecological Society of America; Ferguson Party Room (obtain ticket at registration) Speaker: *Dr. J. Frank McCormick*, Senior Ecologist, Office of Biological Services, U.S. Fish and Wildlife Service. Topic: "Opportunities for Ecologists in Developing Environmental Policy."

1:00 P.M.- 5:30 P.M. PAPER SESSIONS (No Smoking)
Aquatic Ecology II
Ferguson Theatre
Plant Ecology II
Room 205 Smith Hall
Animal Ecology I
Ferguson Ballroom
Ichthyology and Herpetology I
Room 304 Ferguson
Parasitology
Room 315 Ferguson
Plant Systematics
Ferguson Forum

3:00 P. M. EXECUTIVE COMMITTEE
MEETING, ASB
Room 204 Ferguson

4:30 P. M. FRESHWATER CRUSTACEAN
SPECIALIST GROUP
Room 314 Ferguson

7:30 P. M. GENERAL SESSION
Ferguson Theatre
Address of Welcome: *Dr. E. Roger Sayers*, Associate Academic Vice-President, The University of Alabama
Response: *Dr. Madeline P. Burbanck*, ASB President

Panel Discussion: *C. W. Hart, Jr.*, Smithsonian Institution; *A. Krochmal*, U.S. Forest Service; *A. E. Radford*, University of North Carolina; *J. D. Williams*, Office of Endangered Species; Moderator, *J. R. Jordan, Jr.*, Tennessee Valley Authority.
Topic: "Pros and Cons of Legislation for Species Protection."

9:00 P. M.-11:00 P. M. **SMOKER, in Ferguson 3rd Floor Lobby and with Exhibits**

Friday, April 14, 1978

7:00 A. M. BUSINESS MEETINGS AND
BREAKFAST
Southern Appalachian Botanical Club and S.E. Section, Botanical Society of America (Go through **Ferguson Cafeteria line to Room 204**)

8:00 A. M. PAST PRESIDENTS'
BREAKFAST
Anderson Room, 3rd Floor Ferguson

8:00 A. M.-12:00 Noon EXHIBITS
Ferguson Gallery and Room 232-238 Ferguson

8:00 A. M.- 5:00 P. M. PLACEMENT SERVICE
Room 303 Ferguson

8:00 A. M.-11:00 A. M. REGISTRATION
Ferguson Center Lobby, 3rd Floor

8:00 A. M.-11:00 A. M. PAPER SESSIONS (No Smoking)
Cryptogamic Botany
Room 312 Ferguson
Plant Physiology
Room 314 Ferguson
Invertebrate Zoology II
Ferguson Theatre
Animal Ecology II
Room 304 Ferguson
Plant Systematics II
Ferguson Ballroom

11:00 A. M. BUSINESS MEETING, ASB
Ferguson Theatre

1:00 P. M.- 5:30 P. M. PAPER SESSIONS (No Smoking)
Beta Beta Beta
Rooms 202 and 205 Biology
Aquatic Ecology III
Mineral Industries Auditorium
Plant Ecology III
Room 205 Smith Hall
Animal Physiology II
Room 284 Hardaway Hall
Ichthyology and Herpetology II
Room 304 Ferguson
Cytology and Genetics
Room 243 Hardaway Hall

7:00 P. M. BANQUET AND PRESENTATION OF AWARDS
Indian Hills Country Club (obtain ticket at registration)
Association Research Prize, Sponsored by **Carolina Biological Supply Co.**
Meritorious Teaching Award, Sponsored by **Scientific Products**
Retiring President's Address: "On Diversity and Our Plight" by *Dr. John M. Herr*.

Saturday, April 15, 1978

7:30 A. M. FIELD TRIPS **Biology Building South Parking Lot** (register for all field trips and see details about transportation at registration by noon Friday)

1. The Bankhead Forest. Complete day. Tour Leaders: *Robert Kral* and *Robert Haynes*.
2. Dauphin Island Sea Lab (near Mobile). Participants will be-

- gin this field trip from the Sea Lab at 12:30 P.M. From Tuscaloosa to Tuscaloosa, 1½ Days. Tour Leaders: *Will Schroeder, Susan Ivester and Judy Stout.*
3. Mound State Monument (Indian Archaeology). Approximately ½ Day. Entrance fee: \$2.00 for adults, \$1.00 for children. 8:30 A.M.
4. Strip-mine Reclamation. Sponsored by the U.S. Fish and Wildlife Service. Approximately ½ Day. Tour Leader: *Earle A. Cross.*
5. The University of Alabama Arboretum. Approximately ½ Day. Tour Leader: *Frederick C. Gabrielson.*
- EXECUTIVE COMMITTEE,
ASB BREAKFAST AND MEETING
Holiday Inn North

SCHEDULE OF PAPER SESSIONS

THURSDAY MORNING — APRIL 13

SUCCESSION IN SOUTHEASTERN ECOSYSTEMS AND RECOVERY FOLLOWING PERTURBATIONS

Ferguson Ballroom

Symposium co-sponsored by the Association of Southeastern Biologists, The Southeastern Chapter of the Ecological Society of America and the U.S. Department of the Interior, Fish and Wildlife Service.

Part I. Terrestrial Ecosystems

Chairperson: *J. Frank McCormick*, Office of Biological Services,
Fish and Wildlife Service

- | | | | |
|-----------|---|------------|---|
| 8:25 A.M. | Introduction
J. FRANK MCCORMICK | 10:00 A.M. | Secondary Succession — Animal Populations
FRANK B. GOLLEY,
University of Georgia |
| 8:30 A.M. | Primary Succession — Plant Populations
J. FRANK MCCORMICK | 10:30 A.M. | Upland Forest Recovery Following Perturbation
EDWARD E. C. CLEBSCH,
University of Tennessee |
| 9:00 A.M. | Primary Succession — Animal Populations
DONALD J. SHURE,
Emory University | 11:00 A.M. | Lowland Forest Recovery Following Perturbation
REBECCA R. SHARITZ,
University of Georgia |
| 9:30 A.M. | Secondary Succession — Plant Populations
CATHERINE KEEVER,
Millersville College
and ELSIE QUARTERMAN,
Vanderbilt University | 11:30 A.M. | Conclusion of Symposium |

AQUATIC ECOLOGY, SESSION I

Ferguson Theatre

Presiding: *Dr. Joseph F. Scheiring*, University of Alabama

- | | | | |
|------|--|------|--|
| 8:00 | 1. LEHMAN, HERMAN K. (University of West Florida). A Study of An Association Between the Gastropod, <i>Neritina reclinata</i> , and the Seagrass, <i>Ruppia maritima</i> . | 8:26 | 3. SEAGLE, HENRY H., JR. AND ALBERT C. HENDRICKS (Virginia Polytechnic Institute and State University). Microdistribution of Six Species of Elmidae Beetles in the South Fork of the Shenandoah River Basin, Virginia (Coleoptera: Elmidae). |
| 8:13 | 2. WALTON, O. EUGENE, JR. (University of North Carolina). Substrate Acquisition by Drifting Aquatic Insect Larvae. | 8:39 | 4. SEAGLE, HENRY H., JR. AND ALBERT C. |

HENDRICKS (Virginia Polytechnic Institute and State University). Macrodistribution of the Dryopodea of the South Fork of the Shenandoah River, Virginia (Coleoptera).

- 8:52 5. RUSSO, THOMAS N. AND T. J. HILL (University of Alabama and U.S. Geological Survey). Differences in the Composition of Insect Communities in Small Streams in West Alabama.
- 9:05 6. ROBERTS, EVERETT A. AND RONALD V. DIMOCK, JR. (Wake Forest University). Population Structure of the Symbiotic Water Mite, *Unionicola formosa* (Acarina: Unionicolidae).
- 9:18 7. COOPER, CHARLES M. (University of Mississippi). Mollusca of the Yalobusha River, Mississippi.
- 9:31 8. WICKSTROM, CONRAD E. AND R. W. CASTENHOLZ (Emory University and University of Oregon). A Grazer-Induced Microhabitat Along a Thermal Stream.
- 9:44 9. CURRY, MARY G. AND JAMES E. LEEMAN (VTN Louisiana, Inc.). Salinity Ranges of Freshwater Glossiphoniid Leeches (Annelida: Hirudinea: Glossiphoniidae) in Louisiana.
- 9:57 10. PUGH, CHARLES R., RONALD LINDAHL AND GORDON ULTSCH (University of Alabama). Responses of Isozyme Activities and Patterns to Temperature Acclimation in Two Species of Aquatic Snails.
- 10:10 11. NELSON, DIANE R., DEEDEE KATHMAN AND ERIC L. MORGAN (East Tennessee State University and Tennessee Technological University). Population Trends in *Isohypsiobius augusti* (Murray) (Phylum Tardigrada) from the Ocoee River, Copperhill, Tennessee.
- 10:23 12. KLARBERG, DAVID P. (Ferrum College). Stability in a Large River System as Indicated by Macroinvertebrate Replacement Rates.
- 10:36 13. REILLY, FRANCIS J., JR. AND VINCENT J. BELLIS (East Carolina University). Trophodynamics of Sandy Beach Macrobenthos.
- 10:49 14. KAUFMAN, LAURENCE H., KENNETH L. DICKSON AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Non-taxonomic Characteristics of the Early Colonization Process of Aufwuchs in Artificial Streams.
- 11:02 15. PARIANI, FREDERICK P., JOHN R. BOZEMAN AND STEVEN L. OLIVER (Georgia Department of Natural Resources and Montana State University). The National Wetland Inventory in Georgia: Status Report.
- 11:15 16. MATHEWS, RAYMOND C., JR., RAYMOND HERRMANN, AND RAYMOND BURGE (National Park Service). Remote Water Quality and Weather Monitoring in the Great Smoky Mountains National Park.
- 11:28 17. BRIGHT, THOMAS J. (Texas A & M University). Benthic Communities and Zonation on Louisiana Outer Continental Shelf Fishing Banks.

PLANT ECOLOGY, SESSION I

Room 205 Smith Hall

Presiding: Ms. Judy Stout, University of South Alabama

- 8:00 18. STOUT, JUDY P. (University of South Alabama and Dauphin Island Sea Lab). Annual Net Primary Productivity of Aboveground and Belowground Portions of *Juncus roemerianus* and *Spartina alterniflora*.
- 8:13 19. BROWN, ROBIN AND GEORGE WEAVER (Southern Illinois University). Stability of pH and Nutrient Concentrations in Precipitation in Field Collectors.
- 8:26 20. HACKNEY, COURTNEY T. (Mississippi State University). An Intuitive Technique for Estimating the Productivity of Vascular Flora in Temperate Marshes.
- 8:39 21. BASKIN, JERRY M. AND CAROL C. BASKIN (University of Kentucky). The Germination of Strategy of Oldfield Aster (*Aster pilosus* Willd.).
- 8:52 22. O'DELL, R. KENT AND JAMES S. FRALISH (Southern Illinois University). Variation in Biomass and Leaf Area of Selected Mid-Canopy Species in Southern Illinois.
- 9:05 23. HUNT, E. J. AND D. J. SHURE (Emory University). Vegetation Responses to Chronic Wastewater Application.
- 9:18 24. PINDER, JOHN E., III AND GRANT C. CARINGTON (Savannah River Ecology Laboratory). Relationships Between Occupied Space, Size and Reproductive Effort in *Andropogon ternarius* Michaux (Poaceae).
- 9:31 25. BLANCK, CYNTHIA E. AND VINCENT J. BELLIS (East Carolina University). An Ecological Study of Bald Cypress (*Taxodium distichum*) Along a North Carolina Shoreline.
- 9:44 26. LUVALL, JEFFREY C. AND CHARLES E. MURPHY, JR. (Savannah River Ecology Laboratory). Residence Time and Transpiration Rate of Tritiated Water in a Young *Pinus taeda* L. Plantation.
- 9:57 BREAK.
- 10:10 27. GRECO, ANTHONY AND JOE E. WINSTEAD (Western Kentucky University). Ecotypic Differentiation in Ohio and Mississippi Populations of *Acer negundo* L. (Aceraceae).
- 10:23 28. DAY, FRANK P. JR., (Old Dominion University). Litter Accumulation in Four Plant Communities in the Dismal Swamp, Virginia.
- 10:36 29. OSTMAN, NANCY L. AND GEORGE T. WEAVER (Southern Illinois University). The Relationship Between Plant Species Diversity, Community Biomass and Plant Nutrient Concentrations.

- 10:49 30. PEARSON, JOHN A. AND GEORGE T. WEAVER (Southern Illinois University). Structural and Functional Aspects of Litterfall Production in Oak-Hickory Forests of the Ozark Hills, Illinois.
- 11:02 31. RAYNER, DOUGLAS A. (South Carolina Wildlife and Marine Resources Department). Preliminary Observations on the Ecology of *Litsea aestivalis* (L.) Fern. (Lauraceae).
- 11:15 32. SCOTT, TAYLOR C., III (Southern Illinois University). Water Relations of Plants Grown on Strip-mine Spoils Treated with Sewage Sludge.
- 11:28 33. JONES, STEVEN M. AND B. ALLEN DUNN (Clemson University). Compositional and Soil-Site Characteristics of a *Ribes echinellum* (Saxifragaceae) Community.
- 11:41 34. GORMAN, R. T. AND C. E. ANDERSON (North Carolina State University). The Effects of Multiple Air Contaminants on Loblolly Pine (*Pinus taeda* L., Pinaceae)

ANIMAL PHYSIOLOGY, SESSION I

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Presiding: *Dr. George Crozier*, University of South Alabama

- 8:00 35. DINDO, JOHN, ROBERT MACGREGOR AND GEORGE CROZIER (University of Alabama in Birmingham). Analysis of Reproductive Hormones and Plasma Lipid Levels Associated with the Migration of the Striped Mullet, *Mugin cephalus* L.
- 8:13 36. BINGHAM, RICHARD D., C. S. DUKE AND J. P. GIESY (Savannah River Ecology Laboratory). Change in Adenylate Energy Charge of *Corbicula manilensis* (Pelecypoda) Foot Muscle Tissue Due to Cadmium Exposure.
- 8:26 37. DUKE, CLIFFORD S., J. P. GIESY, G. W. DICKSON, G. J. LEVERSEL AND R. D. BINGHAM (Savannah River Ecology Laboratory). Effects of Cadmium on Adenylate Energy Charge in the Crayfish, *Procambarus pubescens*.
- 8:39 38. BRANDES, WILLIAM F., JOHN W. HARRIS AND R. DON ESTES (Tennessee Technological University). Isozyme Variation in the Eastern Brook Trout, *Salvelinus fontinalis* (Mitchell).
- 8:52 39. HARRIS, JOHN W. AND WILLIAM F. BRANDES (Tennessee Technological University). The Genetic Control of Isocitrate Dehydrogenase Isozymes in Brook Trout, *Salvelinus fontinalis* (Mitchell).
- 9:05 40. RICHARDSON, L. B., D. T. BURTON, S. L. MARGREY AND A. ROSENKRANZ (Academy of Natural Sciences of Philadelphia and University of Maryland). Egg and Prolarval Development of Striped Bass, *Morone saxatilis* (Walbaum), Exposed to Ozone Produced Oxidants in Fresh and Estuarine Water.
- 9:18 41. HALL, LENWOOD W., JR., CHARLES H. HOCUTT AND JAY R. STAUFFER, JR. (University of Maryland and Frostburg State College). The Effect of Geographic Location on the Temperature Preference of the White Perch (*Morone americana*).
- 9:31 42. GREELEY, MARK AND ROBERT MACGREGOR, III (University of Alabama in Birmingham). A Function of Seasonal Temperature Cycles During the Gonadal Cycle of *Fundulus grandis*. (Pisces: Cyprinodontidae).
- 9:44 BREAK
- 9:57 43. BYRNE, STEVEN E. AND C. B. COBURN, JR. (Tennessee Technological University). Relationship of ATP and Glucose Levels in the Bluegill, *Lepomis macrochirus* (Centrarchidae).
- 10:10 44. GOUDIE, CHERYL A. AND KENNETH B. DAVIS (Memphis State University). Effect of Temperature and Calcium on Electrolyte Regulation in Channel Catfish Acclimated to Various Salinities.
- 10:23 45. ZEMAN, M. E., J. R. WINNINGHAM AND F. J. BULOW (Tennessee Technological University). Factors Associated with Seasonal Variations in Bluegill Nucleic Acid Levels, I. Temperature, Sex, Gonadal Development and Spawning.
- 10:36 46. WINNINGHAM, J. R., M. E. ZEMAN, F. J. BULOW AND W. F. HUDSON (Tennessee Technological University). Factors Associated with Seasonal Variations in Bluegill Nucleic Acid Levels, II. Feeding, Growth and Condition.
- 10:49 47. MCCORKLE, FRED M., IMRE OLAH AND BRUCE GLICK (Mississippi State University). The Histological Response to Phytohaemagglutinin (PHA) Injection in the Wattle of the Chicken.
- 11:02 48. TREADWAY, TERRY AND MARION WELLS (Middle Tennessee State University). Blood Chemistry Profile of Bursectomized and Intact Chickens.
- 11:15 49. WORKING, KIM AND MARION WELLS (Middle Tennessee State University). Prostaglandin Levels in the Avian Bursae of Fabricius and Thymus.
- 11:28 50. KARL, PETER AND MARION WELLS (Middle Tennessee State University). Isoelectric Focusing of Thrombocyte Membrane Proteins from Chemically Bursectomized and Intact Chickens.
- 11:41 51. ROSENKRANZ, A., L. B. RICHARDSON AND D. T. BURTON (University of Maryland and Academy of Natural Sciences of Philadelphia). The Toxicity of Ozone Produced Oxidants to Adult White Perch, *Morone americana* (Gmelin).

INVERTEBRATE ZOOLOGY, SESSION I

Ferguson Forum

Presiding: *Dr. Harriett E. Smith*, University of Alabama

- 8:52 52. SMITH, H. E., H. E. BUHSE, JR. AND S. M. COCHRANE (University of Alabama and University of Illinois, Chicago). Evidence for an Attachment Stage in the Life Cycle of *Oxymonad* Flagellates in the Termite, *Reticulitermes flavipes* Kollar.
- 9:05 53. WILLIAMS, JUDITH L. (Academy of Natural Sciences of Philadelphia). The Elusive Macrothricid Cladoceran, *Ilyocryptus*, in the United States: A Range Extension Now Including the New World and Introduction of a New Species.
- 9:18 54. TARTER, DONALD, DAVID WATKINS, PAUL HILL AND DAVID ETNIER (Marshall University of Tennessee). Habitat Notes and Larval and Pupal Descriptions of the Fishfly, *Neohermes concolor* (Davis) (Megaloptera: Corydalidae).
- 9:31 55. COPELAND, T. P. (East Tennessee State University). Three New Species of Protura (Insecta) from Highlands, North Carolina.
- 9:44 56. DICKSON, GARY W. (Old Dominion University). The Significance of Cave Mud Sediments in Mortality, Growth and Food Preference of the Troglotic Amphipod Crustacean, *Crangonyx antennatus*.
- 9:57 57. TROTT, THOMAS J. AND RONALD V. DIMOCK, JR. (Wake Forest University). Mechanisms Mediating Trail Following by the Mud Snail, *Ilyanassa obsoleta* (Prosobranchia: Neogastropoda).
- 10:10 58. SHELLEY, ROWLAND M. (North Carolina State Museum). A Preliminary Report on the Genus *Pleuroloma* (Diplopoda: Polydesmida: Xystodesmidae).
- 10:23 BREAK
- 10:36 59. HOOD, R. L. AND N. C. EDWARDS (University of North Carolina at Charlotte). Embryonic Development and Larval Differentiation in *Cassoipea xamachana*.
- 10:49 60. COOPER, JOHN E. AND MARTHA R. COOPER (North Carolina State Museum). Comparative Reproductive Strategies of Troglotic Crayfishes in Shelta Cave, Alabama.
- 11:02 61. POIRRIER, MICHAEL A. (University of New Orleans). Taxonomic Studies of a Brackish-Water Bryozoan, *Conopeum* sp.
- 11:15 62. DUOBINIS, E. M. AND C. T. HACKNEY (Mississippi State University). Seasonal and Spatial Distribution of the Carolina Marsh Clam, *Polymesoda caroliniana* (Pelecypoda: Corbiculidae), in a Mississippi Tidal Marsh.
- 11:28 63. DICKSON, GARY W. (Old Dominion University). Behavioral Adaptation to Stream Habitats in the Troglotic Amphipod Crustacean, *Crangonyx antennatus*.

THURSDAY AFTERNOON—APRIL 13

AQUATIC ECOLOGY, SESSION II

Ferguson Theatre

Presiding: *Dr. George P. Whittle*, University of Alabama

- 1:26 64. CAMERON, JANE T. AND C. B. COBURN, JR. (Tennessee Technological University). Observations on Productivity and Species Composition of Midwater and Shallow Water Periphyton Communities in a Small Pond.
- 1:39 65. JOHNSON, EDWARD L. AND ROBERT G. JOHNSON (Murray State University). Phytoplankton and Water Quality Investigations of an Alluvial Stream in Kentucky.
- 1:52 66. SHEARON, MARK S., ERIC L. MORGAN AND DANIEL L. STONEBURNER (Tennessee Technological University and National Park Service). A Comparison of Chlorophyll *a* Values Obtained from Absorbance Spectroscopy and Fluorometry.
- 2:05 67. READING, JEFFREY T., JEANNE MILES POTTER AND ARTHUR L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). The Relationship of Phytoplankton Populations to Total Vitamin B₁₂ Concentration in a Soft Water Appalachian Pond.
- 2:18 68. POTTER, JEANNE MILES AND ARTHUR L. BUIKEMA, JR. (Virginia Polytechnic Institute and State University). Relationship of Plankton Biomass and Zooplankton to Vitamin B₁₂ Fluctuations.
- 2:31 69. WILLIAMS, LOUIS G. (University of Alabama). Improved Techniques for the Quantification of River Plankton and Periphyton.
- 2:44 70. WINN, WILLIAM M. AND ERIC L. MORGAN (Tennessee Technological University). Benthic Macroinvertebrate Community Recovery after Municipal Sewage Discharge Termination.
- 2:57 71. POTTER, WAYNE A. (Virginia Polytechnic Institute and State University). A Simple, Inexpensive Sampling Gear for Shallow, Rapid Discharges.
- 3:10 72. MORGAN, ERIC L., RAY HERRMANN, K. W. EAGLESON AND N. D. MCCOLLOUGH (Tennessee Technological University, National Park Service and University of Tennessee). Remote Sensing from Automated Biomoni-

- toring Stations: New Developments in Water Quality Management.
- 3:23 73. DOLEN, WILLIAM K. AND CHARLES K. WAGNER (Southwestern at Memphis and Clemson University). The Response of an Aquatic Microecosystem to a Simulated Oil Spill.
- 3:36 74. GARRETT, R. A., F. B. BLOOD, M. R. CORN, W. E. IMBUR AND J. C. NEMETH (Law Engineering Testing Company). An Effects Assessment of Impingement at the Lansing Smith Steam Plant.
- 3:49 75. SICKEL, JAMES B. AND SHARON A. SMALLMON (Murray State University). Thermal and Oxygen Effects on the Heart Rate of the Asiatic Clam, *Corbicula manilensis*.
- 4:02 76. ROOSENBURG, W. H., J. C. RHODERICK, S. R. GULLANS, S. M. VREENEGOR, ANN ROSENKRANZ, CORA COLLETTE AND R. M. BLOCK (University of Maryland). The Influence of Chlorine-Produced Oxidants on Larval Stages of the American Oyster, *Crassostrea virginica*.
- 4:15 77. RHODERICK, J. C., L. B. RICHARDSON, D. T. BURTON, W. H. ROOSENBURG, A. ROSENKRANZ AND R. M. BLOCK (University of Maryland). The Effect of Ozone and Chlorine Produced Oxidants on Larval Stages of the American Oyster, *Crassostrea virginica*.
- 4:28 78. WYATT, J. T. (U.S. Army Environmental Hygiene Agency). Benthic Responses to a Combined Plating Shop and Domestic Effluent in Corpus Christi Bay.
- 4:41 79. RODGERS, J. H., JR., D. S. CHERRY, K. L. DICKSON AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University). Influence of Thermal Effluent on Population Dynamics of Asiatic Clam (*Corbicula manilensis*) in the New River, Virginia (Mollusca:Bivalvia).
- 4:54 80. LARRICK, S. R., D. S. CHERRY, J. D. GIATTINA, K. L. DICKSON AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University). The Impact of Coal Ash Effluent on Heterotrophic Bacterial Populations.
- 5:07 81. CLARK, J. R., K. L. DICKSON AND J. CAIRNS, JR. (Virginia Polytechnic Institute and State University). Effects of Copper Sulfate and Potassium Dichromate on Aufwuchs Biomass.
- 5:20 82. NEMETH, J. C., R. A. GARRETT, W. E. IMBUR AND M. R. CORN (Law Engineering Testing Company). An Investigation of Thermal Impacts of a Fossil-fueled Electric Power Plant Discharge on Seagrass Bed Communities.
- 5:33 83. HENEGBRY, M. S. AND B. T. RIDGEWAY (Virginia Polytechnic Institute and State University and Eastern Illinois University). Epizoic Protozoa of Planktonic Copepoda and Cladocera from a Small Eutrophic Lake and Their Possible Use as Indicators of Organic Water Pollution.

PLANT ECOLOGY, SESSION II

Room 205 Smith Hall

Presiding: *Dr. J. Dan Pittillo*, Western Carolina University

- 1:39 84. PITTILLO, J. DAN (Western Carolina University). Field Observations of Fraser's Sedge (*Cymophyllus fraseri* — Cyperaceae).
- 1:52 85. FULLER, ROBERT D. AND EDWARD E. C. CLEBSCH (University of Tennessee). Why Does Spruce Not Invade the High Elevation Beech Forests of the Great Smoky Mountains?
- 2:05 86. SIALTER, RICHARD (St. John's University). The *Ilex opaca* Aiton Forest, Sandy Hook, New Jersey.
- 2:18 87. MOORE, JULIE AND ROBERT G. QUALLS (Ocean Data Systems, Inc. and University of North Carolina). The Impact of Intermittent Flooding on Forest Vegetation.
- 2:31 88. GOLDEN, MICHAEL S. (Auburn University). Forest Communities of the Lower Alabama Piedmont.
- 2:44 89. LEGATO, N. RENÉ AND G. L. PLUMMER (University of Georgia). Impact Gradients in Recreational Habitats.
- 2:57 90. HANNAN, RICHARD R., J. STUART LASSETTER AND WILLIAM H. MARTIN (Eastern Kentucky University). The Overstory Vegetation of an Upland Hardwood Swamp in Rockcastle County, Kentucky.
- 3:10 91. IMBUR, WILLIAM E. (Law Engineering Testing Company). A Terrestrial Ecological Study at Caryville, Florida.
- 3:23 92. HUCK, ROBIN B. (University of North Carolina). Vegetation and Soils of the Bull Creek Watershed, Osceola County, Florida).
- 3:36 BREAK
- 3:49 93. WEAVER, GEORGE T. (Southern Illinois University). Size-class Structure of Old-growth Forests.
- 4:02 94. HINKLE, ROSS, PAUL SCHMALZER AND H. R. DESELM (University of Tennessee). The Vegetation of Dick Cove, Sewanee, Tennessee.
- 4:15 95. PORCHER, RICHARD D. (The Citadel). A Survey of the Vascular Flora of Francis Beidler Forest (Four Hole Swamp) in Berkeley and Dorchester Counties, South Carolina.
- 4:28 96. PATRICK, T. S., L. R. PHILLIPPE, D. H. WEBB AND B. E. WOFFORD (University of Tennessee). The Vascular Flora of the Savage Gulf Natural Area, Tennessee.
- 4:41 97. STEVENS-KATERERE, M. Y. AND JAMES S. FRALISH (Southern Illinois University). Influence of Site Characteristics on the Distribution of Forest Tree Species in the Southern Till Plain Division of Illinois.
- 4:54 98. PINDER, JOHN E., III (Savannah River Ecol-

ANIMAL ECOLOGY, SESSION I

Ferguson Ballroom

Presiding: *Dr. M. Susan Ivester*, University of Alabama

- 2:05 100. CROWLEY, PHILIP H. (University of Kentucky). How Dispersal Stabilizes Multi-cellular Ecosystems.
- 2:18 101. BAMFORTH, STUART S. (Tulane University). Observation of Protozoan Population Dynamics on Two-Dimensional Substrates.
- 2:31 102. IVESTER, M. SUSAN (University of Alabama). Seasonal Variation of Meiofaunal Communities in Three Alabama Tidal Marshes.
- 2:44 103. PARSONS, KEITH A. AND A. A. DE LA CRUZ (Mississippi State University). The Effects of Grasshopper (Tettigoniidae: *Orchelimum* sp.) Grazing on the Energy Flow of a Mississippi *Juncus roemerianus* Marsh.
- 2:57 104. TUTTLE, REBECCA D., RONALD LINDAHL AND THOMAS S. HOPKINS (University of Alabama). Systematic and Electrophoretic Analyses of Three Sympatric Morphs of the Asteroid Genus *Echinaster* (Spinulosida).
- 3:10 105. LEE, BARBARA B. AND DAVID S. LEE (North Carolina State Museum). Observations of Autumn Hawk Migrations Along North Carolina's Outer Banks.
- 3:23 106. WERSCHKUL, DAVID F. (Mississippi State University). Sibling Competition, Predation and Nestling Development in the Little Blue Heron.
- 3:36 107. VARGO, M. J., I. L. BRISBIN, JR. AND P. B. BUSH (Savannah River Ecology Laboratory and University of Georgia Cooperative Extension Service). Contamination Patterns of Radiocesium and Chlorinated Hydrocarbons in a Wintering Population of American Coots (*Fulica americana*).
- 3:49 108. STRIBLING, H. L., L. H. STRIBLING AND I. L. BRISBIN, JR. (Savannah River Ecology Laboratory). Fecal Contamination Analyses: Investigations of a New Method for Monitoring Radiocesium Levels in Free-Ranging Feral Swine (Mammalia:Suidae).
- 4:02 109. LEWIS, W. W., M. P. THOMPSON AND W. H. MARTIN (Eastern Kentucky University). Mammal Populations in the Forest Communities of Lilley Cornett Woods, Kentucky.
- 4:15 110. BRISBIN, I. L., JR. AND W. H. MORRISON, III (Savannah River Ecology Laboratory and Richard B. Russell Agricultural Research Center). Determination of the Direction of Quarry Movement by Experienced Tracking Dogs.

ICHTHYOLOGY AND HERPETOLOGY, SESSION I

304 Ferguson

Presiding: *Dr. Herbert Boschung*, University of Alabama

- 1:00 111. KNIGHT, L. A., JR. AND C. M. COOPER (University of Mississippi and USDA Sedimentation Laboratory). A Survey of Fishes of the Bear Creek, Mississippi Drainage.
- 1:13 112. TIMMONS, T. J., W. L. SHELTON AND W. D. DAVIES (Auburn University). Fish Population Changes Following Impoundment of West Point Reservoir (Chattahoochee River, Alabama-Georgia).
- 1:26 113. MOORE, CHARLES J. AND DENNIS T. BURTON (South Carolina Wildlife and Marine Resources Department and Academy of Natural Sciences of Philadelphia). A Six Year Study of Demersal Fish Prior to and During Operation of a Steam Electric Station on the Potomac River, Maryland.
- 1:39 114. CLARK, JOHN AND WILLIAM S. WOOLCOTT (University of Richmond). A Possible Occurrence of Hybridization of *Etheostoma o. olmstedii* and *Etheostoma nigrum* in the James River, Virginia.
- 1:52 115. KOCH, LEROY M. (University of North Alabama). Food Habits of *Etheostoma (Psychromaster) tuscumbia* in Buffler Spring, Lauderdale County, Alabama.
- 2:05 116. SEESOCK, WENDY E., JOHN S. RAMSEY AND FRANK L. SEESOCK (Auburn University). Life and Limitation of the Coldwater Darter (*Etheostoma ditrema*) in Glencoe Spring, Alabama.
- 2:18 117. CONNER, JOHN V. (Louisiana State University). Larval Suckers (Pisces:Catostomidae) from the Lower Mississippi River.
- 2:31 118. GILBERT, RONNIE J. (Georgia Cooperative Fishery Research Unit). Status of the Spotted Bass, (*Micropterus punctulatus*) (Centrarchidae), in the Eastern United States.
- 2:44 119. BLACK, ANN AND W. MIKE HOWELL (Samford University). The North American Mosquitofish, *Gambusia affinis*: A Unique Case in Sex-Chromosome Evolution.
- 2:57 120. THOMPSON, BRUCE A. (Louisiana State University). Log-perches of Southeastern U.S. (Etheostomatini, Percina).
- 3:10 121. JENKINS, R. E. AND W. M. PALMER (Virginia Commonwealth University and North Carolina State Museum). A New Species of Madtom Catfish (Ictaluridae) from the Coastal Plain of the Carolinas.

- 3:23 122. MODDE, TIMOTHY AND STEPHEN T. ROSS (University of Southern Mississippi). Seasonal Occurrence of Fishes Within the Surf-Zone of a Northern Gulf Coast Barrier Island.
- 3:36 123. TRAVIS, JOHN H., JR. (University of West Florida). Dorsal-Anal Spine Histology and Toxicity of *Oligoplites saurus* (Carangidae).
- 3:49 124. APPLGATE, MICHAEL C. (University of West Florida). Sexual Dichromatism in the Slippery Dick, *Halichoeres bivittatus* (Labridae).
- 4:02 125. BURGESS, GEORGE H. AND CARTER R. GILBERT (Florida State Museum). Fishes of Isla de Providencia, Colombia.
- 4:15 126. WILLIAMS, JEFFREY T. AND DOUGLAS CLARKE (University of South Alabama and Dauphin Island Sea Lab). Notes on Tropical Marine Fishes in Alabama Waters with New Records for the Region.
- 4:28 127. CLARKE, DOUGLAS G. (Dauphin Island Sea Lab). Effects of Population Density and Food Resource Abundance on Space Utilization in *Hypsoblennius ionthas* (Teleostei: Blenniidae).
- 4:41 128. HASTINGS, PHILIP A. (Harbor Branch Foundation, Inc.). The First North American Continental Record of *Gobionellus pseudo-fasciatus* (Gobiidae).

PARASITOLOGY

315 Ferguson

Presiding: Dr. H. M. Turner, McNeese State University

- 2:05 129. YONGUE, WILLIAM H., JR. AND R. CHRISTIAN JONES (Virginia Polytechnic Institute and State University, and University of Wisconsin). A Paramecium—Suctorian (Protozoa: Ciliata) Parasitism Associated with a Kepone-Holding Pond.
- 2:18 130. WEATHERSBY, A. B. AND JAMES TROOPER (University of Georgia). The Effects of Haemolymph of Susceptible and Refractory Mosquitoes on Gametogenesis of *Plasmodium fallax*.
- 2:31 131. HORNICK, FREDERICK R. AND FELIX H. LAUTER (University of South Carolina). Effect of pH on the Developing Ova of *Trichuris vulpis* (Adenophora:Enoplina).
- 2:44 132. PATTON, SHARON (University of Tennessee). Increase of Immunoglobulin T Concentration in Pomes as a Response to Experimental Infection with the Nematode, *Strongylus vulgaris*.
- 2:57 133. CARTER, O. S. AND B. J. BOGITSH (Vanderbilt University). *Schistosoma mansoni*: SEM Observations on Schistosomules Grown *In Vitro* and *In Vivo*.
- 3:10 134. STRINGFELLOW, FRANK AND PHILLIP A. MADDEN (USDA Animal Parasitology Institute). Negligible Leakage of Blood Proteins into Gastric Contents from Calves Infected with *Ostertagia ostertagi* (Nematoda:Trichostrongylidae) Correlated with Structure and Function of Chief Cells.
- 3:23 135. MCCALL, JOHN W., JUNG JUN AND DOREEN DALESANDRO (University of Georgia). Immunogenicity of Developing Larvae of *Brugia pahangi* Attenuated *In Vivo* by Treatment of Infected Jirds with Mebendazole.
- 3:36 136. BAFUNDO, KENNETH W., WALTER E. WILHELM AND MICHAEL L. KENNEDY (Memphis State University). An Analysis of the Helminth Parasites from the Digestive Tract of Tennessee Raccoons, *Procyon lotor* (L.).
- 3:49 137. BUTT, ARTHUR J. (Old Dominion University). Host-Specificity and Zoogeography Among Monogenetic Trematodes of the Family Mazocraeidae.
- 4:02 138. CURRENT, WILLIAM L. (Auburn University). Ultrastructure of *Cryptobia helicis* (Zoomastigophora:Kinetoplastida) in the Snail Host.
- 4:15 139. MOBLEY, RON AND GROVER C. MILLER (North Carolina State University). Helminths of Some Marine Birds from North Carolina.
- 4:28 140. BOOKER, K. A. AND W. H. YONGUE, JR. (Virginia Polytechnic Institute and State University). Some Aspects of Incidence and Transmission of *Todjia bufonis* Franca 1911 (Protozoa:Sporozoa) in *Natrix s. sipedon* and Other Species of *Natrix*.
- 4:41 141. TALTON, E. LYNN AND LARRY N. GLEASON (Western Kentucky University). Intestinal Helminths of Fishes in the Family Percidae from South Central Kentucky.
- 4:54 142. BROOKS, DANIEL R. (University of Mississippi). Evolutionary History of the Cestode Order Proteocephalidea.
- 5:07 143. SALADIN, KENNETH S. (Florida State University). Action Spectrum of the Shadow Response in *Schistosoma mansoni* Cercariae (Digenea:Schistosomatidae).

PLANT SYSTEMATICS, SESSION I

Ferguson Forum

Presiding: Dr. Robert R. Haynes, University of Alabama

- 1:00 144. HAYNES, ROBERT R. (University of Alabama). A Revision of North American *Najas* (Najadaceae).
- 1:13 145. MELVIN, NORMAN C., III (Miami University, Ohio). Taxonomy and Variation within *Leucothoe axillaris* (Ericaceae).

- 1:26 146. PUSATERI, WILLIAM P. AND WILL H. BLACKWELL, JR. (Miami University, Ohio). Taxonomy, Distribution and Historical Considerations of *Echium* (Boraginaceae) in North America.
- 1:39 147. THOMSON, PAUL M. AND ROBERT H. MOHLENBROCK (Southern Illinois University). A Scanning Electron Microscope Study of Foliar Trichomes for Species of *Quercus* L. Subgenus *Lepidobalanus* Endl. in the Eastern United States.
- 1:52 148. JONES, SAMUEL B. (University of Georgia). Toward a More Biologically Meaningful Infrageneric Classification of *Vernonia* (Vernonieae:Compositae).
- 2:05 149. KIRKMAN, L. KATHERINE (University of Georgia). SEM of Pollen Grains of *Centratherum* (Vernonieae:Compositae).
- 2:18 150. WOFFORD, B. EUGENE (University of Tennessee). External Seed Morphology of Selected Southeastern U.S. Taxa of *Arenaria* (Caryophyllaceae).
- 2:31 151. HARDIN, JAMES W. (North Carolina State University). Variability in Oak Leaf Trichomes.
- 2:44 152. McDONALD, CHARLES B. (North Carolina State University). The Nomenclatural Implication of Biosystematic Studies in the *Polygonum hydropiperoides* Complex (Polygonaceae).
- 2:57 153. DENNIS, W. MICHAEL AND T. F. HALL (Tennessee Valley Authority and Alabama Wildflower Society). Notes on the Endangered Alabama Endemic, *Jamesianthus alabamensis* Blake & Sherff (Asteraceae).
- 3:10 154. BIERNER, MARK W. (University of Tennessee). The Recognition of *Amblyolepis* DC. and its Separation from Subtribe Gaillardiiinae (Asteraceae).
- 3:23 155. WEBB, DAVID H. (University of Tennessee). A Biosystematic Study of the *Hypericum denticulatum* Complex (Hypericaceae).
- 3:36 156. WELLMAN, LYNN H. AND JOE E. WINSTEAD (Western Kentucky University). Laboratory Comparisons of Two Species of *Liquidambar* (Hamamelidaceae).
- 3:49 157. TAYLOR, JAN R. AND DAN K. EVANS (Marshall University). A Taxonomic Study of the Genus *Cyperus* (Cyperaceae) in West Virginia.
- 4:02 158. MALLORY, MARION AND DAN K. EVANS (Marshall University). Leaf Anatomy as a Basis for Classification in Selected Species of *Carex* (Cyperaceae).
- 4:15 159. FLORY, WALTER S. (Wake Forest University). Chromosome Evolution in the Amaryllidaceae.
- 4:28 160. FANTZ, PAUL R. (University of Florida). A Morphological Comparison of *Clitoria guianensis* and *C. laurifolia* (Leguminosae).
- 4:41 161. EVANS, A. MURRAY (University of Tennessee). *Ampelothamnus* Revisited: Its Singular Climbing Habit Occurs also in *Clethra* and *Leucothoe*.
- 4:54 162. DAVENPORT, L. J. (University of Alabama). The Herbarium of the Geological Survey of Alabama.
- 5:07 163. WIERSEMA, JOHN H. (University of Alabama). Correlation of Selected Chemical and Physical Parameters and the Distribution of the Nymphaeaceae *sensu lato* in Alabama.
- 5:20 164. ANDERSON, LINDA C. (North Carolina State University). The Life History and Ecology of *Carex misera* Buckley and *C. purpurifera* MacKenzie (Cyperaceae).

FRIDAY MORNING — APRIL 14

CRYPTOGAMIC BOTANY

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Presiding: *Dr. Margaret Miller*, University of South Alabama

- 8:13 165. MILLER, MARGARET AND ROBERT NESTER (University of South Alabama). A Survey of the Algae Inhabiting Three Mile Creek, Mobile County, Alabama.
- 8:26 166. DILLARD, GARY E. (Western Kentucky University). Some Interesting Freshwater Algae from South-central Kentucky.
- 8:39 167. GIBSON, ROBERT A. (Harbor Branch Foundation, Inc.). Observations on the Ecology and Morphology of a Marine Epizoic Diatom.
- 8:52 168. WARD, H. BAILEY (University of Mississippi). Cytokinesis in Cryptomonad (Cryptophyceae) Algae.
- 9:05 169. BULLOCK, KENNETH W. AND TEMD R. DEASON (University of Alabama). The Occurrence of Glycolate Enzymes in Some Coccoid Green Algae.
- 9:18 BREAK
- 9:31 170. KELLER, HAROLD W. AND LAURA L. ANDERSON (Wright State University). Some Coprophilous Species of Myxomycetes.
- 9:44 171. SMITH, DAVID M. AND HAROLD W. KELLER (Wright State University). Spore to Spore Cultivation of a New Species of *Didymium* (Myxomycetes) in Association with an Acarid Mite, *Tyrophagus putrescentiae*.
- 9:57 172. MESCALL, YVONNE M. (University of Tennessee). The Bryophyte Flora of Savage Gulf, Grundy County, Tennessee.
- 10:10 173. GRIFFIN, DANA, III (University of Florida). Mosses of the Alto Rio Buritaca, Colombia.
- 10:23 174. WALLACE, JAMES W. (Western Carolina University). Flavonoids of the Psilotaceae, Stromatopteridaceae and other Primitive Ferns and Their Phylogenetic Significance.

PLANT PHYSIOLOGY

314 Ferguson

Presiding: *Dr. B. P. Stone*, Austin Peay State University

- 8:13 175. ATKINSON, W. H. AND B. P. STONE (Austin Peay State University). Reversal of IAA and GA Induced Pea Epicotyl Elongation by Alternate Electron Transport Inhibitors and Concanavalin A.
- 8:26 176. WOLF, FREDERICK T. (Vanderbilt University). Effects of Light Quality upon the Growth of *Avena* Coleoptiles.
- 8:39 177. GARRISON, PAUL F. (University of West Florida). Preliminary Studies on the Effects of Acrylonitrile and Potassium Thiocyanate on the Seagrass, *Ruppia maritima* (Potamogetonaceae).
- 8:52 178. DUKE, STEPHEN O. AND ROBERT E. HOAGLAND (Southern Weed Science Laboratory). Glyphosate Effects on Phenylalanine Ammonia-Lyase in Three Crop Species.
- 9:05 179. HOAGLAND, ROBERT E. AND STEPHEN O. DUKE (Southern Weed Science Laboratory). Effects of Glyphosate on Growth and Levels of Phenolic Compounds, Proteins and Amino Acids in Three Crop Species.
- 9:18 BREAK
- 9:31 180. HOAGLAND, ROBERT E. (Southern Weed Science Laboratory). Effects of n-Triacontanol on Seed Germination and Early Growth.
- 9:44 181. DUKE, S. O. AND S. H. DUKE (Southern Weed Science Laboratory and University of Wisconsin). *In Vitro* Nitrate Reductase Activity and *In Vivo* Phytochrome Measurements of Maize Seedlings as Affected by Various Light Treatments.
- 9:57 182. ROSS, JAMES W., J. C. O'KELLEY AND J. K. HARDMAN (University of Alabama). Flavin-Mediated Photooxidation of Plastocyanin from *Protosiphon*.
- 10:10 183. HOAGLAND, ROBERT E. AND REX PAUL (Southern Weed Science Laboratory). SEM Analysis of Red Rice and Several Rice Cultivars.
- 10:23 184. RUNNINGWOLFE, JOHN, BETTYE R. STOKES AND VALERIE J. POSTMAN (South Carolina State College). Use of an Aeroponic Culture System for Studying Copper Toxicity to Soybeans (*Glycine max* (L.) Merrill).

INVERTEBRATE ZOOLOGY, SESSION II

Ferguson Theatre

Presiding: *Dr. Thomas Hopkins*, University of Alabama

- 8:13 185. BOUCHARD, RAYMOND W. (University of North Alabama). Threatened Eastern North American Shrimps and Crayfishes (Decapoda: Atyidae, Palaemonidae and Cambaridae).
- 8:26 186. HUNER, JAY V. AND SAMUEL P. MEYERS (Southern University and Louisiana State University). Dietary Protein Requirements of Red Swamp Crawfish, *Procambarus clarkii* (Girard) (Decapoda: Cambaridae).
- 8:39 187. BEAN, R. A. AND JAY V. HUNER (Louisiana State University and Southern University). Comparison of the Growth and Survival of Red Swamp Crawfish (*Procambarus clarkii* (Girard)) and White River Crawfish (*Procambarus acutus acutus* (Girard)) (Decapoda: Cambaridae).
- 8:52 188. CUSIC, ANNE M. AND ELLEN W. MCLAUGHLIN (Samford University). Survival of Pond Snail Embryos Treated with Four Insecticides.
- 9:05 189. JENNER, CHARLES E. (University of North Carolina). Sex Identification, Sex Ratio and Social Organization in the Thalassinid Shrimp, *Upogebia affinis* (Crustacea: Decapoda).
- 9:18 BREAK
- 9:31 190. JENNER, MARTHA G. (University of North Carolina). Pseudohermaphroditism: A Major Sexual Phenomenon in the Neogastropoda (Mollusca).
- 9:44 191. MCCRARY, ANNE B. (University of North Carolina at Wilmington). The Life Cycle of *Anomalocera ornata* Sutcliff (Copepoda) in North Carolina Waters.
- 9:57 192. HARRISON, JULIAN R. (College of Charleston). Observations on Mollusk Populations in the Leadenwah Salt Marsh System, Wadmalaw Island, South Carolina.
- 10:10 193. VIDRINE, MALCOLM F. AND DANIEL J. BEREZA (University of Southwestern Louisiana). Preliminary List of Species from Recent Collections of Fresh-water Mussels (Bivalvia: Unionacea) from the Atchafalaya River Drainages in Louisiana.
- 10:23 194. VIDRINE, MALCOLM F. (University of Southwestern Louisiana). New Host and Locality Records for the Water Mite, *Unionicola serrate* (Wolcott) (Arthropoda: Acarina: Unionicolidae).
- 10:36 195. ADKISON, DANIEL L. (University of West Florida). Distribution of *Latreutes fucorum* (Decapoda: Caridea) and the Branchial Parasite, *Probopyrinella lateuticola* (Isopoda: Epicaridea).

ANIMAL ECOLOGY, SESSION II

304 Ferguson

Presiding: *Dr. J. Whitfield Gibbons*, Savannah River Ecology Laboratory

- 8:26 196. SCHUBAUER, J. P. AND J. WHITFIELD GIBBONS (Savannah River Ecology Laboratory). Home Range and Movement Patterns of *Chrysemys scripta* (Reptilia: Emydidae) in a Thermally Altered Lake in South Carolina.
- 8:39 197. LEE, DAVID S. AND BEN A. SANDERS (North Carolina State Museum and U.S. Forest Service). The Status of the Panther, *Felis concolor*, in North Carolina.
- 8:52 198. ROBSON, FRAN (Chesapeake Audubon Society). When the Wolves Went.
- 9:05 199. LANGLEY, ALBERT K., JR. (Emory University). Movements and Home Ranges of the Cotton Rat (*Sigmodon hispidus*) in Relation to Habitat Type.
- 9:18 200. EAGLESON, K. W., E. L. MORGAN, D. L. STONEBURNER AND N. MCCOLLOUGH (Tennessee Technological University, National Park Service and University of Tennessee). Loggerhead Sea Turtle Tracking by Satellite, Preliminary Report.
- 9:31 BREAK
- 9:44 201. JOHNSON, PAUL G. AND MIKE DARDEAU (Dauphin Island Sea Lab). Nesting Success and Mortality of Nestlings in a Coastal Alabama Heron-Egret Colony, 1977.
- 9:57 202. MENDONCA, MARY T. AND LLEWELLYN M. EHRHART (Florida Technological University). Preliminary Findings of Population Structure and Movements in a Lagoonal Sea Turtle (Cheloniidae) Population.
- 10:10 203. TRAUTH, STANLEY E. AND ROBERT H. MOUNT (Auburn University). Excavation of Hibernating *Cnemidophorus sexlineatus* (Lacertilia: Teiidae) and Other Lizards from Alabama and Georgia Highway Roadcuts.
- 10:23 204. SHABICA, S. V. AND D. L. STONEBURNER (Coastal Field Research Laboratory, National Park Service). Raccoon Predation on Sea Turtle Nests, Canaveral National Seashore.
- 10:36 205. FRAZIER, MICHAEL K. AND RICHARD FRANZ (Florida State Museum, University of Florida). Paleocology of the Late Pleistocene, Orange Lake IIA Local Fauna, Marion County, Florida.

PLANT SYSTEMATICS, SESSION II

Ferguson Ballroom

Presiding: *Dr. T. Lawrence Mellichamp*, University of North Carolina at Charlotte

- 8:00 206. WATSON, FRANCIS D. (North Carolina State University). Vascular Flora of Three Ridges Mountain, Nelson County, Virginia.
- 8:13 207. PHILLIPPE, LOY R. (University of Tennessee). *Sanicula odorata* (Raf.) Phillippe, comb. nov. (Umbelliferae).
- 8:26 208. WERTH, C. R., W. V. BAIRD AND L. J. MUSSELMAN (Miami University, Ohio and Old Dominion University). Root Parasitism in *Schoepfia* Schreb. (Olacaceae).
- 8:39 209. JOHNSON, MILES F. (Virginia Commonwealth University). The Genus *Prenanthes* (Cichorieae: Asteraceae) in Virginia.
- 8:52 210. JOHNSON, MILES F. (Virginia Commonwealth University). Studies in the Virginia Flora: Species New to Virginia.
- 9:05 211. WHITSON, P. D. AND J. R. MASSEY (University of Northern Iowa and University of North Carolina). Information Systems for Use in Studying the Biological Status of Threatened and Endangered Plant Populations.
- 9:18 212. MASSEY, J. R. AND P. D. WHITSON (University of North Carolina and University of Northern Iowa). Species Biology Studies — Products.
- 9:31 213. MATTHEWS, JAMES F. (University of North Carolina at Charlotte). A Comparative Biological Study: *Pellaea* × *wrightiana* Hooker, an Endangered Disjunct in North Carolina.
- 9:44 214. SOWERS, F. CHRISTOPHER (University of North Carolina at Charlotte). Some Aspects of Species Biology: *Nestronia umbellula* Rafinesque.
- 9:57 215. MELLICHAMP, T. LAWRENCE (University of North Carolina at Charlotte). Species Biology and Convergent Evolution in *Arunca* and *Astilbe*.
- 10:10 216. RADFORD, ALBERT E. (University of North Carolina). Natural Diversity as a Systematics Course.
- 10:23 217. OTTE, DEBORAH K. S. (University of North Carolina). Principles and Application of Natural Diversity Study.
- 10:36 218. WHETSTONE, R. DAVID (University of North Carolina). Some Vegetational Relationships of Plant Communities near Bee Branch Wilderness Area, Cumberland Plateau of Alabama.

FRIDAY AFTERNOON—APRIL 14

AQUATIC ECOLOGY, SESSION III

Mineral Industries Auditorium

Presiding: *Dr. M. Susan Ivester*, University of Alabama

- 1:00 219. LEFFLER, JOHN W. (University of Georgia). Element Distribution Index: A Technique for Assessing Nutrient Cycling Changes in Aquatic Microcosms.
- 1:13 220. SHERIDAN, JOHN AND LARRY TUCKER (University of West Florida). Sediment Redox Potentials of East Bay, Pensacola, Florida.
- 1:26 221. COOK, LAWRENCE L. AND STEPHEN A. WHIPPLE (Louisiana State University). Diatom (Bacillariophyceae) Communities of a Louisiana Salt Marsh.
- 1:39 222. RADTKE, DEAN B. AND THOMAS N. RUSSO (U.S. Geological Survey). A Floristic Comparison Between Periphytic Diatom Communities in Four Hydrologic Watersheds.
- 1:52 223. BUTT, ARTHUR J. AND MICHAEL C. APPLE-GATE (Old Dominion University). Emergent Vegetation as Indicators for Estimation of the Mean High Water Level of Fresh-water Lacustrine Systems.
- 2:05 224. BUTT, ARTHUR J. AND MICHAEL C. APPLE-GATE (Old Dominion University). Estuarine Shoreline Vegetation as Indicators of the Mean High Water Line.
- 2:18 225. SAGE, WILLIAM W. (Mississippi State University). An Analysis of Edaphic Blue-green Algal Communities of a Mississippi Gulf Coast Salt Marsh.
- 2:31 226. BROWN, HELEN DAVIS (Clayton Junior College and University of Florida). Summer and Winter Attached Algae of A Brown-Water Lake.
- 2:44 227. RANDALL, J. FRANK (Appalachian State University). The Ecesis of Two Species of the Salmonidae in an Isolated Stream.
- 2:57 228. LIDEN, L. H., E. L. MORGAN, K. W. EAGLE-SON, D. T. BURTON AND S. L. MARGREY (Tennessee Technological University and Academy of Natural Sciences of Philadelphia). The Effect of Total Residual Chlorine on Goldfish (*Carassius auratus*) Previously Exposed to Long-Term Metal Stress.
- 3:10 229. MARGREY, S. L., D. T. BURTON, L. H. LIDEN AND C. J. MOORE (Academy of Natural Sciences of Philadelphia and South Carolina Wildlife and Marine Resources Department). The Acute Toxicity of Soluble Copper to Tidewater Silverside, *Menidia beryllina* (Cope), at Constant and Cycling Temperatures.
- 3:23 230. MELISKY, EDWARD L., JAY R. STAUFFER, JR. AND CHARLES H. HOCUTT (University of Maryland and Frostburg State College). Temperature Preference of the Bluntnose Minnow, *Pimephales notatus*, in Maryland.
- 3:36 231. HARGIS, KATHRYN J., KENNETH W. EAGLE-SON AND ERIC L. MORGAN (Tennessee Technological University). Automated Breathing Rate Monitor for Measuring Respiratory Synchrony in Schooling and Non-schooling Fish.
- 3:49 232. ROBINETTE, JOHN R. AND ERIC L. MORGAN (Tennessee Technological University). An Improved Design for an Inexpensive Backpack Electrofishing Unit.
- 4:02 233. POTTER, W. A., K. L. DICKSON, J. CAIRNS, JR. AND J. R. STAUFFER, JR. (Virginia Polytechnic Institute and State University and University of Maryland). Temporal Distribution of Ichthyoplankton Drift in the New River in the Vicinity of Glen Lyn, Virginia.
- 4:15 234. ABBOTT, TOM M., KENNETH L. DICKSON AND JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). The Importance of Drift and Benthic Food Sources to Rainbow (*Salmo gairdneri*) and Brown Trout (*Salmo trutta*) Diets in a Stream.
- 4:28 235. CANNAMELA, DAVID A. (Murray State University). Spring and Fall Food Habits of the Shorthead Sculpin, *Cottus confusus*, from the Big Lost River, Idaho.
- 4:41 236. GASSER, KENNETH W. (Murray State University). Age, Growth and Fecundity of the Shorthead Sculpin, *Cottus confusus*, from the Big Lost River, Idaho.
- 4:54 237. GIATTINA, J. D., D. S. CHERRY, S. R. LAR-RICK, J. CAIRNS, JR. AND K. L. DICKSON (Virginia Polytechnic Institute and State University). Avoidance Behavior of Fish to Intermittent Chlorination in Thermally Influenced Waste Water.
- 5:07 238. KING, CHRISTINE AND KENNETH L. DICKSON (Virginia Polytechnic Institute and State University). A System to Monitor Ventilatory Activity of the Fathead Minnow, *Pimephales promelas*.
- 5:20 239. VAUGHN, GERALD L. AND VIRGINIA R. TOL-BERT (University of Tennessee). Effects of Strip Mining on Aquatic Communities in Streams in the New River Basin of Eastern Tennessee.

PLANT ECOLOGY, SESSION III

Room 205 Smith Hall

Presiding: Dr. H. R. DeSelm, University of Tennessee

- 1:00 240. WALKER, GARY L. AND JAMES H. HORTON (Western Carolina University). A Comparative Vegetational Analysis of Cove Hardwood Communities.
- 1:13 241. ROBERTSON, PHILIP A. (Southern Illinois University). Comparisons Among Three Classification Techniques Using Simulated Coenoplanes.
- 1:26 242. O'NEILL, ELLEN J. AND SANDRA L. LEDFORD (University of West Florida). Anatomical and Histochemical Characteristics of *Ruppia maritima* L. (Potamogetonaceae).
- 1:39 243. MCCORD, RAYMOND A. AND EDWARD E. C. CLEBSCH (University of Tennessee). A Preliminary Investigation of Theories of Island Biogeography with the Floristics of the Aleutians and Other Beringian Islands.
- 1:52 244. OLSON, STEFNI AND PAT H. LEWIS (Wesleyan College). *Scalesia*, *Wilkesia*, *Argyroxiphium* and *Hesperomannia* of the Family Compositae in the Galapagos and Hawaii.
- 2:05 245. SHARMA, G. K. (University of Tennessee at Martin and Harvard University). Ecotypic Variations in *Cannabis* (Cannabinaceae).
- 2:18 246. DESELN, H. R. AND J. L. BROWN (University of Tennessee and University of Tennessee, Chattanooga). Fossil Flora of the Briar Branch and Boyd Buchanan School Sites.
- 2:31 247. WERTH, CHARLES R. AND JAMES L. RIOPEL (University of Virginia). A Study of the Host Range of *Aureolaria pedicularia* (L.) Raf. (Scrophulariaceae).
- 2:57 248. GRELLER, A. M., R. E. CALHOON AND J. MANSKY (Queens College, CUNY and Kalbfleisch Field Research Station). Grace Forest, A Mixed Mesophytic Stand on Long Island, New York.
- 3:10 249. HOOD, LAURA N. (University of North Carolina at Charlotte). A Natural Diversity Classification and Description of the Rocky River Bluffs Natural Area, Stanly County, N.C.
- 3:23 BREAK
- 3:36 250. HARDIN, E. D. AND K. P. LEWIS (University of Alabama in Huntsville). Quantitative Analyses of the Vegetation and Abiotic Factors of a Beech (*Fagus grandifolia*)-Hemlock (*Tsuga canadensis*) Forest in Bankhead National Forest, Alabama.
- 3:49 251. MARTIN, W. H., W. S. BRYANT, M. E. WHARTON AND J. B. VARNER (Eastern Kentucky University, Thomas More College and Georgetown College). Blue Ash-Oak Savanna-Woodland of the Inner Bluegrass Region of Kentucky.
- 4:02 252. SMOUT, GENE A. AND GEORGE T. WEAVER (Southern Illinois University). The Relation of Heavy Metal Concentrations in Tree Tissues and Sludge Amended Mining Spoil.
- 4:15 253. ASHBY, W. CLARK AND CLAY A. KOLAR (Southern Illinois University). Thirty-Year Tree Growth on Surface-Mined Lands.
- 4:28 254. SHABICA, S. AND S. CALL (National Park Service). Sand Dune Revegetation Following Pedestrian Perturbation at Santa Rosa Island, Gulf Islands National Seashore.
- 4:41 255. SHERROD, CASEY, JR., D. E. SOMERS AND K. W. MCLEOD (Savannah River Ecology Laboratory and Ohio University). The Effect of Thermal Effluents on the Germination and Growth of Baldcypress.
- 4:54 256. PINDER, J. E., III, M. H. SMITH, A. L. BONI, J. C. COREY AND J. H. HORTON (Savannah River Ecology Laboratory and Savannah River Laboratory). Plutonium Contents of an Old-Field Ecosystem Near a Nuclear-Fuel Reprocessing Facility.

ANIMAL PHYSIOLOGY, SESSION II

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Presiding: Dr. Ronald D. Hood, University of Alabama

- 1:00 257. PATTERSON, B. L., R. D. HOOD, G. T. THACKER, G. L. SLOAN AND G. M. SZCZECZ (University of Alabama and The Upjohn Company). Prenatal Effects of 2,4,5,-T and Related Compounds in Mice.
- 1:13 258. BAUMAN, T. R. AND S. M. GROSS (University of Alabama). Thyroxine and Toxicity of Trypan Blue in the Fetal Rat.
- 1:26 259. WELCH, BRUCE L. (Johns Hopkins University). Sustained Alteration of Cardiac and Circulatory Dynamics by Brief Intense Social Stress (Fighting) in Mice.
- 1:39 260. SIMPSON, FORD AND RONALD LINDAHL (University of Alabama). Aldehyde Dehydrogenase Isozymes of the Mongolian Gerbil, *Meriones unguiculatus*.
- 1:52 261. MCCARTY, KAREN E. AND T. DANIEL KIMBROUGH (Virginia Commonwealth University). The Effects of Nutritional Depletion of 5-Hydroxytryptamine in Rat Gut.
- 2:05 262. SOWELL, P. T. AND G. R. HOGAN (University of North Carolina at Charlotte). Erythropoietic Alterations in Sublethally Irradiated Mice.
- 2:18 263. DAWSON, W. D. AND W. W. MILLER, III (Northeast Louisiana University). The Prophylactic Effects of Retinyl Acetate on Cancer of the Urinary Bladder.

- 2:31 264. TERRY, PAT AND P. S. RUSHTON (Memphis State University). An Electrophoretic Study of Transferrin in X-irradiated Mice.
- 2:44 265. CAMPBELL, P. S. (University of Alabama in Huntsville). Developmental Effects of Neonatal Hormone Treatment Upon Uterotrophic Responses in the Prepubertal Rat.
- 2:57 266. FARMER, P. K., D. A. OLEWINE, D. W. COMER, M. EDWARDS, T. M. COLEMAN, G. THOMAS AND C. G. HAMES (Georgia Southern College and Evans County Heart Research Unit). Effect of Submaximal Exercise on Recovery Frontalis Muscle Tension and Occipital Alpha Wave Production in College-Aged Males.
- 3:10 267. ELLIOTT, L. P. AND A. A. HIRATA (Western Kentucky University and University of Kansas). Circulating Antibodies to Bovine Serum Albumin and Ovalbumin in the Serum of University Students.
- 3:23 268. ROBINSON, LARRY AND WILLIAM B. KEITH (University of Mississippi). Nuclear Binding of 17- β Estradiol in Thyroid Inhibited Golden Hamsters.
- 3:36 BREAK
- 3:49 269. ERKENBRACK, DAVID AND WILLIAM B. KEITH (University of Mississippi). The Effect of Aging on Levels of Nuclear Receptors of Thyroid Hormone in the Rat.
- 4:02 270. BELL, FLOYD E. AND W. D. DAWSON (University of South Carolina). Progesterone Effects on Skin Allografts in *Peromyscus*.
- 4:15 271. HOKE, GLENN D. AND GERALD C. LLEWELLYN (Virginia Commonwealth University). Aflatoxicosis and Dietary Zinc Interaction in Hamsters.
- 4:28 272. WEEKLEY, L. B. AND T. DANIEL KIMBROUGH (Virginia Commonwealth University). The Effects of Xanthopterin and Its Isomer on the Biosynthesis of 5-Hydroxytryptamine in the Rat Gut.
- 4:41 273. DEBERRY, JAN AND P. S. RUSHTON (Memphis State University). The Effect of Different Photoperiods on the Mitotic Rhythm of Mouse Bone Marrow Cells.
- 4:54 274. HOWARD, BUFORD P. AND WILLIAM B. KEITH (University of Mississippi). Palmitic Acid Metabolism by Guinea Pig Thymocytes, *In Vitro*: Relationship to Steroid Resistant Populations.
- 5:07 275. ADAMS, D. P. AND G. R. HOGAN (University of North Carolina at Charlotte). Lead Acetate-Induced Leukocytosis in Female Mice.
- 5:20 276. GARTH, R. E., M. J. LEVINE, M. GREEN, M. EDWARDS AND F. DENNEY (University of Tennessee at Chattanooga). Transuterine Migration in the Rat.

ICHTHYOLOGY AND HERPETOLOGY, SESSION II

304 Ferguson

Presiding: *Dr. Robert Mount, Auburn University*

- 1:00 277. BROCKMAN, KAREN A. (University of West Florida). Age-and-Growth and Reproduction of *Notropis signipinnis* and *N. hypselepterus* (Cyprinidae).
- 1:13 278. MATTHEWS, WILLIAM J. AND LOREN G. HILL (Roanoke College and University of Oklahoma). Habitats of Small Fishes of the South Canadian River, Oklahoma: Occurrence with Respect to Physico-Chemical Factors.
- 1:26 279. MURPHY, P. A. (Savannah River Ecology Laboratory). Sun Compass Orientation in Juvenile American Alligators.
- 1:39 280. DODD, C. KENNETH, JR. AND CORINNE MITCHELL (U.S. Fish and Wildlife Service). The Conservation Status of Southeastern Herpetofauna.
- 1:52 281. MCGEHEE, ANGIE (Florida Technological University). Factors Affecting the Hatching Success of Loggerhead Sea Turtle Eggs.
- 2:05 282. STANDORA, E. A., M. J. VARGO AND I. L. BRISBIN, JR. (Savannah River Ecology Laboratory). Documentation of Autumnal Denning Behavior in the Aquatic Turtle, *Chrysemys scripta*.
- 2:18 283. KRAEMER, JED E. AND REBECCA BELL (University of Georgia). Rain Induced Mortality of Loggerhead Sea Turtle (*Caretta caretta*, Cheloniidae) Eggs on the Georgia Coast.
- 2:31 284. GIBBONS, J. WHITFIELD (Savannah River Ecology Laboratory). Do Reptiles Really Have Indeterminate Growth?
- 2:44 285. SCHWARTZ, FRANK J. (University of North Carolina). Body-Organ Weights for Three Basking Sharks, *Cetorhinus maximus*, from North Carolina Waters.
- 2:57 286. SAFRIT, GLENN W., JR. AND FLYNN S. SMITH, JR. (Institute of Marine Sciences, University of North Carolina). Recent Records of *Pomacentrus planifrons*, *Holacanthus ciliaris* and *Pomacanthus paru* from North Carolina (Pomacentridae, Chaetodontidae).
- 3:10 287. ASHTON, RAY E., JR., PATRICIA ASHTON AND DAVID DEITZ (North Carolina State Museum and University of Florida). Investigation into the Natural History of *Pseudacris ornata* in North Central Florida.
- 3:23 288. PAV, D. I. AND R. J. COWIE (East Tennessee State University). Brain Study in Four Genera of the Family Plethodontidae.
- 3:36 289. HENDERSON, S. E., D. I. PAV, J. W. NAGEL AND J. G. SPAULDING (Pennsylvania State University, East Tennessee State University and Edinboro State College). Histological Examination of Integumental Glands of Plethodontidae Salamanders.
- 3:49 290. PUTNAM, J. L. AND J. B. PARKERSON, JR. (Davidson College). Anatomy of the Heart of *Cryptobranchius alleganiensis*.

- 4:02 291. NOWAK, MARTIN AND KEN R. MARION (University of Alabama in Birmingham). Growth and Food Consumption in the Corn Snake, *Elaphe guttata guttata* (Reptilia: Squamata).
- 4:15 292. FRANZ, RICHARD AND SYLVIA J. SCUDDER (Florida State Museum, University of Florida). Some Patterns of Snake Activity on a Florida Highway.
- 4:28 293. HERRINGTON, ROBERT E. (Georgia College). Growth and Reproduction in the Brown Watersnake, *Nerodia taxispilota* (Reptilia: Serpentes, Colubridae).
- 4:41 294. FITZGERALD, MALINDA E. AND LEWIS B. COONS (Memphis State University). Ultrastructure of the Protozoan *Ambiphyra ameiuri* and Its Attachment to the Gills of *Ictalurus punctatus*.

CYTOLOGY AND GENETICS

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Presiding: Dr. J. K. Shull, Loyola University

- 1:26 295. ALCHEDIAK, THOMAS AND J. K. SHULL (Loyola University). Distribution of Meiotic Bivalents in the Sterile Hybrid *Lilium* × 'Black Beauty' (Liliaceae).
- 1:39 296. SULLIVAN, MICHAEL H. AND DANIEL W. BATH (Austin Peay State University). Induction and Analysis of Meiotic Banding Patterns in the Chinese Hamster (*Gricetulus griseus*).
- 1:52 297. BENNER, D. B. (East Tennessee State University). Modified Expression of Y Chromosome Fertility Factors Located on a X-Y-Fourth Chromosome Rearrangement in *Drosophila melanogaster*.
- 2:05 298. COX, SHIRLEY AND P. S. RUSHTON (Memphis State University). Effects of X-rays on the Mitotic Rhythm in Mouse Bone Marrow.
- 2:18 299. WILLIAMS, ARTHUR L. (Murray State University). Isoleucine-Valine (ilv) Enzyme Levels in Lysogens Carrying λ dilvADE and λ dilvCB Plus a Valine Resistant Marker.
- 2:31 300. RUSSELL, LINDA AND CHARITY WAYMOUTH (The Jackson Laboratory). Hormonal Requirements for Growth of a Mammary Tumor in Chemically Defined Media.
- 2:44 301. RUSSELL, LINDA AND C. W. HEALD (Virginia Polytechnic Institute and State University). The Effects of Crude *Staphylococcus aureus* Toxin on Mammary Explants: An Ultrastructure Study.
- 2:57 BREAK
- 3:10 302. KALMUS, GERHARD W. (East Carolina University). Aggregation Patterns Between Unincubated Chick Blastoderm Cells from Older Embryos.
- 3:23 303. FISHER, CHRISTOPHER AND R. H. SAWYER (University of South Carolina). Inductive Tissue-Interactions During Avian Scale Development.
- 3:36 304. WEST, L. K., P. L. WALNE AND J. BENTLEY (University of Tennessee and Oak Ridge National Laboratory). Substructure and Composition of Cell Envelopes (Loricae) of *Trachelomonas hispida* var. *coronata* Lemm. (Euglenophyceae).
- 3:49 305. GERARD, DAVID A. AND PATRICIA L. WALNE (University of Tennessee). Preliminary Observations on Lorica Structure and Composition in *Pteromonas protracta* (Volvocales).
- 4:02 306. WALL, WENDELL E. AND DANIEL D. JONES (University of Alabama in Birmingham). Ultrastructural Study of Cell Wall Development and Cell Separation in *Microcystis aeruginosa*.
- 4:15 307. WALL, WENDELL E. AND DANIEL D. JONES (University of Alabama in Birmingham). The Effects of Mannitol and Lysozyme on the Cell Wall of *Microcystis aeruginosa*.
- 4:28 308. JOHNSON, L. K. AND BRUCE B. SMITH (York College). Early Ovule Development, Megasporogenesis, and Megagametogenesis in *Solidago canadensis* var. *canadensis* (Asterales: Asteraceae).
- 4:41 309. McCLURKIN, IOLA T., D. C. McCLURKIN AND CHARLES F. YOUNG (University of Mississippi). A Rapid Fixing and Infiltrating Procedure for Plant or Animal Histological Sections.

Abstracts of Papers Presented at the 39th Annual Meeting of the Association of Southeastern Biologists

The number in parenthesis at the top of each abstract refers to the number of that paper in the Program.

(1)

A Study of An Association Between the Gastropod, *Neritina reclivata*, and the Seagrass, *Ruppia maritima*

HERMAN K. LEHMAN
University of West Florida

In northwest Florida estuaries, large numbers of *Neritina reclivata* Say (Mollusca:Gastropoda) are present on the shoot systems of the seagrass *Ruppia maritima* L. (Potamogetonaceae). Controlled laboratory experiments were conducted to determine whether the food source of *N. reclivata* was the seagrass, the epiphytes in association with the seagrass or both seagrass and epiphytes. Plant growth rates, the population density of microphytic algae in association with the seagrass and the snail gut contents were monitored for both experimental and control groups during a five week period. Analysis of the data showed that *N. reclivata* did not consume the seagrass but did ingest many algal epiphytes. The data also suggested feeding by the snail significantly reduced the algal epiphyte populations associated with this seagrass.

(2)

Substrate Acquisition by Drifting Aquatic Insect Larvae

O. EUGENE WALTON, JR.
University of North Carolina

A series of laboratory experiments evaluated sediment type and illumination as factors affecting substrate acquisition by three species of drifting aquatic insect larvae. Stone or cobble sediment patches with (natural) or without (sterile) an epilithic food resource were placed in artificial stream channels. *Stenacron interpunctatum* (Ephemeroptera), *Acroneuria abnormis* (Plecoptera) and *Chimarra aterrima* (Trichoptera) individuals were drifted over these patches. Acquisition was partitioned into settling and resisting return to the drift (delayed drift). *S. interpunctatum* and *C. aterrima* differentially settled, the former only during daylight. For all three species, significantly fewer animals settled in darkness. Significant delayed drift occurred in both *S. interpunctatum* and *C. aterrima*, but only in darkness off sterile sediments for the former. These results suggest that invertebrate drift may occasionally function as a direct, one-way link between similar substrate specific faunal associations.

(3)

Microdistribution of Six Species of Elmidae Beetles in the South Fork of the Shenandoah River Basin, Virginia (Coleoptera:Elmidae)

HENRY H. SEAGLE, JR. AND ALBERT C. HENDRICKS
Virginia Polytechnic Institute and State University

Invertebrate samples (0.1 square meter) were taken at two sites in the South Fork of the Shenandoah Basin to determine the microdistribution of six species of elmidae beetles. Adults of *Stenelmis crenata*, *S. mera*, *Optioservus trivittatus* and *Microcylloepus pusillus aptus* were most abundant in riffles while *Dubiraphia minima* and *S. markeli* preferred pools and runs. The larvae of *D. minima* preferred pools and runs while larvae of the other species were most prevalent in riffles. The larvae of all species appeared to be more evenly distributed over the three areas (i.e., pools, runs and riffles) than the adults. Samples to determine the distribution within the riffle substrate showed that adults of *S. crenata* and *M. pusillus aptus* were evenly distributed throughout the substrate while *O. trivittatus* and *S. mera* preferred the bottom layer. The larvae of *S. crenata* and *O. trivittatus* were most abundant in the bottom layer while *M. pusillus aptus* were most prevalent in the upper rubble.

(4)

Macrodistribution of the Dryopoidea of the South Fork of the Shenandoah River Basin, Virginia (Coleoptera)

HENRY H. SEAGLE, JR. AND ALBERT C. HENDRICKS
Virginia Polytechnic Institute and State University

Dryopoid beetles form an important component of the lotic community on the basis of adult and larval abundance, species diversity and their role in the benthic community. A survey of these beetles in the South Fork of the Shenandoah River Basin was conducted from August, 1975, to July, 1976. Samples were collected at 10 stations, one each on three major tributaries and seven stations along the length of the South Fork of the Shenandoah River. Twenty-seven timed kick samples were taken at each station over the 12 month period. Fifteen dryopoid species in four families were collected. These beetles comprised as much as 50% of the riffle fauna with *Stenelmis crenata*, *Optioservus trivittatus*, *S. mera* and *Psephenus herricki* being most abundant. General trends in the macrodistribution were

a decrease in abundance and species diversity downstream. Longitudinal zonation was evidenced by the downstream decrease in numbers of *S. crenata*, *O. trivittatus*, *Dubiraphia minina* and *Promoresia elegans* and the increase in numbers of *S. mera* and *S. markeli*.

(5)

Differences in the Composition of Insect Communities in Small Streams in West Alabama

THOMAS N. RUSSO AND T. J. HILL

University of Alabama and U.S. Geological Survey

Ninety genera of aquatic insects were collected from nine riffles in streams draining the Pottsville and Coker geologic formations. Seasonal changes within riffles were indicated by measurements of richness and Multiple M, an index of similarity derived by McArthur (1972).

The average number of genera collected in the riffles during the spring was 20 and increased to 28 by the end of summer. Values of Multiple M indicated that changes occurred chiefly during the spring; values increased from 1.20 to 1.65 indicating greater dissimilarity. Differences in Multiple M values between Pottsville and Coker riffles were larger ranging between 1.44 and 1.63. The differences are a function of substrate size, shape, and hydrologic characteristics. Diversity averaged 3.7, but failed to show differences between riffles. Multiple M was more sensitive to changes between riffles (Pottsville and Coker) because it reflects the relative proportion of genera common to both communities.

(6)

Population Structure of the Symbiotic Water Mite, *Unionicola formosa* (Acarina: Unionicolidae)

EVERETT A. ROBERTS AND RONALD V. DIMOCK, JR.
Wake Forest University

Unionicola formosa inhabits various freshwater muscels including *Anodonta imbecilis*. In addition to harboring adult mites the host mussel serves as sites for oviposition and for transformational stages in the mite's life cycle. Twenty to forty ($\bar{X} = 24.5$) *Anodonta imbecilis* were collected monthly for one year and the symbiont's distribution assessed. Female mites occurred in highest density in July (43.4 ± 2.3 SE) and October (41.6 ± 2.1) and lowest in April (22.4 ± 2.4). Males were distributed approximately one per host, varying from highs of 1.65 ± 0.03 (February) and 1.64 ± 0.3 (October) to a low of 0.76 ± 0.9 in August. Nymphs were most abundant in May (4.64 ± 0.07) and least so in April (0.04 ± 0.2). The abundance of mite eggs in host gills increased from fall to spring, with larvae emerging in spring and summer. Quiescent transformational stages were present during summer and fall. The highly skewed ratio of females to males may be due in part to intraspecific aggression among males.

(7)

Mollusca of the Yalobusha River, Mississippi

CHARLES M. COOPER¹
University of Mississippi

The molluscan fauna of the Yalobusha River in north central Mississippi was examined over a three year period. Thirteen species of bivalves were collected in the river proper and three additional species were found in Grenada Reservoir at the confluence of the Skuna and the Yalobusha rivers. Community make-up as shown by species indicated three distinct habitats. *Carunculina parva* was the main inhabitant of the upper portion of the river with its sandy substrate and sluggish low flow; *Sphaerium rhomboideum* dominated the bivalves of the reservoir, and *Quadrula pustulosa*, *Proptera purpurata* and *Lampsilis clairbornensis* composed the majority of the Mollusca in the swift waters below the reservoir spillway. A comparison of the present fauna was made with the findings of Hinkley (1906) to determine composition changes since land use has changed and the river has been channelized. Eight of the species found were not reported by Hinkley while 13 of the species that he found were not collected during this study.

¹ Present Address: USDA-ARS-US Sedimentation Laboratory, Oxford, Mississippi.

(8)

A Grazer-Induced Microhabitat Along a Thermal Stream

CONRAD E. WICKSTROM
Emory University

RICHARD W. CASTENHOLZ
University of Oregon

Pleurocapsa minor and *Calothrix* sp. (Cyanophyta) constitute 71% (biomass) of the crustose mat found in some alkaline hot springs. The existence of this algal mat (35-50 C) coincides with the presence of an herbivorous ostracod, *Potamocypris* sp. *Calothrix* grew at about twice the rate of *Pleurocapsa* in culture throughout their coincidental temperature range (30-50 C). Considering growth rates and comparative growth strategies, *Calothrix* should exclude *Pleurocapsa* from this relatively stable environment. Algal bait experiments indicated that the compact cell aggregates of *Pleurocapsa* were more resistant to grazing than *Calothrix* filaments. Using mat thickness as indicator of grazing history, microtome sections showed thin mat to contain significantly more *Pleurocapsa* (71%) and less *Calothrix* (5%) than thick mat (27% and 42%, respectively). *Pleurocapsa* dominated the mat's substrate surface independent of thickness. These data infer that grazing prevents *Pleurocapsa* exclusion and that the realized microhabitat of *Pleurocapsa* within thermal streams is bounded by: 1) areas grazed to the near-extinction of *Calothrix* and 2) lightly grazed regions where *Pleurocapsa* is relegated to inner portions of the mat.

(9)

Salinity Ranges of Freshwater Glossiphoniid
Leeches (Annelida:Hirudinea:Glossiphoniidae)
in Louisiana

MARY G. CURRY AND JAMES E. LEEMANN
VTN Louisiana, Inc.

Various investigations on freshwater leeches suggest that certain glossiphoniids are especially sensitive to salinity, while others are comparatively more tolerant to saline conditions. Five species of freshwater glossiphoniids (*Helobdella elongata* Castle, *H. lineata* Verrill, *H. stagnalis* Linnaeus, *Placobdella montifera* Moore and *P. parasitica* Say) were collected from ten coastal bayous in southern Louisiana and/or from ten bayous in central Louisiana. The inland areas, however, were characterized by moderately high specific conductance due to the presence of dissolved salts, other than sodium chloride. Each habitat was monitored physiochemically for pH, specific conductance, chlorides, salinity, temperature, color, calcium, magnesium, total hardness, total alkalinity, dissolved oxygen and free carbon dioxide. Preliminary data suggest that the distribution of freshwater glossiphoniids in Louisiana is limited by salinity and not merely by high specific conductance when that parameter is high primarily due to the presence of dissolved salts, other than sodium chloride.

(10)

Responses of Isozyme Activities and Patterns
to Temperature Acclimation in Two Species of
Aquatic Snails

CHARLES R. PUGH, RONALD LINDAHL AND
GORDON ULTSCH
University of Alabama

Two species of the Pleuroceridae snail, *Goniobasis*, occur in Big Sandy Creek, Coaling, Alabama. *G. cahawbensis* is distributed throughout the upper creek, and *G. cochliaris* is restricted to a stenothermic region in and below the discharge of a large cold spring. It is of interest to know whether qualitative and/or quantitative biochemical adaptive responses account for the spatial distribution of species. Therefore, representative marker enzymes of the major metabolic pathways of these species were examined following acclimation to 10, 17 and 23 C. No significant temperature-dependent qualitative differences of enzyme phenotypes were demonstrable by starch-gel electrophoresis. Significant temperature-dependent quantitative differences have been observed for several enzyme systems including Malate Dehydrogenase and Glucose-6-Phosphate Dehydrogenase. The data suggest that major metabolic reorganizations occur during thermal acclimation. Whether these reorganizations interact with other factors to limit the range of *G. cochliaris* is at present unknown.

(11)

Population Trends in *Isohypsibius augusti*
(Murray) (Phylum Tardigrada) from the
Ocoee River, Copperhill, Tennessee

DIANE R. NELSON
East Tennessee State University

DEEDEE KATHMAN AND ERIC L. MORGAN
Tennessee Technological University

In December, 1976, a two-year study of the Ocoee River drainage in the Copperhill Basin, Tennessee, was initiated to evaluate water pollution abatement systems installed by Cities Service Corporation. At one of the 16 benthic sampling sites a population of *Isohypsibius augusti* was found in January, 1977, on the Kathman artificial substrate sampler. The site is above the effluent from Cities Service Operations and below an outflow of raw sewage from the town of Copperhill. Triplicate samples were taken bimonthly for one year, and one-month samples were collected in June, August, October and December. Seasonal trends in the population density and reproduction in *Isohypsibius augusti* were noted. Males, females with and without eggs and molting individuals were observed and photographed with the SEM. Frequency distributions of body lengths, buccal tube lengths and periods of ecdysis were determined. The population reached its peak in the late fall and was lowest in the summer.

(12)

Stability in a Large River System as Indicated by
Macrobenthic Invertebrate Replacement Rates

DAVID P. KLARBERG
Ferrum College

The macrobenthic invertebrates at seven stations in the relatively pollution-free upper New River basin were monitored during four consecutive summer surveys. The number of taxa present each year and the rates of replacement of taxa from year to year at each station were noted as indications of system stability and were in agreement with previously reported observations of both small and large lotic environments.

(13)

Trophodynamics of Sandy Beach Macrobenthos

FRANCIS J. REILLY, JR. AND VINCENT J. BELLIS
East Carolina University

Mechanical replenishment of beach sediments lost as a result of shoreline erosion (beach nourishment) was accomplished at Fort Macon State Park, Atlantic Beach, North Carolina during the winter of 1977-78. This paper reports results of a year-long 'prenourish-

ment' study of the macrofauna inhabiting the site. Bi-weekly coring and transect techniques were employed to obtain density, distribution, population and biomass data. The mole crab (*Emerita talpoida*) and the coquina clams (*Donax parvula* and *D. variabilis*) displayed the greatest numerical dominance, followed closely by the ghost crab (*Ocypode albicans*), lady crab (*Ovalipes ocellatus*), speckled crab (*Arenaeus cribrarius*) and an amphipod (*Haustorius canadensis*). *Donax* and *Emerita* proved to be important trophic links between suspended particulate organic matter and higher order carnivores. These latter two genera exhibited great density and biomass up to 99% of the total at their peak.

(14)

Non-taxonomic Characteristics of the Early Colonization Process of Aufwuchs in Artificial Streams

LAURENCE H. KAUFMAN, KENNETH L. DICKSON AND JOHN CAIRNS, JR.
Virginia Polytechnic Institute and State University

This research is part of a comprehensive investigation of non-taxonomic aspects of Aufwuchs colonization. A non-taxonomic approach to the study of early phases of colonization may offer several advantages over traditional Aufwuchs studies used in effluent assessment including no need for taxonomic expertise, shorter immersion times, less variability and quicker analyses. Accumulation patterns of ATP and chlorophyll *a* and their variability are reported from glass slides placed in artificial streams at Glen Lyn Power Plant at Glen Lyn, WV. In three separate experiments of ten days each, ATP accumulation patterns were quite similar to each other and showed an excellent fit to the MacArthur-Wilson Island Colonization Model ($Y = A - Ae^{-BX}$; $X = \text{days immersed}$). Among the same experiments chlorophyll *a* accumulation was much more variable and fit the regression $Y = AX^2 + BX + C$ substantially better than the MacArthur-Wilson Model. Funded by ERDA, Contract #E-(40-1)4939.

(15)

The National Wetland Inventory in Georgia: Status Report

FREDERICK P. PARIANI AND JOHN R. BOZEMAN
Georgia Department of Natural Resources

STEVEN L. OLIVER
Montana State University

This paper reports the regional application and testing of the National Wetland Inventory Classification Scheme in the South Atlantic States. An area of approximately 5600 square miles was mapped encompassing all wetland habitats as defined by the Service's Wetland and Deep-Water Classification Scheme. Using recent color infrared stereo-models, wetlands were delineated to within one-half acre, where photo scale permitted. Seasonal variation in spectral signature was juxtaposed both by utilizing October and April imagery and by scheduling a research period from July, 1977, to April, 1978. Aerial reconnaissance, ground truthing

and correlation with existing data were important processes in substantiating decisions.

Wetland classes, their acreages and regimes, have been digitized and machine-stored, facilitating updating procedures. User maps have been constructed at 1:100,000 scale and 1:24,000 scale maps will be offered in areas necessitating such detail. The inventory inherently provides the first step towards monitoring wetland alterations through time, thus creating new and promising research alternatives. Various applications, mapping conventions and major problems encountered will be discussed with a slide presentation. Supported by the Georgia Department of Natural Resources under contract with the U.S. Fish and Wildlife Service.

(16)

Remote Water Quality and Weather Monitoring in the Great Smoky Mountains National Park

RAYMOND C. MATHEWS, JR., RAYMOND HERRMANN AND RAYMOND BURGE
*Department of the Interior
National Park Service*

Water quality and weather data are being collected in the Great Smoky Mountains National Park by remote sensing instrumentation. Four Convertible Data Collection Platforms (CDCP) are interfaced with water quality and weather sensors and relayed at regular intervals (3 hours) by the Geostationary Operational Environmental Satellite (GOES) system.

The CDCP instrumentation has much potential as a research tool in the park because it can be deployed in remote areas where inaccessibility and lack of personnel and time hinder frequent time interval data acquisition. At present, water quality data (temperature, dissolved oxygen, pH, conductivity and oxidation-reduction potential) are being collected from two CDCP units in Abrams Creek in the park. These data, along with complimentary data on other physical and chemical parameters, macroinvertebrates and fish species compositions, are being used to determine the impact of cattle and other animals on the quality of the stream. Furthermore, weather data are being collected near one of the remote water quality sensing units and at the Uplands Field Research Laboratory in the Park. The weather data (temperature, wind speed, wind direction, relative humidity and rainfall) will be correlated to the water quality of Abrams Creek and a small stream near the Uplands Laboratory.

(17)

Benthic Communities and Zonation on Louisiana Outer Continental Shelf Fishing Banks

THOMAS J. BRIGHT
Texas A & M University

The major fishing banks of the Louisiana Outer Continental Shelf bear clearwater benthic communities with Caribbean and West Floridian affinities. Anthozoan and hydrozoan coral reefs are present on some of the Louisiana banks farthest from the Mississippi (Flower Gardens, 18 Fathom Lump, Sonnier Bank). Coralline algal nodules and crusts predominate on most other banks, accompanied by diverse assemblages of leafy algae, invertebrates and fishes. Sackett Bank, closest to

the Mississippi, harbours a comparatively depauperate benthic community having characteristics similar to communities occupying fishing banks off South Texas, which are subject to frequent influxes of turbid water and substantial sedimentation. In addition to commercial snappers and groupers, populations of spiny lobster occur on several of the Louisiana banks.

(18)

Annual Net Primary Productivity of Aboveground and Belowground Portions of *Juncus roemerianus* and *Spartina alterniflora*

JUDY P. STOUT

University of South Alabama and
Dauphin Island Sea Lab

Levels of net annual productivity of aboveground and root/rhizome portions of *Juncus roemerianus* and *Spartina alterniflora* were determined for two Alabama salt marshes. Total plant net annual productivity (dry wt. m^{-2}) of *J. roemerianus* was 10,565 g of which 71% was contributed by belowground portions. Root/rhizome material provided 75% of the 8,247 g net annual productivity of *S. alterniflora*. Belowground biomass did not vary significantly from month to month and a slightly negative correlation between aboveground and belowground biomass production was demonstrated.

(19)

Stability of pH and Nutrient Concentrations in Precipitation in Field Collectors

ROBIN BROWN AND GEORGE WEAVER
Southern Illinois University

The stability of pH values and nutrient concentrations in precipitation in gauges prior to collection was investigated in order to determine the proper sampling interval. Six gauges, three under the canopy of an upland oak-hickory forest and three in an adjacent open field, were used. Collections of precipitation from the gauges were made at various times, from one hour to two weeks, following three storms. The collection made within the first hour had a pH range of 5.50-6.50 in throughfall and 4.00-4.25 in bulk precipitation. After forty-eight hours in the gauges the pH decreased to range of 5.00-6.10 below the canopy and increased to 4.10-4.60 in the collector in the field. Thereafter, values were generally stable from forty-eight hours to two weeks. The concentrations of nutrients (K, Mg, Ca) were generally stable throughout the two week period for both throughfall and bulk precipitation. The data indicates that pH values of rainfall must be measured immediately following a storm while analysis of nutrient concentration may be delayed for up to two weeks.

(20)

An Intuitive Technique for Estimating the Productivity of Vascular Flora in Temperate Marshes

COURTNEY T. HACKNEY
Mississippi State University

This technique combines the intuitive appeal of the max-min technique and the necessity for accounting for loss of material during the year with rigorous mathematical analyses. The changes of live plant biomass are fitted to a one-term periodic model.

$$y_1 = a_0 + \alpha_1 \cos(cx_1) + \beta_1 \sin(cx_1) + e_1$$

where

y_1 = dependent variable (live biomass)

a_0 is a constant parameter

α_1, β_1 are coefficients of the harmonic functions of x_1

$c = 2\pi/n$

x_1 = i th independent variable

e_1 = error

The use of this one term harmonic model is easily explained as the effect of the annual growing cycle on the plant community.

An asymptotic exponential model

$$y_1 = c(1-e^{-bx})$$

where

y_1 = dependent variable (dead plant material)

c = asymptote (total dead biomass at end of season)

b = instantaneous death rate

x = time

is fitted to the changes of dead material during the growing season.

The reliability, data requirements, assumptions and advantages of this technique are discussed through the use of an example.

(21)

The Germination Strategy of Oldfield Aster (*Aster pilosus* Willd.)

JERRY M. BASKIN AND CAROL C. BASKIN
University of Kentucky

Seeds of *Aster pilosus* germinated to high percentages at high temperatures (30/15, 35/20 and 40/25 C) in light, at maturity in November. Stratification during winter lowered the temperature requirement for germination, and high percentages of germination were obtained in light at 15/6 and 20/10 C, as well as at 30/15, 35/20 and 40/25 C. Stratification in darkness was completely ineffective, and stratification in light was only partially effective, in overcoming the light requirement for germination. Inability of seeds to germinate at low temperatures prevents germination after dispersal in late autumn and winter, when freezing temperatures would kill the seedlings. The lowering of the temperature requirement for germination during winter stratification allows the seeds to germinate and the resulting vegetative rosettes to become well established before the onset of the periodic summer droughts that occur in habitats occupied by *A. pilosus*.

(22)

Variation in Biomass and Leaf Area of Selected Mid-Canopy Species in Southern Illinois

R. KENT O'DELL AND JAMES S. FRALISH
Southern Illinois University

Variation in aboveground biomass and leaf area across a range of site conditions in the Shawnee Hills Region of southern Illinois was investigated for selected mid-canopy species. Species studied were *Amelanchier arborea*, *Staphylea trifolia*, *Lindera benzoin*, *Vaccinium arboreum*, *Cornus florida*, *Ostrya virginiana*, *Cercis canadensis* and *Asimina triloba*. Density and basal stem diameters were obtained using circular quadrats. For each species, at least 3 individuals in each of 5 size classes were harvested and used to develop regression models to estimate aboveground biomass and leaf area using basal stem diameter as the independent variable.

(23)

Vegetation Responses to Chronic Wastewater Application

E. J. HUNT AND D. J. SHURE
Emory University

Herb-shrub layer vegetation was studied throughout the 1976 growing season to assess the effects of chronic wastewater disposal on an early pine forest in South Carolina. Wastewater application produced a more mesic environment and an earlier successional herb-shrub layer community. Vegetation diversity decreased in treated areas because one or two species strongly dominated the few species present. Peak vegetation biomass levels doubled, and the rate of net primary production was ten times greater in treated areas. However, litter biomass levels did not change significantly. Litter decomposition rates were much greater in treated areas and apparently offset the added litter resulting from increased plant production. Soil analyses indicated that nutrient leaching was pronounced in the sandy spray areas. Apparently, periodic nutrient pulses maintain the vegetation community in an arrested seral stage.

(24)

Relationships Between Occupied Space, Size and Reproduction Effort in *Andropogon ternarius* Michaux (Poaceae)

JOHN E. PINDER, III AND GRANT C. CARRINGTON
Savannah River Ecology Laboratory

To determine whether the size or reproductive effort of *Andropogon ternarius* was related to the space occupied by the individual, we mapped the locations of all individuals within a 2m X 3m plot and wrote a computer program to construct polygons about each individual which contained all the points nearest to that individual. The program also computed the area of the polygon. The diameter at base, leaf weight, the number and weight of flower stalks and the weight of seeds

were determined for each individual, and correlation coefficients between these measures and the areas of the polygons were computed to evaluate the importance of occupied space.

(25)

An Ecological Study of Bald Cypress (*Taxodium distichum*) Along a North Carolina Shoreline

CYNTHIA E. BLANCK¹ AND VINCENT J. BELLIS
East Carolina University

Estuarine shoreline erosion in North Carolina is least evident along bald cypress (*Taxodium distichum*) swamps or where the eroding bank is protected by an offshore bald cypress fringe. Field studies indicate that the bald cypress in these areas act as natural buffers which dissipate storm wind and wave energy as much as 69% and thus retard shoreline erosion. The current practice of bulkheading exposed shoreline alters near-shore sediment flow patterns and prevents the accretion of sandy beaches required for bald cypress germination and re-establishment. Plant growth chamber studies were undertaken to determine seedling responses of bald cypress and its co-dominant tupelo gum (*Nyssa aquatica*) to selected light intensities. Factors investigated were: 1) seed germination — temperature response; 2) seedling growth rates as measured by: change in height, total leaf area, mean chlorophyll concentrations, wet and dry weights, biomass partitioning, diameter and 3) photosynthetic rates.

¹ Present Address: University of South Carolina

(26)

Residence Time and Transpiration Rate of Tritiated Water in a Young *Pinus taeda* L. Plantation

JEFFREY C. LUVALL AND CHARLES E. MURPHY, JR.
Savannah River Ecology Laboratory, University of Georgia and Savannah River Laboratory

Transpiration rate and residence time of injected tritiated water was determined for two seven year-old *Pinus taeda* L. trees in a plantation growing on sandy-loam soils at the Savannah River Plant near Aiken, S.C. Also, distribution of tritiated water in the free water phase was determined for needles and woody components. Each tree received 1 ml of tritiated water (1×10^8 dpm activity) volumetrically pipeted into each of three 0.5 cm diameter and 5 cm long stainless steel tubes inserted at a 45° angle to a depth of 2 cm in the tree trunk, 30 cm above ground. Each tube was sealed in the trunk with caulking and a septum was used to seal the open end. On each tree six branch ends were covered with clear plastic bags from which condensation was collected for counting. In addition, needles and core samples were taken and moisture extracted by freeze-drying. All samples were counted using standard liquid scintillation procedures. This represents one phase of a project to determine energy-water balances for *P. taeda* plantations in the southeast.

(27)

Ecotypic Differentiation in Ohio and Mississippi Populations of *Acer negundo* L. (Aceraceae)

ANTHONY GRECO AND JOE E. WINSTEAD
Western Kentucky University

Laboratory investigations of *Acer negundo* populations from two widely separated habitats revealed distinct patterns of ecotypic differentiation in patterns of bud burst, leaf fall and levels of chlorophyll. Second year seedlings of Mississippi seed origin had complete leaf emergence before any evidence of bud bursting in the Ohio progeny of similar age. Leaf fall patterns showed a clear difference between the two populations with Ohio plants showing leaf fall 2.5 weeks prior to complete defoliation in the Mississippi progeny. Significant differences in chlorophyll levels were demonstrated with the more northern (higher latitude) Ohio population showing consistently greater amounts of chlorophyll per gram dry weight than the more southern (lower latitude) Mississippi populations. The chlorophyll differences were consistent as the individual plants aged during the test and were also found in comparing first and second year old seedlings. Examinations at the ultrastructural level revealed significant differences in the numbers of starch particles per cell with higher averages in the Ohio population.

(28)

Litter Accumulation in Four Plant Communities in the Dismal Swamp, Virginia

FRANK P. DAY, JR.
Old Dominion University

The quantity and quality of leaf and wood litter were determined for four plant communities in the Dismal Swamp. The communities included a mixed oak (*Quercus* spp.) stand, a maple-gum (*Acer rubrum* — *Nyssa* spp.) stand, a cypress (*Taxodium distichum*) stand and an Atlantic white cedar (*Chamaecyparis thyoides*) stand. Woody litter ranged from a minimum of 8428 kg ha⁻¹ in the mixed oak stand to a maximum of 50,147 kg ha⁻¹ in the cedar stand. The ranking of sites based on quantity of leaf litter was reversed with 4028 kg ha⁻¹ in the cedar stand and 5484 kg ha⁻¹ in the mixed oak stand. The decreasing quantity of leaf litter was examined in winter, spring and late summer, and species composition was evaluated. Comparisons were made between the standing crops of litter and annual leaf production, measured by regression estimates of biomass and also by litter fall collections.

(29)

The Relationship Between Plant Species Diversity, Community Biomass and Plant Nutrient Concentrations

NANCY L. OSTMAN AND GEORGE T. WEAVER
Southern Illinois University

This study explores the relationships between a heterogeneity index, species richness and nutrient concentra-

tions in plants and above ground plant biomass in a successional community. Biomass and diversity were determined for one meter square plots on a clearcut after two and one-half growing seasons. The study area was a former upland oak-hickory forest in the Shawnee National Forest, Union County, Illinois. Species richness in conjunction with a heterogeneity index was a significant predictor of the total plant biomass on the plots. The six mineral concentrations in three plant species did not vary systematically with either biomass or diversity on plots. Nutrient concentrations were significantly distinct among plant species. The findings seem to indicate that maximum biomass is produced with decreased species equitability and increased species number.

(30)

Structural and Functional Aspects of Litterfall Production in Oak-Hickory Forests of the Ozark Hills, Illinois

JOHN A. PEARSON AND GEORGE T. WEAVER
Southern Illinois University

The relationship of litterfall biomass and mineral-mass production for 8 elements (Ca, K, Mg, Mn, Al, Fe, Zn, Cu) to topography, aspect, slope, basal area and species composition of the stand are investigated in oak-hickory forests of southwestern Illinois. Seasonal changes in mineral composition of the litterfall are also discussed.

(31)

Preliminary Observations on the Ecology of *Litsea aestivalis* (L.) Fern. (Lauraceae)

DOUGLAS A. RAYNER
South Carolina Wildlife and Marine Resources Department

Twenty sites containing *Litsea aestivalis*, pondspice, were recently found in a 480 hectare tract between U.S. 278 and the Colleton River in Beaufort County, South Carolina. Potential sites were found by means of infrared aerial photos. Thirty-five sites were examined. All sites examined were: 1) wet depressions, 2) oriented in a northeast-southwest direction (except, of course, for the circularly shaped sites), 3) surrounded by Florida scrub vegetation and 4) highly acidic. Sites varied as to: 1) shape (circular, elliptic or oblong), 2) size (from 0.04 to 18.6 hectares), 3) canopy closure (0-80%), 4) amount and duration of standing water, 5) herbaceous associates and 6) exposure to ground fire. Amount and duration of standing water are the critical factors in the establishment of the species. Light intensity plays a very minor role. The role of ground fire is somewhat nebulous; it plays no part in establishment and, seemingly, has no effect on abundance.

(32)

Water Relations of Plants Grown on Strip-mine Spoils Treated with Sewage Sludge

TAYLOR C. SCOTT, III
Southern Illinois University

Water stress investigations were conducted on cottonwood, green ash, sycamore, black alder, orchardgrass, switchgrass and tall fescue which were grown on extremely acidic strip-mined land that had been treated with sewage sludge. Xylem water potential was measured on a weekly basis throughout the summer of 1977 on leaves of each species using a Scholander pressure bomb. Species responses to stress showed considerable variation. Root distributions showed little variation but were severely distorted as a result of the soil profile caused by the mining operation and sludge applications at the Palzo site. Therefore variation in water potential is probably due to individual species ability to adjust to drought conditions.

(33)

Compositional and Soil-Site Characteristics of a *Ribes echinellum* (Saxifragaceae) Community

STEVEN M. JONES AND B. ALLEN DUNN
Clemson University

There are only two known populations of *Ribes echinellum* in the United States. One population is located in the 53-hectare Stevens Creek Natural Area in McCormick County, South Carolina. The species is classified as nationally endangered. Results indicate the population is primarily restricted to and most abundant within the mixed mesophytic hardwood forest of mesic, northerly slopes. Within the *Ribes* community, data were obtained on overstory, understory, shrub and herbaceous strata. The overstory was dominated by *Ulmus rubra*, *Carya glabra* and *Quercus alba*, while basal area levels ranged from 10 m²/ha to 32 m²/ha, with a mean of 24 m²/ha. Mean density of *Ribes* was found to be 54,000 stems/ha and ranged from 13,000 stems/ha to 161,000 stems/ha. Community structural and compositional aspects and relationships to soil-site characteristics were examined. Although the species is very localized, the population at Stevens Creek is apparently stable and maintaining itself.

(34)

The Effects of Multiple Air Contaminants on Loblolly Pine (*Pinus taeda* L., Pinaceae)

R. T. GORMAN AND C. E. ANDERSON
North Carolina State University

Air pollution in the area of two industries is injuring numerous trees of *Pinus taeda* L. The major emission in the area is biphenyl which apparently does not kill pine trees independently. However, biphenyl applied in

conjunction with small doses of other pollutants from the area such as aniline, acetic acid or acetic anhydride induces symptoms similar to those seen in the field. The nature of this interaction will be discussed.

(35)

Analysis of Reproductive Hormones and Plasma Lipid Levels Associated with the Migration of the Striped Mullet, *Mugil cephalus* L.

JOHN DINDO, ROBERT MACGREGOR AND GEORGE CROZIER
University of Alabama in Birmingham

Mugil cephalus, a ubiquitous estuarine fish, makes an annual migration to the open sea to spawn. The specimens for this project were caught within the lower and middle reaches of Mobile Bay. Monthly samples of the reproductive steroids (testosterone and estrogens) were analyzed for a one year cycle utilizing a radioimmunoassay technique. Plasma lipid levels were analyzed by use of standard clinical methods utilizing spectrophotometry. Initial analysis shows that male plasma testosterone levels begin a rapid rise from April through August. Females showed a slight rise in plasma estrogens from March to May followed by a decline in July. The gonadal somatic index at this time does not reflect early steroid production. The plasma lipids, total lipids and triglycerides, show a rise from April with a peak being attained in June for both males and females. Cholesterol, however, shows a decrease in level from April to June for both males and females. A peak in reproductive steroids is predicted for November with spawning to occur at the end of December and early January.

(36)

Changes in Adenylate Energy Charge of *Corbicula manilensis* (Pelecypoda) Foot Muscle Tissue Due to Cadmium Exposure

RICHARD D. BINGHAM, C. S. DUKE AND J. P. GIESY
Savannah River Ecology Laboratory

Adenylate energy charge $\left(\frac{\text{ATP} + \frac{1}{2} \text{ADP}}{\text{ATP} + \text{ADP} + \text{AMP}} \right)$ in *Corbicula manilensis* foot muscle tissue was dependent on animal size and acclimatization to laboratory conditions and exposure to cadmium chloride. Larger clams (3.1-4.0 g shell weight; in second year of growth) extracted in the field, immediately after collection have lower energy charges than smaller clams (1.6-2.1 g shell wt, in first year of growth). The mean energy charges and 95% confidence intervals (n = 4) of these two groups were 0.700 ± 0.61 and 0.844 ± 0.038 respectively. The energy charge of larger animals, acclimated and fed in the laboratory, increased to 0.91-0.94. Exposure to cadmium chloride significantly decreases energy charge. Methods of adenylate extraction and analysis are presented.

(37)

Effects of Cadmium on Adenylate Energy Charge in the Crayfish, *Procambarus pubescens*

CLIFFORD S. DUKE, J. P. GILSY, G. W. DICKSON,
G. J. LEVERSEE AND R. D. BINGHAM
Savannah River Ecology Laboratory

Adenylate energy charge $\left(\frac{ATP + \frac{1}{2}ADP}{ATP + ADP + AMP}\right)$ was measured in tail muscle crayfish in the field, after laboratory acclimation and after exposure to 10 and 30 $\mu\text{g/l}$ Cd as cadmium chloride. Adenylate energy charge is a sensitive measure of Cd stress in crayfish with Cd causing significant reduction in adenylate energy charge after only short exposure. Methods of enzyme inactivation and adenylate measurement are presented.

(38)

Isozyme Variation in the Eastern Brook Trout, *Salvelinus fontinalis* (Mitchell)

WILLIAM F. BRANDES, JOHN W. HARRIS AND
R. DON ESTES
Tennessee Technological University

Eastern brook trout were electrophoretically examined for 10 different proteins. Three enzymes, phosphoglucose isomerase (PGI), isocitrate dehydrogenase (IDH) and lactate dehydrogenase (LDH), extracted from liver and muscle tissues, were found to be polymorphic at one or more loci. Significant differences in allelic frequencies were found between the 13 allopatric populations sampled. A high degree of polymorphism was observed at the PGI-1 locus, where four alleles were identified. Populations from the Great Smoky Mountains National Park were fixed for loci observed to be polymorphic in other populations sampled. It is hypothesized that this lack of genetic variation is due to a high degree of inbreeding characteristic of the small brook trout populations present in the Park.

(39)

The Genetic Control of Isocitrate Dehydrogenase Isozymes in Brook Trout, *Salvelinus fontinalis* (Mitchell)

JOHN W. HARRIS AND WILLIAM BRANDES
Tennessee Technological University

Liver samples were collected from 13 allopatric brook trout populations throughout the eastern United States and Utah. The samples were extracted and subjected to starch gel electrophoresis, and the gels were stained for isocitrate dehydrogenase (IDH). The results indicate that IDH in brook trout is a dimer coded for by two different loci. A total of four alleles were identified on the basis of the observed migration rates of the homodimers composed of the subunits which the various alleles specify. The data suggest that at least two of the alleles occur at both loci. The distribution of alleles at each locus was found to vary with the population.

(40)

Egg and Prolarval Development of Striped Bass, *Morone saxatilis* (Walbaum), Exposed to Ozone Produced Oxidants in Fresh and Estuarine Water

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STUART L. MARGREY
*Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory*

ANN ROSENKRANZ
*University of Maryland
Chesapeake Biological Laboratory*

Twelve hour old striped bass eggs were exposed to ozone produced oxidant (OPO) concentrations of 0.00, 0.005, 0.01, 0.05 and 0.10 $\text{mg} \cdot \text{l}^{-1}$ in both fresh and estuarine water (3.5‰) under continuous-flow bioassay conditions at 17-18 C. The effect of OPO was evaluated at two egg development stages (24 and 42 hr after fertilization) and two prolarval stages (24 and 48 hr after hatch). Observations were thus made at 24, 42, 72 and 96 hours after fertilization. Control eggs (0.00 $\text{mg} \cdot \text{l}^{-1}$ OPO) hatched approximately 48 hours after fertilization. Condition and hatching success were observed, as well as survival. Subsamples of surviving organisms were placed at each observation period in non-ozoneated water to observe recovery, while non-exposed organisms were placed in each test concentration to evaluate the sensitivity of the various developmental stages.

The following results were found: 1) OPO was more toxic in fresh water than in estuarine water; 2) eggs were more resistant than prolarvae in both fresh and estuarine water; 3) delayed hatching occurred in eggs exposed to 0.05 and 0.10 $\text{mg} \cdot \text{l}^{-1}$ OPO in estuarine water and 4) survival of delayed hatch organisms was greater than that of hatched larvae at the same developmental stage. Supported by U.S. Environmental Protection Agency Grant No. R804683010.

(41)

The Effects of Geographic Location on the Temperature Preference of the White Perch (*Morone americana*)

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*University of Maryland
and
Frostburg State College*

Temperature preference tests were conducted on freshwater white perch (*Morone americana*) collected from the following geographic areas: Albemarle Sound, N.C.; Wicomico River, Md.; and Mullica River, N.J. Acclimation temperatures used in temperature preference tests were 6, 12, 18, 24, 30 and 33 C and collection temperatures for each population were 25 C (± 2 C). The calculated final temperature preference using linear regression for North Carolina, Maryland and New Jersey populations was 32.35, 28.87 and 29.60 C, respectively.

(42)

A Function of Seasonal Temperature Cycles During the Gonadal Cycle of *Fundulus grandis* (Pisces: Cyprinodontidae)

MARK GREELEY AND ROBERT MACGREGOR, III
University of Alabama in Birmingham

A seasonal rise in the gonadosomatic index (GSI), plasma testosterone in males and plasma estrogens in females of *Fundulus grandis* is directly associated with increasing water temperatures from winter through spring. A rapid reduction in gonadal activity is observed during the warmer summer months.

To identify a role of temperature in gonadal activity, male *F. grandis* were maintained in six groups at various temperatures (12 C, 24 C or 29 C) and salinities (5‰; 25‰) during May. All fish held at 24 C showed significant gonadal growth (GSI: 0.485 ± 0.048) and increased plasma testosterone ($3,342 \pm 1,595$ pg/ml) above the pretreatment controls (GSI: 0.305 ± 0.088 ; testosterone: 271 ± 123 pg/ml). Those fish held at 29 C had a reduction in gonadal size (GSI: 0.108 ± 0.02) with no change in plasma testosterone concentration. The gonadal activity of fish held at 12 C was influenced by the salinity condition. Fish in high salinity (25‰) tended to have a reduced GSI (0.181 ± 0.02) without a change in plasma testosterone. However, fish in low salinity (5‰) had a significant increase in plasma testosterone ($1,700 \pm 129$ pg/ml) without a change in the GSI.

These data indicate that the temperatures experienced by *Fundulus grandis* during the spring are conducive to gonadal recrudescence and that the warmer months of summer are capable of inducing gonadal regression. The effects of cold temperature on gonadal activity can be modified by the ambient salinity.

(43)

Relationship of ATP and Glucose Levels in the Bluegill, *Lepomis macrochirus* (Centrarchidae)

STEVEN E. BYRNE AND C. B. COBURN, JR.
Tennessee Technological University

This study investigated relationships between ATP and glucose levels in the epaxial muscle of bluegill (*Lepomis macrochirus*). ATP was measured using the hexokinase system, while a modified Folin and Wu method was used to measure glucose. Liver weight, gonadal development and several other physical and physiological parameters were also measured and evaluated.

The results indicated that gonadal development and spawning had more of an impact on energy compartments than did temperature during the 1977 spring and summer. Prior to spawning, the gonosomatic index and liver-somatic index rose followed by a decline after spawning. The data also indicated that muscle ATP was reduced after each spawn. It was possible to tell the time of spawning by observing female gonad fluctuations during the study.

(44)

Effect of Temperature and Calcium on Electrolyte Regulation in Channel Catfish Acclimated to Various Salinities

CHERYL A. GOUDIE AND KENNETH B. DAVIS
Memphis State University

Addition of calcium to water has been implicated in reducing electrolyte imbalance which often accompanies various types of stress in fish. Tissue sodium and chloride levels and intra-extracellular water distribution was compared in channel catfish acclimated to 0, 7.5 and 11 g/liter sodium chloride in aged tap water and in calcium enriched (1.07 g/liter CaSO₄) tap water. In fish from 7.5 g/liter sodium chloride low in calcium, slight elevations in plasma sodium and chloride, chloride space and muscle sodium occurred, but muscle water decreased when compared to those in 0 g/liter. These effects were more dramatic in fish held in 11 g/liter sodium chloride. Fish held in calcium enriched tap water at 0 and 7.5 g/liter sodium chloride revealed no apparent differences in these parameters. Elevations in 11 g/liter sodium chloride in calcium enriched water were not as dramatic when compared to 11 g/liter sodium chloride in aged tap water. These data suggest that the presence of calcium diminishes the effects of high salinity at 10 C. Similar experiments at 23 C indicate that temperature may modify the protective effects of calcium.

(45)

Factors Associated with Seasonal Variations in Bluegill Nucleic Acid Levels, I. Temperature, Sex, Gonadal Development and Spawning

MICHAEL E. ZEMAN, JAMES R. WINNINGHAM AND FRANK J. BULOW
Tennessee Technological University

This study was designed to: 1) record monthly levels of bluegill (*Lepomis macrochirus*) liver and epaxial muscle RNA and DNA for an entire annual cycle and 2) analyze certain factors which may affect these levels. Monthly samples of 20 bluegills were collected from a central Tennessee lake from December, 1976, through November, 1977. Liver and muscle tissue nucleic acid levels were determined for each fish; gonadal development was monitored using the gonosomatic index; and spawning activity was recorded by observation and seining. RNA, DNA and RNA-DNA ratio data are presented with an analysis of the effects of temperature, sex, gonadal development and spawning.

(46)

Factors Associated with Seasonal Variations in Bluegill Nucleic Acid Levels, II. Feeding, Growth and Condition

JAMES R. WINNINGHAM, MICHAEL E. ZEMAN, FRANK J. BULOW AND WILLIAM F. HUDSON
Tennessee Technological University

The relationships between RNA-DNA ratios of bluegill (*Lepomis macrochirus*) liver and epaxial muscle tissues and feeding, growth and condition were investi-

gated. Monthly samples of 20 bluegills were collected from a central Tennessee lake from December, 1976, through November, 1977. For each fish, the following factors were analyzed: 1) liver and muscle tissue nucleic acid levels using the orcinol and diphenylamine reactions, 2) feeding activity using stomach analysis, 3) growth in length using scale samples and 4) index of condition using the condition factor. Data are presented with an analysis of possible relationships.

(47)

The Histological Response to Phytohaemagglutinin (PHA) Injection in the Wattle of the Chicken

FRED M. McCORKLE, IMRE OLAH AND BRUCE GLICK
Mississippi State University

Phytohaemagglutinin (PHA), 100 μ g, was injected into the wattle of chickens and histological changes were studied by light and transmission electron microscopy. Primary changes occurred in the vicinity of the postcapillaries. Various granulocytes and mononuclear cells became prominent between 12 and 24 hours. Granulocytic and mononuclear cells were scattered throughout the wattle, while lymphocytes were restricted to the vicinity of the postcapillaries. Lymphocyte numbers increased 48 hours after PHA injection while the number of granulocytes declined. Multinucleated cells were found and appeared to be formed by fusing of cell membranes of mononuclear cells. Before lymphocyte infiltration, many small lymphocytes could be seen in the wall of the postcapillaries indicating their origin as blood borne. The swollen endothelial cells of postcapillaries, caused by PHA, are similar to that of normal postcapillaries occurring in the T-cell dependent areas of mammalian lymph nodes.

(48)

Blood Chemistry Profile of Bursectomized and Intact Chickens

TERRY TREADWAY AND MARION WELLS
Middle Tennessee State University

Blood serum from bursectomized and intact chickens three to eight weeks of age were assayed for fourteen blood chemistries. The blood profile for the two groups of chickens is discussed.

(49)

Prostaglandin Levels in the Avian Bursae of Fabricius and Thymus

KIM WORKING AND MARION WELLS
Middle Tennessee State University

Prostaglandins $F_{1\alpha}$, $F_{2\alpha}$, E and E_2 were extracted from the avian bursae of fabricius and thymus and were quantitatively determined at weekly intervals for seven weeks post-hatch. The relationship of prostaglandin levels to immunological development and control mechanisms is discussed.

(50)

Isoelectric Focusing of Thrombocyte Membrane Proteins from Chemically Bursectomized and Intact Chickens

PETER KARL AND MARION WELLS
Middle Tennessee State University

Thrombocyte membrane proteins from chickens were separated by isoelectric focusing. Protein patterns were used to characterize thrombocytes from bursectomized and intact chickens.

(51)

The Toxicity of Ozone Produced Oxidants to Adult White Perch, *Morone americana* (Gmelin)

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Chesapeake Biological Laboratory*

LEONARD B. RICHARDSON AND DENNIS T. BURTON
*Academy of Natural Sciences of Philadelphia,
Benedict Estuarine Research Laboratory*

Acute toxicity bioassays were conducted on adult white perch, *Morone americana* (Gmelin), exposed to several concentrations of ozone produced oxidants (OPO) under continuous flow conditions at 15 C. The 24-, 48- and 96-hour LC50's were 0.36, 0.25 and 0.22 mg/l OPO, respectively.

Sublethal response and recovery studies were also conducted on white perch at 15 C. The fish were exposed to 0.00, 0.01, 0.05, 0.10 and 0.15 mg/l OPO for 96 hours and subsequently transferred to non-ozonated water for observation up to 14 days. Blood pH, hematocrit and gill histopathology were studied every 24 hours during the 96-hour exposure period and at days 4 and 14 during recovery. Significant decreases in blood pH and increases in hematocrit were observed over the 96-hour exposure period on fish subjected to OPO concentrations of 0.10 and 0.15 mg/l. Both parameters returned to pre-exposure levels by day 4 of recovery. Histological changes in the gill occurred within 24 hours of exposure at all concentrations studied; various degrees of gill repair were evident by day 14 of recovery. Supported by the U.S. Environmental Protection Agency Grant No. R804683010.

(52)

Evidence for an Attachment Stage in the Life Cycle of Oxymonad Flagellates in the Termite, *Reticulitermes flavipes* Kollar

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University of Alabama and University of Illinois, Chicago

The existence of an attached stage in the life cycle of oxymonad flagellates which inhabit the hindgut of the termite *Reticulitermes flavipes* reported by Porter (Bull. Mus. Comp. Zool., Harvard, 31:47, 1897) has been confirmed. Attached flagellates do not contact the hindgut lining but are secured to the cuticle by short fibers extending from finger-like projections of the at-

attachment organelle. The attachment organelle is a membrane-bound extension at the anterior end of the flagellate and includes part of at least one of the recurrent flagella. These organelles vary in length from short structures with highly ridged surfaces to elongated structures with smaller diameters and less ridged surfaces. The interior of the organelle is filled with microfilaments oriented parallel to the long axis. These microfilaments originate from larger fibers which radiate from at least one basal body and flagellar axoneme located at the base of the organelle.

(53)

The Elusive Macrothricid Cladoceran,
Ilyocryptus, in the United States:
A Range Extension Now Including
the New World and Introduction of
a New Species

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Academy of Natural Sciences of Philadelphia

Members of the genus *Ilyocryptus* either live on, or burrow in, soft, detrital bottom sediments of lakes and rivers. This has probably been the key reason for their virtual obscurity in zooplankton and meiobenthic literature. *Ilyocryptus agilis* Kurz, 1878, once considered a rare European form, has recently been found in large numbers in the Potomac River, Maryland. This represents a new record for the New World. A new species, *I. gouldeni* Williams, 1977, closely resembles the cosmopolitan *I. sordidus* Leiven, 1848, and cohabitates with the other members of this genus on the eastern coast of the United States.

(54)

Habitat Notes and Larval and Pupal Descriptions
of the Fishfly, *Neohermes concolor* (Davis)
(Megaloptera: Corydalidae)

DONALD TARTER, DAVID WATKINS AND PAUL HILL
Marshall University

DAVID ETNIER
University of Tennessee

Three eastern genera of fishflies, *Chauliodes* Latreille, *Nigronia* Banks and *Neohermes* Banks, are found in the subfamily Chaulioidinae. Three species of the genus *Neohermes*, *N. angusticollis* (Hagen), *N. concolor* (Davis) and *N. matheri* Flint, have been reported from the Eastern United States. Based on adult males, *Neohermes concolor* has been recorded from 13 states in the central and northeastern parts of the Eastern United States. In 1903, Davis described the adult of *Chauliodes* (= *Neohermes*) *concolor* from Ithaca, New York. The larvae and pupae of *N. concolor* have never been collected in the field. On 16 April, 1977, three larvae were collected under leaf litter in a spring seep in the Cherokee National Forest in Tennessee and returned to the laboratory at Marshall University. Following pupation, the adult male and female fishflies emerged and were associated with larval characteristics. Observations on the morphology and habitat of the larvae and pupae are presented in this investigation.

(55)

Three New Species of Protura (Insecta) from
Highlands, North Carolina

T. P. COPELAND
East Tennessee State University

Three new species of Protura (Eosentomidae) belonging to the genus *Eosentomon* are described. They are *Eosentomon nelsoni*, *E. janei* and *E. glenfallsi*. All belong to the wheeleri group of Bonet-Tuxen and the 3:1:1 subgroup of Copeland.

(56)

The Significance of Cave Mud Sediments in
Mortality, Growth and Food Preference of the
Troglotic Amphipod Crustacean,
Crangonyx antennatus

GARY W. DICKSON¹
Old Dominion University

Newly released juveniles of the cave-dwelling amphipod, *C. antennatus*, were reared in the laboratory for a period of 24 months on three different substrates: cave mud sediments, maple leaves (*Acer saccharum*) and small gravels. Mortality rates indicate that *C. antennatus* does not require cave mud sediments as a food source and thus does not possess the highly specific food relationship found in another troglotic amphipod, *Niphargus o. virei*. Body length, integument coloration and the number of first antennal segments per unit body length were observed to differ between juveniles reared on different substrates. In food preference experiments, both juvenile and adult *C. antennatus* were attracted to leaves rather than to cave mud sediments. Leaf detritus and the associated microorganisms represent a complete and attractive food source for *C. antennatus* indicating ecological flexibility in this troglotic species.

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(57)

Mechanisms Mediating Trail Following by the
Mud Snail, *Ilyanassa obsoleta*
(Prosobranchia: Neogastropoda)

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Wake Forest University

Upon intersecting a conspecific's mucous trail *Ilyanassa obsoleta* pursues the trail away from its origin. The mechanism guiding trail following apparently is distinct from that mediating the detection of the directionality of trails as evidenced by snails following a trail to its end regardless of which end of the trail a snail is placed upon initially. Since snails follow trails and respond to their polarity even when in contact with the underside of a trail, neither trail following nor detection of direction is guided by the morphology of a trail's surface. *Ilyanassa* is capable of distinguishing a conspecific's trail from a self-deposited one and the fresher of two trails differing by as little as 5 minutes in age. These results and data on the specificity of trail follow-

ing suggest that these responses are mediated by chemical cues. These cues and the chemoreceptors involved in their detection are being investigated.

(58)

A Preliminary Report on the Genus *Pleuroloma*
(Diplopoda: Polydesmida: Xystodesmidae)

ROWLAND M. SHELLEY
North Carolina State Museum

The milliped genus *Pleuroloma*, a member of the tribe Rhysodesmini, has the largest range of any xystodesmid genus — the United States east of the Great Plains — and is one of the few xystodesmids occurring in glaciated regions of the country. It is also the only xystodesmid known to aggregate in masses and migrate, a fact which probably accounts for the sizeable range. Unfortunately, the taxonomy of *Pleuroloma* is hopelessly tangled in nomenclatorial confusion. Twelve species have been described, and there have been several contradictory attempts at synonymizing some of these names. There is even some doubt about the correct generic name, as the synonymy of *Zinaria* with *Pleuroloma*, while logical and probably correct, has never been verified with a specimen. Today, it is impossible to accurately assign specific names or identify forms. Revisionary studies indicate that only four species are involved, two of which are undescribed. The current status of this research will be reported.

(59)

Embryonic Development and Larval
Differentiation in *Cassiopea xamachana*

R. L. HOOD AND N. C. EDWARDS
University of North Carolina at Charlotte

During early development of *Cassiopea*, cellular polarity was reflected in the distribution of cytoplasmic granules. Naphthol yellow-positive materials were specifically associated with the periphery of blastodermal cells, while granules stained by chromotrope or aniline blue were concentrated toward the blastocoel. This pattern, present in the early coeloblastula, may reflect, at least in part, accumulations of yolk nutrients during oogenesis. Cnidoblasts were visualized early in both the ectoderm and endoderm. By the late planula stage, these were restricted primarily to the ectoderm, and stained variously with naphthol yellow and chromotrope. The precise mode of gastrulation, as well as the time and mechanism of the formation of the mesoglea, are currently being investigated. The significance of these observations is discussed in relation to the life cycle of this marine jellyfish.

(60)

Comparative Reproductive Strategies of
Troglobitic Crayfishes in Shelta Cave, Alabama

JOHN E. COOPER AND MARTHA R. COOPER
North Carolina State Museum

Comparative studies of reproductive biology in a troglobitic crayfish triad were conducted in Shelta Cave, Alabama. Reproductive cycles occurred in most adult-

sized female *Orconectes a. australis*, but few were completed. Production of young appeared restricted to a few largest females. An increase in frequency of form-I males with increasing size indicates that sexual maturity is delayed beyond minimum adult size. Repeated reproductive cycles occurred in mature female *Cambarus jonesi*, but none were found with attached young or ova. The young at recruitment are smaller than those of the other two species. A small, fragile, undescribed species has the largest and fewest (8 to 12) oocytes, and the young at recruitment appear to be larger in proportion to adult body size than reported for any crayfish species. In addition to being adaptive in an energy-limited system, the inferred strategies appear to be related to differential predation by the Southern cavefish, *Typhlichthys subterraneus*.

(61)

Taxonomic Studies of a
Brackish-Water Bryozoan, *Conopeum* sp.

MICHAEL A. POIRRIER
University of New Orleans

Studies are currently in progress to determine whether an ectoproct population in the genus *Conopeum* is a low salinity form of *C. tenuissimum* or an undescribed species. It is common in Lake Pontchartrain and other low salinity estuaries in the New Orleans area. Studies of colony astogeny have shown that the zooid budding pattern is similar to *C. tenuissimum*; however, it differs from typical *C. tenuissimum* in having upright branched colonies and always having a granular cryptocyst. It also occurs in a lower salinity zone than *C. tenuissimum*. I am attempting to obtain specimens from salinity gradients to determine whether the morphological differences are due to an ecophenotypic response or due to reproductive isolation.

(62)

Seasonal and Spatial Distribution of the
Carolina Marsh Clam, *Polymesoda caroliniana*
(Pelecypoda: Corbiculidae), in a
Mississippi Tidal Marsh

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Mississippi State University

The Carolina marsh clam (*Polymesoda caroliniana* Bosc) was found in all sampled areas of a Mississippi tidal marsh. Monthly samples were collected from four stations during an annual cycle. The stations varied with respect to vegetative composition and inundation time. The largest populations were found in a regularly flooded area (293 individuals/m²) and in the upper reaches of a tidal creek inverting the marsh (380 individuals/m²). *P. caroliniana* was also found in areas flooded as little as 0.2% of the year. Ninety percent of all specimens were smaller than 10 mm, although specimens as large as 56.5 mm were collected. The average specimen was larger in the regularly flooded areas than in those flooded less often. Young clam recruitment occurred in February and in July, 1977. A high juvenile mortality followed each peak in abundance.

(63)

Behavioral Adaptation to Stream Habitats
in the Troglotic Amphipod Crustacean,
Crangonyx antennatus

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The cave-dwelling amphipod *C. antennatus* populates two distinct habitats in southern Appalachian caves, mud-bottom pools and gravel-bottom streams. Observations and experiments were conducted to determine if stream populations possess behavioral adaptations to lotic conditions. Thigmotactic behavior of *C. antennatus* was recorded seasonally in six Lee Co., Virginia caves, three containing pool habitats and three with stream habitats. Stream-dwelling amphipods were found to exhibit more cryptic behavior than those inhabiting pools under natural and disturbed conditions. Results of artificial stream experiments support field observations and indicate that stream populations of *C. antennatus* are better adapted behaviorally to lotic conditions than pool-dwelling amphipods.

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(64)

Observations on Productivity and
Species Composition of Midwater and
Shallow Water Periphyton Communities
in a Small Pond

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This study investigated differences between surface periphytic communities of midwater and shallow water zones in a small pond receiving urban runoff. Productivity was measured indirectly by chlorophyll analyses. Cell counts and volumes were determined with an inverted microscope. Dense macrophytic growth was present throughout the pond beginning in April and diminishing through November and December. During this time both areas studied had similar provision for inoculation of glass slides. In the winter months the midwater zone was free of macrophytes, thus relatively lacking in seed material for periphytic colonization. However, bottom muds, submerged logs and debris provided seed material in the shallow water zone.

(65)

Phytoplankton and Water Quality Investigations
of an Alluvial Stream in Kentucky

EDWARD L. JOHNSON AND ROBERT G. JOHNSON
Murray State University

This study presents results of a twelve month investigation of the physical, chemical and phytoplankton characteristics of the Bayou de Chien, a stream in southwestern Kentucky.

The purpose of this study was to: 1) identify and describe the algal flora in the stream, 2) observe seasonal fluctuations of phytoplankton populations, 3) monitor the physicochemical parameters of the stream and 4)

statistically compare diversity indices between each sampling site and statistically correlate chemical parameters with phytoplankton population changes. Fifteen physicochemical parameters were monitored during the study. Multiple Linear Regression and Correlation analyses were performed using a BMDPIR (Biomedical) Statistical Program. Partial correlation coefficients, F-test statistics and DMS/TMS ratios varied from one sampling site to another. The results indicate that over 50% of the variability in phytoplankton population densities at sampling sites located at the headwaters and at the mouth of the stream was attributable to physicochemical parameters. Physicochemical parameters that were significant at the 5% level included alkalinity, calcium, water temperature, dissolved oxygen and pH. Algal diversity indices indicated a richness of species and a narrow distribution of individuals among the species at ninety percent of the sampling sites. Additionally, twenty-one algal species heretofore unknown in Kentucky were discovered.

(66)

A Comparison of Chlorophyll *a* Values Obtained
from Absorbance Spectroscopy and Fluorometry

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and National Park Service*

Chlorophyll *a* is increasingly used as a biological parameter in various types of ecological and environmental assessments. Present commonly employed procedures require tedious solvent extraction, spectroscopic analysis and involved calculations, making the determination both laborious and expensive. Experiments were performed using a Turner Model 10 fluorometer and a Beckman DB-G grating spectrophotometer to compare the chlorophyll *a* levels obtained with various fluorometric techniques. To utilize the capacity of the fluorometer to measure the non-extracted pigments, algae obtained from batch culture were homogenized and read directly for chlorophyll *a* fluorescence. These samples were then extracted with 90% aqueous acetone and measured by the trichromatic procedure for the spectrophotometer to determine "standard method" levels of chlorophyll *a*. Results of the comparison will be presented with a discussion of the advantages of the more rapid fluorometric techniques to ecological investigations.

(67)

The Relationship of Phytoplankton Populations
to Total Vitamin B₁₂ Concentration in a
Soft Water Appalachian Pond

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Virginia Polytechnic Institute and State University

Phytoplankton were sampled and total vitamin B₁₂ concentrations were determined on a weekly basis from June to September, 1977, in Pandapas Pond, a shallow soft water impoundment in southwest Virginia. Identification and enumeration of phytoplankton were done on both live and preserved samples. The phytoplankton population was dominated by members of three flagel-

lated groups, the Chrysophyceae, the Euglenaceae and the Dinophyceae. Dominant species were *Dinobryon divergens*, *Trachelomonas hispida* and *Glenodinium gymnodinium*, with mean summer counts of 43600, 2000 and 980 l^{-1} , respectively. The Chlorophytes were scarce; over fifty percent counted were desmids with *Hyalotheca* sp. being the most dominant. Dense *Spirogyra* sp. beds along shore were noted. Of the Cyanophytes, *Anabaena* sp. was only found once at a concentration of 2.1 l^{-1} . All three groups of dominant flagellates are known vitamin B₁₂ requirees and their seasonal patterns generally followed that of the total vitamin B₁₂ concentration. Close agreement was also observed between the phytoplankton and the zooplankton seasonal patterns.

(68)

Relationship of Plankton Biomass and Zooplankton to Vitamin B₁₂ Fluctuations

JEANNE MILES POTTER AND ARTHUR L. BUIKEMA, JR.
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Vitamin B₁₂ concentrations were measured weekly from June to September, 1977, in Pandapas Pond, a shallow soft water impoundment in the Southern Appalachians. Vitamin B₁₂ concentrations were assayed using *Euglena gracilis* "z" strain. The concentration of vitamin B₁₂ decreased 39% from summer to fall. Values ranged from 0.5 to 4.6 ng l^{-1} at the deep end of the pond and from 0.37 to 6.8 ng l^{-1} at the shallow end. Zooplankton were collected and quantitatively and qualitatively analyzed. Dominant zooplankton were *Polyarthra vulgaris* and *Keratella cochlearis*. Water samples were analyzed for chlorophyll; values ranged from unmeasurable to 0.05 mgm⁻³. Fluctuations of the rotifer *Polyarthra* were positively correlated with total vitamin B₁₂ concentration after a one week lag. Negative correlations also were found between chlorophyll and total vitamin concentrations.

(69)

Improved Techniques for the Quantification of River Plankton and Periphyton

LOUIS G. WILLIAMS
University of Alabama

The use of large sample sizes, sedimentation, cleaning and proportional biomass and seston tallying greatly improved the quantification and identification of phytoplankton, zooplankton and periphyton from typical estuarine and river habitats, thereby reflecting more accurately water quality values.

(70)

Benthic Macroinvertebrate Community Recovery After Municipal Sewage Discharge Termination

WILLIAM M. WINN AND E. L. MORGAN
Tennessee Technological University

Two secondary treatment municipal sewage discharges into Pistol Creek, Blount County, Tennessee were removed during September, 1976, and piped to a new

wastewater treatment facility located on a downstream reservoir. This complete termination of sewage-source municipal loadings allowed us to assess the stream's biological recovery capacity from associated organic waste stresses. During the post termination year, benthic macroinvertebrate community structure substantially improved below the first sewage outfall, but recovery was negligible below the second downstream treatment plant point source. Community changes below each outfall will be discussed in light of the improved water and sediment quality and the detrimental effects of industrial effluents located between the two sewage treatment plant outfalls.

(71)

A Simple, Inexpensive Sampling Gear for Shallow, Rapid Discharges

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Research to determine the effects of operation of the intakes of Appalachian Power Company's Glen Lyn Power Station (GLPS) on the fishes of the New River was required by Section 316(b) of P.L. 92-500. The intakes of GLPS were sampled using suspended rectangular (0.93 × 0.64 m) drift nets of 0.5 mm mesh. The shallow (< 1.5 m), turbulent and rapid (> 1.5 m/sec) nature of the discharge made the technique utilized at the intakes unsuitable. The gear used at the discharge was composed of an L-shaped angle iron frame which was anchored to the substrate at the mouth of the discharge. Samples were taken by clipping a net of the same specifications used at the intakes to the end of the frame and raising and lowering the frame with a 4:1 ratio hand winch. The gear proved to be reliable and cost less than \$50.00 to outfit (excluding net).

(72)

Remote Sensing from Automated Biomonitoring Stations: New Developments in Water Quality Management

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KENNETH W. EAGLESON
Tennessee Technological University

NORMAN D. MCCOLLOUGH
University of Tennessee

Real time measurements of biological responses to water quality fluctuations are desirable alternatives for supplementing extensive sampling surveys which detect adverse conditions by changes in community structure and species composition. Recent developments for detecting changes in fish breathing rates to undesirable water quality by remote means are being tested as a reasonable complement or possible alternative to the problem. An automated biomonitor with remote capabilities for measuring fish breathing rates was interfaced with a remote data collection platform for NOAA's GOES satellite transmission of data. Similarly, a Hy-

drolab (Model 6D) was interfaced for simultaneous measurement of dissolved oxygen, temperature, hydrogen ion concentration, conductance and oxidation-reduction potential. Both biological and physical measurements are transmitted to a data processing center for immediate data interpretation. Real time remote monitoring stations yield the capacity for wilderness monitoring, watershed management, identification of regional non-point source run-off pollutants and other water quality management needs.

(73)

The Response of an Aquatic Microecosystem to a Simulated Oil Spill

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Young aquatic microecosystems containing a community of algae, fungi, bacteria and protozoans were treated with light arabian crude oil to simulate an oil spill such as might be experienced in nature. A number of the treated microecosystems were further treated with a biodegradable surfactant used in oil spill clean-ups to simulate the efforts of man to clean up an oil spill. Biomass, chlorophyll *a* and diurnal community metabolism were measured in oil treated, oil and surfactant treated and control microecosystems for 60 days as the microecosystems aged. Results indicate that the oil and oil and surfactant treated microecosystems exhibit an increase in biomass accumulation during the experiment. Diurnal metabolism was depressed in the surfactant treated microecosystems but returned to a level similar to the other treatment and the control by the end of the experimental period. Chlorophyll *a* content was similar in all three sets of microecosystems. It appears that an ecosystem containing only microflora and microfauna is not permanently harmed and may even be benefitted by an oil spill.

(74)

An Effects Assessment of Impingement at the Lansing Smith Steam Plant

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MICHAEL R. CORN, WILLIAM E. IMBUR AND
JOHN C. NEMETH
Law Engineering Testing Company

The screen wash from the traveling screens at the Gulf Power Company Lansing Smith Steam Plant near Panama City, Florida, was sampled over a one year period during 1975 and 1976. A total of 19,025 organisms weighing 15.6 kg was collected. These numbers represent 61 species of vertebrates and 13 species of invertebrates. The species collected in greatest abundance was the Atlantic bumper, *Chloroscombrus chrysurus*, while the species contributing the greatest biomass was the spotted seatrout, *Cynoscion nebulosus*. Of the finfishes collected, 58.3% were juveniles. In-

take velocities did not appear to be a critical factor influencing impingement. Statistical analysis of data indicated a strong correlation between the presence of coal-delivery tugboats in the intake canal and increased impingement. The projected annual impingement at Lansing Smith was 267,082 organisms weighing 2,182.3 kg. The value of the projected impingement was \$944. No rare and/or endangered species were collected during the study.

(75)

Thermal and Oxygen Effects on the Heart Rate of the Asiatic Clam, *Corbicula manilensis*

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Murray State University

Pin electrodes were placed on either side of the pericardial cavity through small holes drilled in the shell of *Corbicula manilensis*. The electrodes were cemented to the shell with "Quik-Rok," a brand of fast setting Portland cement. The clams were allowed to burrow and assume their natural position under water in Ottawa sand. The heart rate was recorded with a NARCO Bio-Systems physiograph using an impedance pneumograph. Temperature and concentrations of dissolved oxygen were altered to determine their effects on the heart rate. The results indicate that this technique can be useful as a biomonitor of environmental conditions and for determining thermal and oxygen stress in clams.

(76)

The Influence of Chlorine-Produced Oxidants on Larval Stages of the American Oyster, *Crassostrea virginica*

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The effects of chlorination on two larval stages of *Crassostrea virginica* (Gmelin) were studied in flowing estuarine water. Straight-hinge veliger larvae and setting umbo larvae were subjected to concentrations of 0.01, 0.05, 0.1, 0.2 and 0.3 ppm chlorine-produced oxidants (CPO) for 6, 8, 12, 24, 48, 72 and 96 h. There was a direct relationship of mortality with increased dose of CPO and time of exposure. Straight-hinge veliger larvae had 30% mortality at 0.05 ppm CPO for 96 h, but at 0.075 ppm for 96 h 50% died. LD 50 at 0.1 ppm CPO occurred at 62 h and at 0.3 ppm CPO at 42 h. Maximum mortality observed in straight-hinge veliger larvae was 91.5% at 0.3 ppm CPO at 96 h. Setting larvae proved hardier with 39.2% as the highest observed mortality at 0.3 ppm CPO at 96 h. Mortalities of lesser concentrations CPO and shorter exposure had related lower mortalities. Multiple regression analysis of percentage of mortality on concentration of CPO and time produced equations that allow prediction of percentage mortality at different CPO concentrations and exposure times. *Funded by the State of Maryland Power Plant Siting Program Contract No. 25-75-04.*

(77)

The Effect of Ozone and Chlorine Produced Oxidants on Larval Stages of the American Oyster, *Crassostrea virginica* (Gmelin)

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WILLEM H. ROOSENBURG, ANN ROSENKRANZ AND RONALD M. BLOCK
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The toxicity of ozone produced oxidants (OPO) and chlorine produced oxidants (CPO) was studied in straight-hinge and umbo-setting larvae of the American oyster, *Crassostrea virginica* (Gmelin). Both larval stages were exposed to 0.00, 0.01, 0.05, 0.10, 0.20 and 0.30 mg/l OPO and CPO under continuous flow bioassay conditions with subsamples taken at 6, 12, 24, 48, 72 and 96 hours to establish live-dead ratios over time. Response surface analyses of the straight-hinge showed that mortality increased proportionally with concentrations and time for larvae exposed to both OPO and CPO at concentrations above 0.05 mg/l. A similar mortality response was found for setting larvae at all OPO and CPO concentrations studied. Mortality of the set larvae was less than that of the straight-hinge larvae for both OPO and CPO. *Sponsored by the U.S. Environmental Protection Agency Grant No. R804683010 and The State of Maryland Power Plant Siting Program Contract No. 25-75-40.*

(78)

Benthic Responses to a Combined Plating Shop and Domestic Effluent in Corpus Christi Bay

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Biotic communities in the vicinity of the outfall appeared to reflect patterns of stress and recovery that may have developed from past intermittent spills. However, analysis was complicated because the outfall empties onto a broad, shallow, frequently exposed sandy shelf near the entrance of Oso Bay. Normal effluents were probably not acutely toxic since a simple assemblage of both microalgae and animals grew in the discharge trough. Along the shoreline, benthic microalgae capable of rapid recolonization were plentiful but large macroalgae were rarely found in the outfall vicinity; however, occasional remains of the latter could still be found near the outfall. The local macroinvertebrate assemblage was relatively large but apparently modified. With the exception of oysters, most specimens were either juveniles or organisms with short life cycles. Animals which are able to limit exposure during short term impingements were prevalent in the discharge area; for example, clams and barnacles which can temporarily close up and crabs and isopods which can move out of toxic plumes were most abundant.

(79)

Influence of Thermal Effluent on Population Dynamics of Asiatic Clam (*Corbicula manilensis*) in the New River, Virginia (Mollusca:Bivalvia)

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Virginia Polytechnic Institute and State University

Successfully overcoming physical and ecological barriers, *Corbicula manilensis* extended its range to include the New River, Giles County, Virginia, in 1975. Upstream invasion rates have been calculated at approximately nine river miles per year although factors or agents of dispersion have not been discerned. Population density beyond the area of influence of thermal effluent from a coal-fired power plant drastically declined during severe low water temperatures (≤ 0.0 C) in the winter of 1976. However, Asiatic clam density remained relatively stable within the thermal effluent. Size frequency analysis revealed population restructuring during subsequent recovery in the following year. The influence of thermal discharges upon the population dynamics and ecology of the clam is discussed.

(80)

The Impact of Coal Ash Effluent on Heterotrophic Bacterial Populations

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The effect of heavy and fly ash from power production discharges on naturally occurring heterotrophic bacteria was examined in the New River at Glen Lyn, Virginia. Concentrations of 15 elements in the water and sediments at 11 stations were determined by neutron activation analysis. Elemental concentrations were higher in the ash basins than in the river but returned to normal ranges approximately 100m downstream from the basins' outfalls. Total viable bacteria taken from plate count media did not vary significantly between stations above, in, or below ash basins. Community diversity, as defined by the Sequential Comparison Index (SCI), was minimal in both ash basins due to a 33% reduction in the ratio of chromogenic total viable bacteria from upstream values. Populations immediately below these outfall areas were similarly affected but returned to reference densities within 200m. It is concluded that bacterial populations are greatly modified within the confines of this power plant, but natural populations recover quickly if the ash basins are functioning properly and the effluents are markedly less than the total flow of the receiving water. *Supported by the American Electric Power Service Corporation.*

(81)

Effects of Copper Sulfate and Potassium Dichromate on Aufwuchs Biomass

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Gravimetric, chlorophyll and adenosine triphosphate analyses were used to estimate Aufwuchs biomass in artificial streams treated with a series of copper sulfate or sodium dichromate concentrations. Data from these nontaxonomic methods were closely correlated. Any differences in trends were attributed to a method's sensitivity or biases. Organic carbon biomass estimates, computed for each method through appropriate conversion factors, were used to partition Aufwuchs biomass into functional groups. This approach was useful in interpreting changes in the Aufwuchs community's autotrophic and heterotrophic components or viable and non-viable fractions under the metal ion stresses.

(82)

An Investigation of Thermal Impacts of a Fossil-fueled Electric Power Plant Discharge on Seagrass Bed Communities

JOHN C. NEMETH, ROBERT A. GARRETT, WILLIAM E. IMBUR AND MICHAEL R. CORN

Law Engineering Testing Company

Investigations of the distribution, population and biomass of seagrass species, macroinvertebrates and fishes were conducted in an estuary near Panama City, Florida, to determine the effects of thermal discharge from a fossil-fueled electric power plant. Hydrographic parameters were measured to characterize salinity, dissolved oxygen and temperature conditions with depth in the study area. It was noted that heated water discharge moved to the channel and bay bottom as it exited the canal. This phenomenon was attributed to salinity differences between the discharge water and the estuary. The study results presented indicate no adverse effects on the seagrass bed communities or associated benthic and fisheries populations which can be related to thermal discharges.

(83)

Epizoa Protozoa of Planktonic Copepoda and Cladocera from a Small Eutrophic Lake and Their Possible Use as Indicators of Organic Water Pollution

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BILL T. RIDGEWAY

Eastern Illinois University

The epizoa protozoa of planktonic copepoda and cladocera from a eutrophic lake (Ashmore Lake, Coles County, Illinois) were studied over a 13-week period in the summer and fall of 1975. Epizoans (all peritrichs and suctorians) were found on three of four species of copepods and four of the 10 species of cladocerans. The percentage of total organisms hosting epi-

zoans varied significantly by month (0.001 level), but averaged 11.6 percent. This high occurrence of epizoans was thought to be related to the highly-eutrophic conditions existing in the lake. If the occurrence of epizoa peritrichs and suctorians is related to the degree of organic enrichment of a body of water then the percent of planktonic organisms hosting them could be a useful index of water quality. Evidence from other studies was presented in support of this hypothesis. Several interesting symbiotic associations were found. *Tokophyra cyclopum* was always found on the anterior ends of its cyclopoid copepod hosts, and *Vorticella microstoma* was found exclusively on the cladoceran, *Scapholeberis kingi*.

(84)

Field Observations of Fraser's Sedge (*Cymophyllus fraseri* — Cyperaceae)

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Fraser's sedge is considered a nationally threatened species primarily because of its restricted range and local population distributions. It appears to occupy two habitat types: moist rhododendron thickets bordering streams in cove hardwood communities in its southern range and open hardwood community slopes in the central and northern sites. Fruit set is seldom observed and a study to elucidate the problem yielded the following information: 1) Pollination is partially facilitated by insects; 2) Self-pollination can occur but is of low frequency; 3) Cross pollination yielded higher numbers of fruit set; 4) Within three weeks after pollination, deer browsing eliminated all detectable inflorescences. Pieces of the inflorescences were observed in unfurmed deer feces, suggesting the plant might play a role in purging the digestive tract of the animal. It is tempting to speculate the biological significance of the effect that this early browsing has had on the distribution of the sedge.

(85)

Why Does Spruce Not Invade the High Elevation Beech Forests of the Great Smoky Mountains?

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University of Tennessee

Mechanisms of dominance which limit the invasion of high elevation beech forests (*Fagus grandifolia* Ehrhart) by red spruce (*Picea rubens* Sargent) in the Great Smoky Mountains were investigated. Large diurnal soil temperature variation under the beech canopy in spring appears to delay and inhibit the germination of red spruce seed. Bioassays of spruce germination and growth revealed potential allelopathic toxins in fresh autumn leaf litter, decomposed summer litter, and autumn soil under the beech canopy. Seed mortality caused by animal foraging is enhanced in beech litter. A combination of interference mechanisms which progressively increases spruce seed and seedling mortality in the beech forests serve to maintain the structural integrity of the beech forests. A theory is presented, based upon those of earlier investigators, on the origin of the high elevation beech forests of the Great Smoky Mountains in the hypsithermal period of the post-Pleistocene.

(86)

The *Ilex opaca* Aiton Forest,
Sandy Hook, New Jersey

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St. John's University

Sandy Hook is a narrow peninsula of land approximately five miles long that extends northward from the coast of New Jersey. On this narrow peninsula exists the best developed holly forest on the east coast of the United States. This forest, encompassing sixty acres, was studied during the late summer and fall, 1977. The point quarter method was used to sample arborescent species. *Ilex opaca* Aiton dominates and is well represented in all stages of its life history, from seedlings to trees in excess of 24" DBH. The largest trees may exceed 200 years in age. The holly forest is isolated from mesophytic forest seed sources and can tolerate a moderate amount of salt spray. The recent geological origin of the peninsula, *Ilex's* isolation, longevity, and tolerance to salt spray probably account for its dominance (Importance Value = 268). The forest will be compared with maritime forests at Montauk, New York; Fire Island, New York; and Bull Island, South Carolina.

(87)

The Impact of Intermittent Flooding
on Forest Vegetation

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*Ocean Data Systems, Inc. and
University of North Carolina*

Since September, 1972, the B. Everett Jordan Dam at the confluence of the Haw and New Hope Rivers in central North Carolina has caused floods that inundate more acreage for longer periods than previously occurred in low lying regions along the rivers. To assess the effects of periodic inundation, twenty-five one-fifth acre plots were located in forested areas at elevations subjected to varying periods of flooding. The woody plants in each plot were measured and mapped; the herb layer in each was sampled randomly. Selected plots were re-examined in 1975, 1976 and 1977 to correlate mortality and growth rates with frequency of flooding. The sensitivity and mortality of several common mesic trees to prolonged inundation was dramatically observed.

(88)

Forest Communities of the
Lower Alabama Piedmont

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This study examined the forest vegetation of the lower end of the Alabama Piedmont in relation to environment. Vegetation pattern in this area was found most conspicuously related to topography and disturbance history. A combination of numerical classification and ordination techniques was used to distinguish 13 forest community-types and to segregate these into three groups by topography-moisture regime relationships. *Acer negundo-Fraxinus*, *Quercus nigra-Liquidambar styraciflua*, *L. styraciflua-Acer rubrum* and *Liriodendron tulipifera-Liquidambar styraciflua* are streambottom types; *Quer-*

cus alba, *Quercus prinus-Q. velutina*, pine-hardwoods, *Q. stellata-Carya tomentosa*, *Pinus taeda*, *P. echinata-P. taeda*, and *Q. falcata-Q. stellata* are general upland types; *Q. marilandica*-pine and *Pinus palustris* are dry upland types. *Quercus prinus* is near the southernmost limit of its range and is important only on steep, north-facing slopes. A local concentration of *P. palustris* occurs in the Devil's Backbone area, which is a large quartzite-phyllite ridge. Here this species is favored by dry sites and frequent fires. The combined classification-ordination approach proved quite useful in uncovering and portraying the general forest vegetation relationships.

(89)

Impact Gradients in Recreational Habitats

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Vegetation studies at a state park reveal disturbances can be aligned along one or more kinds of gradients. Certain parametric characteristics such as flower color, life form, floristic similarity-dissimilarity and others have been ordinated to indicate particular kinds of impact activities and to distinguish those impacts floristically. Studies of recreational sites — camping, swimming, picnicking, etc. — and their support facilities — roadsides, waste disposal areas, service centers, power pathways, etc. — show that successional changes have distinctive patterns in impact areas. Just as road cuts and fills having similar physical features show different floristic patterns, camping and picnic areas also differ.

(90)

The Overstory Vegetation of an
Upland Hardwood Swamp in
Rockcastle County, Kentucky

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WILLIAM H. MARTIN
Eastern Kentucky University

The uplands of the Mississippian Plateau (Pennyroyal) in southcentral Kentucky are characterized by karst topography. Many of the sinks filled by colluvium and local alluvium may have slow internal drainage that will promote the development of more hydric habitats than the surrounding, well-drained areas. Deciduous forests associated with these slowly drained sites are dominated by species that tolerate wet conditions and periodic flooding. Unfortunately, many of these forests have been converted to agricultural use or logged several times leaving few undisturbed sites that permit valid vegetational-environmental studies. The study area, a 50-acre (20 hectare) swamp, was partially logged in 1919; it has remained relatively undisturbed since that time. Because of the drainage pattern, the duration of standing water varies during the growing season, although the soil will become water-logged with limited precipitation.

Forty-seven .05 hectare plots were established throughout the swamp. The differences in the hydroperiods of the plots were reflected in both the species composition and dominance of the overstory vegetation. Comparison of the wet areas to drier areas indicated that species richness and overstory density increased towards the better drained areas. *Quercus bicolor* and *Acer rubrum*, sometimes used as indicator species of

hydric habitats, were found throughout the swamp. *Liquidambar styraciflua* and *Fraxinus pennsylvanica* comprised over 70% of the overstory density throughout the wettest sites. On drier sites, 74% of the canopy was composed of *Liquidambar styraciflua*, *Platanus occidentalis*, *Nyssa sylvatica* and *Acer rubrum*.

(91)

A Terrestrial Ecological Study at Caryville, Florida

W. E. IMBUR

Law Engineering Testing Company

Investigations of the distribution and population of terrestrial plant species were conducted on a 1500 acre site of the proposed Gulf Power Company Caryville electrical power plant in northwest Florida. Studies were done in partial fulfillment of requirements under the Florida Electrical Power Plant Siting Act. Hydric, xeric and mesic community types were examined. Density, dominance, frequency and relative importance values were determined for each major vegetational component by community type. Idealized vegetational profiles were prepared using transect studies, photographs, importance values and on-site descriptions. Analysis of aerial photography coupled with on-site studies was incorporated in developing the vegetational map for the site. Surveys of birds, reptiles, amphibians and mammals were conducted concurrently with the vegetational studies.

(92)

Vegetation and Soils of the Bull Creek Watershed, Osceola County, Florida

ROBIN B. HUCK

University of North Carolina

The major plant communities and soil types were analyzed along three transects of 1.25 miles each within this 26,000 acre tract of the Osceola Plain in central Florida. Pine flatwoods, saw palmetto prairies, savannahs, oak scrub dunes and sand pine ridges were correlated with haplaquods, haplohumods and quartzipsamments. Lower, seasonally wet areas including *Hypericum brachyphyllum* ponds, cypress sinks and cypress-ash creeks were associated with humaquepts, medisaprists, glossaqualfs, ochraqualfs and argiaquolls. Pedogenesis in this area is tied to a flushing moisture regime in which high seasonal precipitation causes exchangeable bases to be displayed by H^+ ions in the upper part of the solum of the dunes and pinelands. The soils of these higher topographic areas are left as acid leached sands with a spodic horizon present. The displaced bases and clays concentrate in the creeks and in some sinks.

(93)

Size-Class Structure of Old-Growth Forests

GEORGE T. WEAVER

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Size-class structure of several old-growth forests showed larger than expected numbers of stems in intermediate diameter classes when compared with density

predicted by either negative exponential or negative power functions. When plotted these form plateaued instead of straight-line distributions predicted by either function. Departures from predicted size-class densities have usually been interpreted as indicating past disturbance and that any shift toward the predicted distribution shows recovery from disturbance. For the stands studied, the plateau-type structure appears to be characteristic and biologically inherent rather than a disturbance feature. Changes in population mortality rates over time, differences between types of size-class structure of individual species, and dense populations of one or more understory species may interact to produce this structure.

(94)

The Vegetation of Dick Cove, Sewanee, Tennessee

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University of Tennessee

Community types were determined by agglomerative clustering of samples (53, 1/25 hectare plots) taken in an old growth cove forest on the western edge of the Cumberland Plateau. The richest community, Sugar Maple-Northern Red Oak, is similar (Jaccard's Index = 59%) to Braun's (1950) Mixed Mesophytic types of the Cliff Section of the Cumberland Plateau and to the All Deciduous Mixed Mesophytic type of southeastern Kentucky (51%). The distribution of community types along the first axis of reciprocal averaging ordination agrees with community distribution along a moisture gradient based upon topographic position.

(95)

A Survey of the Vascular Flora of Francis Beidler Forest (Four Hole Swamp) in Berkeley and Dorchester Counties, South Carolina

RICHARD D. PORCHER
The Citadel

The Four Hole Swamp ecosystem runs seaward for fifty miles through the South Carolina Coastal Plain. It empties into the Edisto River near Givans in Dorchester County. In 1972 the Nature Conservancy and National Audobon Society purchased a 3500 acre tract of Four Hole Swamp in Berkeley and Dorchester counties. The tract included a 1700 acre section of cutover swamp and a 1800 section of mature timber including considerable virgin timber. Presently the National Audobon Society operates this tract (named Francis Beidler Forest) as a wildlife sanctuary with controlled public access via a boardwalk.

During 1976-77 a floristic survey of the 1800 acre section of Beidler Forest was conducted. Included in the swamp ecosystem are five communities; seepage bog; hardwood bottom; pine-mixed hardwood; bald cypress-tupelo gum; and a cypress knee-stump-fallen log community. A rich, mixed hardwood slope community which flanks the swamp was also surveyed. Highly significant botanically is the bald cypress-tupelo gum community (*Taxodium distichum*-*Nyssa aquatica*) which represents one of the few remaining virgin stands of this

community in the southeast. A total of 298 taxa of vascular plants, representing 99 families, 208 genera, and 284 species were collected. Included were 14 species of ferns, 10 species of orchids, and one threatened species, *Trillium pusillum* Michaux. Supported by the *National Audubon Society*.

(96)

The Vascular Flora of the Savage Gulf Natural Area, Tennessee

THOMAS S. PATRICK, LOY R. PHILLIPPE, DAVID H. WEBB
AND B. EUGENE WOFFORD
University of Tennessee

With the support of the Tennessee Heritage Program, an intensive survey of the vascular flora of the Savage Gulf Natural Area was undertaken. The area contains a virgin remnant of mixed mesophytic forest, as well as numerous other botanically interesting habitats from which nearly 650 species have been collected. At the western edge of the Cumberland Plateau in Grundy County, Tennessee, the terrain is rugged with prominent sandstone and conglomerate cliffs. Occasional limestone outcrops, on which several calciphiles grow, lend richness and diversity to the flora. The spring aspect is spectacular near and within the virgin forest. Several ferns, including *Dryopteris goldiana*, are conspicuous, along with at least 15 species of orchids. Two elements have been found nowhere else in the state and are quite rare in the Southeast, namely, *Carex hitchcockiana* and *Veratrum woodii*. A few other species are rare or endangered in Tennessee, or are remarkable for their abundance. A case in point is the vast array of color forms of azaleas along Savage Creek. Many significant plants occur in fragile habitats that warrant critical management practices, especially with regard to trail building. Professional botanists bear some responsibility for the perpetuity of such excellent examples of our natural heritage in as undisturbed a state as possible.

(97)

Influence of Site Characteristics on the Distribution of Forest Tree Species in the Southern Till Plain Division of Illinois

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Forest site-stand-composition relationships were investigated in 70 relatively undisturbed plots in the Southern Till Plain Division of Illinois, a region of soils derived from loess and till. The distribution of species appears primarily related to a complex soil aeration-moisture gradient. In these soils, available water capacity is a function of stoniness, bulk density and effective soil depth to the fragipan. Multiple regression analysis was used to relate individual tree species to selected soil site parameters. The general sequence of species is from post oak on flat, poorly-drained soils, to black oak on ridges with poor to moderately well-drained soils, and white oak on moderately well-drained soils. Walnut, hackberry, ash, bitternut hickory and sugar maple are found on lower north-facing slopes.

(98)

Structure and Function of Old-Field Plant Communities on Clay Soils

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Savannah River Ecology Laboratory

Previous studies have demonstrated the importance of nitrogen as a limiting factor to old-field plant productivity and the role of competition in structuring the species composition of old-field plant communities on sandy soils. Clayey soils support old-field communities that are slightly different from those on sandy soils. Perennial grasses are the dominant vegetation on both soils; however, annual grasses and perennial dicots are more abundant on clay, whereas annual and biennial dicots are more abundant on sand. Experiments involving nitrogen fertilizers or manual extractions of groups of potentially competing species or combinations of fertilizers and species extractions were performed to evaluate the importance of nitrogen and competition in old-field communities on clayey soil. Results from clayey and sandy soils will be compared.

(99)

LANDSAT Looks at Vegetation in the Southern Blue Ridge Mountains

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Satellite imagery shows certain patterns of vegetation to be distinctively typical around Copperhill. The Copperhill area is uniquely sparse. Otherwise fields are distinct from forests; uplands contrast with lowland vegetation; slope vegetation differs from that on ridges; ravine vegetation and cove vegetation have special features about them. Seasonal differences in each case are outstanding. The prime feature, however, is a contrasting difference between the vegetation in an ovoid territory, extending 30 to 35 miles eastward from the rather barren area, and the vegetation surrounding that oval, which is extensively typical of the southern Blue Ridge. The causes for such differences are both environmental and anthropogenic.

(100)

How Dispersal Stabilizes Multicellular Ecosystems

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An ecosystem spread out in space can behave as if it were composed of statistically independent subsystems, or "cells," that interact via the exchange of dispersing organisms. Even though isolated cells may be unstable, in the sense that predator-prey or competitive interactions lead to large amplitude oscillations or extinctions, connected cells and thus the entire cell ensemble can be stabilized by dispersal: amplitudes of oscillation are reduced, perhaps to zero (i.e., a stable equilibrium point), and the rate of recovery from perturbations is increased. These effects are demonstrated by adding dispersal terms

to a simple, general predator-prey model that has been used to describe interactions among invertebrates in the laboratory. This analysis suggests that larger ecosystems persist longer than smaller ones partly because greater size confers a tendency to contain more and larger cells with higher dispersal rates among them.

(101)

Observation of Protozoan Population Dynamics on Two-Dimensional Substrates

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Protozoan population dynamics may be traced by suspending a series of 2.5 cm² plastic net substrates in aquaria and laboratory streams and harvesting periodically. A substrate can be placed on a wide glass slide and examined microscopically to ascertain spatial arrangements of organisms, as well as species and numbers. Some observed phenomena include the following: Predation of *Vorticella convallaria* by *Actinophrys sol* increased species diversity. The colonial flagellate *Coconocladium umbellatum* established itself in large numbers on empty substrates but not on those supporting *Vorticella* populations. Some sessile ciliates and sessile rotifers appears after colonization of a substrate by *Vorticella* and motile species.

(102)

Seasonal Variation of Meiofaunal Communities in Three Alabama Tidal Marshes

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Three marsh types in coastal Alabama have been sampled for meiofauna, total organic content and sediment size distribution, salinity and temperature since February, 1977. The structure of the total meiofaunal community is closely related to the amount and stability of the total organic content of the sediment granulometric parameters. Within each of the individual marshes, however, the community structure appears to be controlled by a combination of these physical factors and by dominance of one of the meiofaunal taxa. The *Distichlis spicata* marsh supports, on the average, a larger meiofaunal community dominated by nematodes. Within the *Juncus roemerianus* marsh there is only slight dominance by the nematodes, and in the *Spartina alterniflora* marsh nematodes and harpacticoid copepods co-dominate.

(103)

The Effects of Grasshopper (Tettigoniidae: *Orchelimum* sp.) Grazing on the Energy Flow of a Mississippi *Juncus roemerianus* Marsh

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Mississippi State University

The grasshopper *Orchelimum* sp. was the dominant herbivore on the *Juncus roemerianus* marsh study site in Mississippi. *Orchelimum* sp. ingested 25.04 Kcal/m² of

Juncus annually. Only 2.30 Kcal/m²/year were incorporated into the production of new grasshopper tissues. The grazing behavior by *Orchelimum* sp. on the *Juncus* shoots followed a specific pattern which produced a secondary effect in the energy flow pattern. That portion of the shoot distal to the grazed area prematurely died which made these *Juncus* tips more susceptible to mechanical breakage. The increased susceptibility to mechanical breakage potentially accounted for the early deposition of as much as 58.74 Kcal/m²/year into the detrital mat decomposer trophic level.

(104)

Systematic and Electrophoretic Analyses of Three Sympatric Morphs of the Asteroid Genus *Echinaster* (Spinulosida)

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THOMAS S. HOPKINS
University of Alabama

Within the described *Echinaster* species, marked variability of individual taxonomic characters occurs. Many distinct morphological types are sympatric at several sites in the eastern Gulf of Mexico. Such variation may be indicative of morphological polymorphism within a species or morphs undergoing speciation.

In recent years electrophoresis has become accepted as a taxonomic tool. To determine if three sympatric morphs of *Echinaster* from the northeast Gulf are diverging species, traditional taxonomic observations have been coupled with electrophoretic analyses of selected biochemical markers. The enzyme systems examined include hexokinase, phosphoglucose isomerase, lactate dehydrogenase, malate dehydrogenase, xanthine dehydrogenase, leucine aminopeptidase, esterase and superoxide dismutase. Excluding low-frequency isozymic polymorphism, frequencies of ≤ 0.10 dissimilarity in the isozymes scored at these eleven loci are indicative of conspecifics while frequencies of ≥ 0.25 dissimilarity are indicative of diverging species. Results will be discussed in light of the hypothesis that these three sympatric morphs are undergoing speciation.

(105)

Observations of the Autumn Hawk Migrations Along North Carolina's Outer Banks

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North Carolina State Museum

Observations of the fall migrations of diurnal raptors made in the autumns of 1975, 1976, and 1977, indicate that large numbers follow North Carolina's Outer Banks. Occasionally as many as 500 hawks were tallied during a several hour period. By monitoring from observation stations at key points along the islands it was possible to ascertain that most of the hawks remained directly over the islands as they move south. Migration intensity and species composition varied with the date, the time of day, and the weather. During September and October Accipiters (87%) and Falcons (10%) were the most abundant forms; Harriers and Ospreys were

common, Buteos and Vultures rare. Sharp-shinned hawks were by far the most abundant single species (85%). The open terrain provided an excellent opportunity to compare foraging techniques and habitat preference, and these were documented for the 7 most common species.

(106)

Sibling Competition, Predation and Nestling Development in the Little Blue Heron

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Mississippi State University

The physical and behavioral development of nestling Little Blue Herons (*Florida caerulea*) were studied from 1974 to 1977 in Mississippi and Alabama. The developmental pattern is dominated by the rapid growth of the feet resulting in the acquisition of ambulatory skills by the age of 13 days. Nestlings are essentially free of parental care after the age of 21 days except for food which is brought to the nestlings until the age of 56 days when they fledge. The hypothesis that the precocial development of the feet and arboreal locomotion should allow an increase in food delivery by releasing adults from protecting the young is not supported. The early developmental pattern is interpreted as a response to sibling competition for food and as a means of reducing the period of vulnerability to large predators.

(107)

Contamination Patterns of Radiocesium and Chlorinated Hydrocarbons in a Wintering Population of American Coots (*Fulica americana*)

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and
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Although environmental contaminants of many kinds have frequently been studied in wildlife species, they have seldom been studied simultaneously in the same animals. Recently, an opportunity was afforded to study both radionuclides and chlorinated hydrocarbons (DDE and PCB's) in a migratory population of American coots wintering on the Par Pond reactor cooling reservoir of the U.S. DOE Savannah River Plant. Contamination patterns of the two classes of substances differed with only radiocesium being influenced by the site of collection within the reservoir. A comparison of contamination patterns suggested that while radiocesium is undoubtedly taken-up by the birds during their stay on the reservoir, the principle sources of DDE and PCB exposure are probably located elsewhere than the Savannah River Plant wintering habitat. Three of the forty coots examined showed levels of PCB's in the fat which exceeded the published tolerance levels of the USDA Meat and Poultry Inspection Service.

(108)

Fecal Contamination Analyses: Investigations of a New Method for Monitoring Radiocesium Levels in Free-Ranging Feral Swine (Mammalia:Suidae)

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Savannah River Ecology Laboratory

Radiocesium levels were determined in samples of both pork muscle and feces from 102 feral swine from two southeastern study areas which differed in magnitude and means of radionuclide contamination. Animals were collected from the swamp forest habitats of the U.S. DOE Savannah River Plant near Aiken, South Carolina, where limited nuclear reactor contamination has occurred, and from Ossabaw Island, Georgia, where radiocesium contamination has occurred only through atmospheric fallout processes. Correlation analyses indicated significant linear relationships between the radiocesium levels found in feces and muscle from individual pigs from each study area. Predictability of muscle contamination from feces was higher in the SRP population ($r^2 = 0.849$ and 0.607 for the SRP and Ossabaw Island populations respectively). This suggests that under appropriate conditions, radiocesium analyses of the droppings of free-ranging feral swine might be used to monitor the levels of this contaminant in the pork muscle of these animals.

(109)

Mammal Populations in the Forest Communities of Lilley Cornett Woods, Kentucky

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Eastern Kentucky University

Lilley Cornett Woods contains one of the last protected tracts of virgin forest in eastern Kentucky and the Appalachian Plateau. This natural area offers a unique opportunity to conduct a comparative study of mammal populations between virgin forest and successional communities. Such a study has never before been attempted in Kentucky.

Population size of small mammals in three major virgin forest communities was determined by live trapping. Various census methods were also used to obtain an index of habitat use of these communities by larger mammals. The species diversity of both small and large mammals was highest in the sugar maple—basswood—tulip poplar community of the old growth forest. The old field community was also high in species diversity for small mammals, but for larger mammals, diversity was lowest in this community. Species diversity of small mammals was lowest in the second growth forest community. When species were found in both the virgin and second growth forests, population size was usually significantly higher in the old growth communities. Uncommon and hard-to-trap mammals such as the woodland jumping mouse, southern flying squirrel and smoky shrew were captured in virgin forest communities but they were absent from the seral communities.

(110)

Determination of the Direction of Quarry Movement by Experienced Tracking Dogs

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Savannah River Ecology Laboratory
and
Richard B. Russell Agricultural Research Center

Tests were conducted on eighteen trained tracking dogs in order to determine their ability to determine the direction in which a human quarry walked, after the track had been aged for 30 minutes. Ten trials were conducted for each of the dogs which represented five different breeds. Only one of the eighteen dogs tested showed a statistically significant ability to correctly determine the direction in which the quarry had walked, although there was a suggestion that most of the dogs were seldom wrong when the dog handlers were informed of the correct direction prior to testing. There was no relationship between the direction that the dogs initially cast on the track and the direction that they eventually chose to follow. Neither was there a relationship between the total number of casts made or the direction of initial cast and the tendency to eventually choose the correct direction.

(111)

A Survey of the Fishes of the Bear Creek, Mississippi Drainage

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A survey of the fish population of Bear Creek, Yazoo River drainage system was conducted from May through July, 1977, with 37 species identified. Gizzard shad (*Dorosoma cepedianum*) constituted 63.0% of the weight and 84.5% of the numbers of fishes in the standing crop June 16, 1977. Forty-nine percent of the shad exceeded 7 inches total length and were unsuitable as food for predatory game species. Smallmouth buffalo (*Ictiobus bubalus*) and bigmouth buffalo (*Ictiobus cyprinellus*) accounted for 24.8% of the weight, but only 5.0% of the numbers of specimens. All other species, including small numbers of panfishes, made up the remaining 12.2% of the weight per acre of fishes. Indexes of condition were calculated for specimens of bluegill (*Lepomis macrochirus*) and white crappie (*Pomoxis annularis*). Both species were in poor condition. The fisheries of the system have been declining over the past several years with game species occurring in reduced numbers. Water quality of the system has deteriorated during recent years primarily as a result of sedimentation. As a consequence, less economically valuable species have increased.

(112)

Fish Population Changes Following Impoundment of West Point Reservoir (Chattahoochee River, Alabama-Georgia)

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Intensive sampling of the fish population in the Chattahoochee River before and after impoundment of West Point Reservoir was conducted from 1972 to 1977. Changes in species composition and relative abundance occurred. Forty-three species were found in the reservoir two years after impoundment. Sixteen species in the pre-impoundment collections disappeared within two years (*Ichthyomyzon gagei*, *Esox americanus*, *Camptostoma anomalum*, *Ericymba buccata*, *Nocomis leptocephalus*, *Notropis hypsilepis*, *N. zonistius*, *Pimephales promelas*, *Semotilus atromaculatus*, *Erinnyzon sucetta*, *Hypentelium etowanum*, *Noturus leptacanthus*, *Fundulus stellifer*, *Micropterus coosae*, *Percina nigrofasciata*, *Cottus carolinae*). Five species endemic to the Apalachicola River drainage were collected in the study area before impoundment. *Notropis hypsilepis* has disappeared. *Notropis callitaenia* and *Micropterus* sp. cf. *M. coosae* (shoal bass) are now accidental species, while *Moxostoma lachneri* and *Moxostoma* sp. cf. *M. poecilurum* are rare. The ranges of *Lepomis marginatus* and *Etheostoma fusiforme* have been extended northward and are found throughout the reservoir. *Ictalurus melas*, rare in the reservoir, may have been introduced into the Chattahoochee River drainage from inundated farm ponds.

(113)

A Six Year Study of Demersal Fish Prior to and During Operation of a Steam Electric Station on the Potomac River, Maryland

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Demersal fish were sampled monthly over a six and one-fourth year period in the vicinity of a 1100 megawatt coal-and-oil-fired steam electric station (SES) in the central Potomac River estuary at Morgantown, Maryland. For 33 months prior to, and during, the first 42 months of plant operation, abundance, species occurrence and diversity of demersal fish in the vicinity of this plant were studied at three stations. A total of 346,835 fish representing 34 species was collected. During the 42 months following the initiation of plant operation numbers of individuals and species of fish collected in the vicinity of the SES were significantly lower than at the upstream and downstream stations for the same period. No significant difference between numbers of individuals or species of fish at these stations was found prior to plant operation. Distribution functions

of monthly catches were found only to be significantly different following plant operation between the plant site station at both the Popes Creek station and the Morgantown station.

(114)

A Possible Occurrence of Hybridization of
Etheostoma olmstedii olmstedii and
Etheostoma nigrum in the
James River, Virginia

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University of Richmond

The James River in Virginia is the northernmost drainage south of Lake Ontario where *Etheostoma nigrum*, Johnny darter, and *Etheostoma olmstedii*, tessellated darter, occur in the same river system. An analysis of proportional measurements and meristic characters of these closely related species identified five populations within the drainage. *E. nigrum* inhabited the montane and piedmont areas through the Fall Line; *E. o. atramaculatum* was distributed throughout the tidal river and its lower tributaries; and *E. o. olmstedii* was restricted to creeks on the upper coastal plain. Appomattox River and Falling Creek, which originate on the Piedmont and drain into the tidal James, contained populations with character frequency distributions intermediate to those of *E. nigrum* and *E. o. olmstedii*. It is proposed that *E. nigrum* probably entered these drainages through stream piracy on piedmont tributaries of the James and interbred with an established population of *E. o. olmstedii*.

(115)

Food Habits of
Etheostoma (Psychromaster) tuscumbia
in Buffler Spring, Lauderdale County, Alabama
(Percidae, Etheostomatini)

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Stomach contents of *Etheostoma tuscumbia* were examined as part of a life history study of this small darter which is being considered for listing on the United States list of endangered and threatened wildlife and plants. Food items of greatest importance included the amphipod *Crangonyx*, the gastropod *Physa* and chironomids belonging to the taxa Tanytarsini and Chironomini (*Dicrotendipes*). Prey of lesser importance were the isopod *Lirceus* and ostracods. Less frequent food items were copepods, the amphipod *Gammarus*, the crayfish *Orconectes alabamensis*, larvae of the biting midge (Ceratopogonidae), chironomids of the Chironomini and Orthocladiinae, and unidentified fish remains. Seasonal variation in diet revealed that during the spring, April to June, the average number of food items per stomach was greatest with a concomitant increase in numbers of chironomids. During the winter, December to February, there was a decrease in the average number of food items. *Etheostoma tuscumbia* can be classified as an opportunistic forager since stomach contents are often dominated by a single food item.

(116)

Life and Limitation of the Goldwater Darter
(*Etheostoma ditrema*) in
Glencoe Spring, Alabama

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Etheostoma ditrema, an Alabama River endemic, has been proposed for recognition as a threatened species. As spring-limited populations are vulnerable to overzealous taking, we photographed and released most of the coldwater darters caught in 16 monthly seine samples. Growth data from photographic images augmented findings from preserved specimens. The life span is short; all died before or during their second winter. Spawning began in March, peaked in April through June and continued through September. Mating pairs deposited eggs singly while oriented vertically against plants. Adults ate amphipods primarily (found in 96.3% of stomachs containing food), as well as chironomids (49.2%) and isopods (20.9%). Copepods were more important than isopods in the diet of young fish. The population exhibited strong dependence on beds of aquatic mosses (*Fontinalis* and *Fissidens*) growing in sluggish current. Although predation was negligible, limitation to the inner portion of moss beds appeared a result of interaction with the Coosa darter (*E. coosae*), which was dominant on open substrate. Management and restoration of coldwater darter populations should consist simply in encouraging moss growth, such as by reducing current speed in shallow spring runs and by planting trees for partial shade.

(117)

Larval Suckers (Pisces:Catostomidae) from
the Lower Mississippi River

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Larvae of the genera *Cycleptus*, *Minytrema*, *Carpiodes* and *Ictiobus* have been taken in plankton-net, dip-net and seine collections from the lower Mississippi River and floodplain habitats near St. Francisville, Louisiana. *Cycleptus* and *Minytrema* are distinguished by 37-39 and 31-35 preanal myomeres, respectively, while *Carpiodes* and *Ictiobus* have 25-30 (usually 27 or 28). Carpsucker larvae tend to have little, if any, midventral pigment in the preanal region and buffalos usually have a well-developed midventral row (or rows) of melanophores. *Carpiodes* tend to reach comparable developmental stages at smaller sizes than *Ictiobus*. Local spawning seasons of *Carpiodes* (May-August) and *Ictiobus* (late February-May) seem to only slightly overlap, and there is some evidence that, under normal hydrographic conditions, older larvae and juveniles of the two genera use separate "nursery" habitats. Only the river carpsucker (*Carpiodes carpio*) seems to occur locally, whereas at least two species of *Ictiobus* have been taken.

(118)

Status of the Spotted Bass,
(*Micropterus punctulatus*) (Centrarchidae),
in the Eastern United States

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Georgia Cooperative Fishery Research Unit

All specimens of *Micropterus punctulatus* (spotted bass) housed at Auburn University, Tulane University, University of Alabama and University of Louisville were examined to delineate meristic and morphometric characteristics and ranges of the two subspecies occurring in the eastern United States. Meristic counts and body measurements indicated that *M. p. henshalli* (Alabama spotted bass) is restricted to an area above the Fall Line in the Mobile Bay drainage. An area of intergradation exists in the lower Mobile Bay drainage. *Micropterus p. punctulatus* (northern spotted bass) occurs from the Guadalupe River drainage in Texas through the Choctawhatchee River drainage in Florida, excluding the Mobile Bay drainage. Northern spotted bass appear to be introduced in Apalachicola drainage.

(119)

The North American Mosquitofish,
Gambusia affinis:
A Unique Case in Sex-Chromosome Evolution

ANN BLACK AND W. MIKE HOWELL

Samford University

Three chromosomal forms of the mosquitofish, *Gambusia affinis*, were found to occur within the U.S. One chromosomal form contains a large heteromorphic sex chromosome in females and is distributed throughout the Mississippi River drainage of Missouri, Arkansas, Mississippi and Tennessee and in the Black Warrior, Cahaba and Coosa Rivers of the Mobile Bay drainage in Alabama. The second chromosomal form contains a small heteromorphic sex chromosome in females and is found in northern Florida. The third chromosomal form contains no heteromorphic sex chromosomes in females and is found along the Atlantic Coast of North Carolina southward into Florida, along the Gulf Coast of Florida and Alabama, and extending into the Tombigbee River of the Mobile Bay drainage in Alabama. In all populations studied, males did not exhibit any heteromorphic sex chromosome pairs. The evolution of heteromorphic sex chromosomes is discussed in light of occurrence within a single species.

(120)

Logperches of Southeastern United States
(Etheostomatini, *Percina*)

BRUCE ALAN THOMPSON

Louisiana State University

Until recently, all logperches from southeastern United States have been considered to be two subspecies of *Percina caprodes*, *P. c. caprodes* and *P. c. carbonaria*. Jenkins (1976) and Jenkins, Thompson and Zorach (1977) have shown this to be incorrect. East of the Mississippi River and south of the Tennessee drainage there are four forms that deserve specific recogni-

tion. There are three orange-banded species and one without an orange band in the spinous dorsal fin. In at least three areas there is sympatry between two forms. The present known distribution of these species is:

1. *Percina* "A." Conasauga Logperch — confined to the Conasauga R. in SE Tennessee and probably N Georgia; sympatric with *Percina* "B."
2. *Percina* "B." Mobile Logperch — found in the Mobile drainage above the Fall Line. Extends below the Fall Line in the Alabama and Tombigbee rivers; sympatric with *Percina* "A" and "C."
3. *Percina* "C." Gulf Logperch — found from L. Pontchartrain to the Mobile drainage below the Fall Line; sympatric with *Percina* "B."
4. *Percina* "D." Florida Logperch — confined to the Escambia and Choctawhatchie drainages; allopatric with all other logperches.

The relationships of these four forms to the more widespread species of logperch is discussed. *Percina carbonaria* is recognized as a distinct species, separate from the *caprodes* complex.

(121)

A New Species of Madtom Catfish
(Ictaluridae) from the Coastal Plain
of the Carolinas

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Virginia Commonwealth University and
North Carolina State Museum

A new species of *Noturus*, the broadtail madtom, was first collected in 1967; currently 25 specimens are known. It is a member of the subgenus *Schilbeodes* and apparently is most closely related to *Noturus leptacanthus*, the speckled madtom. The broadtail madtom is very distinct, differing from *N. leptacanthus* in: body stockier; eye larger, 4.8-6.7% SL (4.3-5.0% SL in *N. leptacanthus*); caudal fin more rounded, higher and deeper, total caudal rays 57-65 (47-58); body unspotted, smudge on caudal base (usually spotted, smudge absent); vertebrae 36-37 (usually 33-36); POM pores 10 (usually 11).

The broadtail madtom is known only from the Coastal Plain of North and South Carolina; in South River of the Cape Fear drainage and Waccamaw, Lumber and Lynchies Rivers of the Peedee drainage. It is allopatric to *N. leptacanthus*, which ranges north into the Santee drainage. The broadtail madtom is associated with current swept gravel shoals. It merits the conservation status of either threatened or special concern.

(122)

Seasonal Occurrence of Fishes
Within the Surf-Zone of a
Northern Gulf Coast Barrier Island

TIMOTHY MODDE AND STEPHEN T. ROSS

University of Southern Mississippi

Fishes occupying the surf-zone habitat of a northern Gulf coast barrier island have been sampled over a 21 month period. Within this study period over 138,000 fishes representing 76 species have been collected. The exposed beaches of barrier islands appear to attract large numbers of immature marine and estuarine fish species. Seasonal frequency peaks were observed in

the summer months with a secondary peak appearing in mid-winter. During periods of peak abundance the numerical component of the inshore barrier island ichthyofauna is dominated by relatively few species.

Fishes utilizing the surf-zone habitat can be functionally categorized into three groups: 1) permanent residents, 2) temporary residents and 3) migrants. Migrants constitute the greatest number of species observed and can be further subdivided into rhythmic, arrhythmic and estuarine categories.

(123)

Dorsal-Anal Spine Histology and Toxicity of *Oligoplites saurus* (Pisces:Carangidae)

JOHN H. TRAVIS, JR.
University of West Florida

The leatherjacket, *Oligoplites saurus*, possesses a venom apparatus which consists of five dorsal and two anal spines along with associated musculature, venom glands and integumentary sheaths. Venom glands are located in paired anterolateral grooves along each spine. The glands of *O. saurus* are not encapsulated in a sheath of connective tissue. The venom glands of adults appear proportionally thinner than those of juveniles. Histochemical tests reveal the glandular cells comprising the venom gland contain a proteinaceous product. Envenomation occurs when a spine punctures the flesh. The integument surrounding each spine is pushed proximally as the spine and associated glandular tissue enter. Traumatization of the glandular cells allows the venom to disperse inside the wound. Extracts prepared from dorsal and anal spines of *O. saurus* were injected into *Cyprinodon variegatus* and *Fundulus similis*. Pectoral fin extract from *O. saurus* and saline served as controls. Dorsal-anal extract caused extensive chromatophore expansion in both *C. variegatus* and *F. similis*, while control injections caused little or no chromatophore expansion.

(124)

Sexual Dichromatism in the Slippery Dick, *Halichoeres bivittatus* (Pisces:Labridae)

MICHAEL C. APPLIGATE
University of West Florida

The literature implies a controversy regarding the correlation between *H. bivittatus* color and sex. Color as related to sex was examined in approximately 200 specimens in various color stages from the northern Gulf of Mexico. Four different color phases of Caribbean *H. bivittatus* have been described by another as first adult, first intermediate, second intermediate and terminal-color phases. Northern Gulf *H. bivittatus* follow these patterns in all but the terminal-color phase. Northern Gulf terminal-color males and females were consistently separated by distinctive color differences. Terminal-color males have a green cheek area, whereas terminal-color females have a pink or orange cheek. Preliminary histological examination of the gonads substantiate that *H. bivittatus* are diandric, protogynous hermaphrodites and indicates that terminal-color phase males are sexually reversed females. Gonads from secondary males may exhibit atretic ova or other regressive ovarian tissue surrounded by spermatogenic tissue.

(125)

Fishes of Isla de Providencia, Colombia

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Isla de Providencia (= Old Providence Island) is a zoogeographically important but poorly studied outcropping of volcanic origin situated in the extreme southwestern Caribbean Sea. During the summers of 1968-1971, 105 marine, fresh and brackish water fish collections were made on the island by the second author and James C. Tyler. Most effort was directed at sampling coral reef dwellers, especially small forms found intimately associated with the coral and sponge substrate, by using SCUBA and ichthyocides. A total of over 11,400 fish representing 315 species was obtained; dominant families were the Gobiidae (42 species), Clinidae (41), Apogonidae (18), Serranidae (18), Labridae (12) and Pomacentridae (12). Analysis of depth preferences of individual species revealed 137 species (43.5%) confined to depths of less than 50 ft., 36 (11.4%) to depths greater than 50 ft., and 17 (5.4%) ubiquitous forms captured throughout the entire sampled depth range (0-120 ft.). Species diversity was highest at depths of 50-79 ft., lowest at 10-49 ft., and equally intermediate at the shallowest (0-9 ft.) and deepest (80-120 ft.) depths. Zoogeography of the ichthyofauna is discussed, including reference to species conspicuously absent (e.g., *Allanetta harringtonensis*, *Chaetodon ocellatus*) and possibly endemic (*Pycnomma roseovelti*, *Lipogramma* n. sp., *Evermannichthys* n. sp.).

(126)

Notes on Tropical Marine Fishes in Alabama Waters with New Records for the Region

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University of South Alabama

DOUGLAS CLARKE
Dauphin Island Sea Lab

Research on the ichthyofauna of the northeastern Gulf of Mexico has yielded valuable information concerning the zoogeographic affinities of the region. Recent collections from the artificial reefs off the Alabama coast indicate that large numbers of tropical reef species quickly become associated with these hard substrate structures. Included in collections were specimens of *Apogon pseudomaculatus*, *Equetus umbrosus*, *Holacanthus tricolor*, *Chromis enchrysurus*, *C. scotti*, *Pomacentrus variabilis*, *Lythrypnus nesiotes* and *Acanthurus chirurgus*. Species which have been sighted, but not collected, include *Priacanthus arenatus*, *Apogon aurolineatus*, *Equetus lanceolatus*, *Chaetodon ocellatus*, *C. sedentarius*, *C. striatus*, *Holacanthus bermudensis*, *H. ciliaris*, *Pomacanthus arcuatus* and *Pomacentrus partitus*. Several male *Apogon pseudomaculatus* had developing eggs in their oral cavity. The summer of 1977 appeared especially significant in that several tropical forms, including *Abudefduf saxatilis* and *Chaetodon ocellatus*, were collected inside Mobile Bay. Their occurrence inside the bay has not been recorded in previous years, and their presence may have been due to unusually high salinities during that summer season.

(127)

Effects of Population Density and
Food Resource Abundance on
Space Utilization in *Hypsoblennius ionthas*
(Teleostei:Blenniidae)

DOUGLAS G. CLARKE

University of Alabama in Birmingham and
Dauphin Island Sea Lab

The freckled blenny, *Hypsoblennius ionthas*, occupies oyster reef habitat in the mid to lower reaches of the Mobile Bay estuary. Laboratory colonies of *H. ionthas* males were established at three population density levels (7.1, 14.3 and 21.4 fish/m²) and under conditions of high and low food abundance. Movements of individual blennies were mapped during standardized time intervals, and surface areas encompassed by the movements were measured. Regressions of surface area as function of body size (TL) indicate several patterns of space utilization. As population density decreases, the amount of space used per fish increases. Fish in colonies maintained with a high food supply used significantly more space than those held under scarce food conditions. Results are interpreted with reference to territorial behavior and adherence to a size-dominance social hierarchy.

(128)

The First North American Continental Record
of *Gobionellus pseudofasciatus* (Pisces:Gobiidae)

PHILIP A. HASTINGS

Harbor Branch Foundation, Inc.

Gobionellus pseudofasciatus, previously recorded from Trinidad westward to Costa Rica and northward to Belize, is reported now from three localities in the Indian River region of east-central Florida. The distribution of *G. pseudofasciatus* parallels that of several other fishes having a southern continental distribution, most notably the striped croaker, *Bairdiella sanctaeluciae*. Prevailing current patterns moderate temperatures in the Indian River region and apparently enhance the dispersal of some southern Caribbean fishes into the area. This combined with other physical characteristics of the area results in the presence of a southern tropical continental element in the fish fauna of the Indian River region. The common name of "slash cheek goby" is proposed for *G. pseudofasciatus* in recognition of the most distinctive color characteristic of the species.

(129)

A Paramecium-Suctorian (Protozoa:Ciliata)
Parasitism Associated With a
Kepone Holding-Pond

WILLIAM H. YONGUE, JR. AND R. CHRISTIAN JONES

Virginia Polytechnic Institute and State University and
University of Wisconsin

The most abundant non-algal protists in a grab-sample from a Hopewell, Virginia, Kepone holding-pond were *Paramecium* and *Sphaerophrya* in parasitic symbiosis. (27V77; most abundant metazoan: Rotifer-

Brachionus spp.) The suctorians were generally endo- or exoparasitic but many were free. Both *P. caudatum* (dominant) and *P. aurelia* were present and apparently parasitized to the same extent. In a count of 200, one hundred fifty-three paramecia were parasitized by one to several suctorians ranging from ca. 20 to 50 microns in diameter. Paramecia were generally misshapened by the suctorians. The exoparasites (somewhat larger) were coalesced with the paramecia to varying degrees and endo-parasitism was established by this route. In regard to locomotion, feeding and reproduction, the paramecia showed no malfunction. Suctorians disappeared in six days and paramecia in thirteen, yet nine species of ciliates, seven flagellates and one sarcodine persisted. With addition of soil extract paramecia recurred and persisted but not suctorians (28X177).

(130)

The Effects of Haemolymph of
Susceptible and Refractory Mosquitoes on
Gametogenesis of *Plasmodium fallax*

A. B. WEATHERSBY AND JAMES TROOPER

University of Georgia

The effects on gametogenesis of exposure of the exoerythrocytic stages of *P. fallax* to the hemocoels of susceptible and refractory mosquitoes was determined. The number of oocysts produced in *A. albopictus* allowed to feed on turkeys with parasitemias induced by inoculation with mosquitoes previously injected with exoerythrocytic stages of *P. fallax* was compared to the number of oocysts found in *A. albopictus* having fed on turkeys inoculated with exoerythrocytic stages of *P. fallax* taken directly from infected cell cultures. Exposure of exoerythrocytic stages of *P. fallax* to the internal milieu of susceptible and refractory species of mosquitoes failed to stimulate gametocyte infectivity or production in turkey poults.

(131)

Effect of pH on the Developing Ova of
Trichurus vulpis (Adenophora:Enoplina)

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University of South Carolina

Ova of *Trichurus vulpis* were subjected to a series of pH-altered soils. Two pH series were needed. The first series failed to show any development of the ova. The fecal samples used were stored in 1.7% Formalin at 0-4 C prior to the tests. A sample which had frozen failed to develop on soil samples. This indicated a loss of viability of the ova stored in 1.7% Formalin at less than 4 C. The second pH series indicated the ova develop best at a pH near 6.0. The dog fecal pH was determined to be about 6.0 also. These two facts indicated an optimum ova development pH of about 6.0. The pH-adjusted soils registered a change of pH between the onset of the test and the end of the test. The pH was seen to change to the optimum ova developmental pH. However, the time interval this change involves would allow adverse environmental changes to affect the viability of the ova. It was seen that 1.7% Formalin and certain fungi have an effect on the ova development.

(132)

Increase of Immunoglobulin T Concentration
in Ponies as a Response to Experimental Infection
With the Nematode, *Strongylus vulgaris*

SHARON PATTON
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Semiweekly for 8 weeks, 3 ponies were each given 200 *Strongylus vulgaris* infective larvae. Two additional ponies remained uninfected during this time. Serum was collected semiweekly and analyzed by gel electrophoresis, immunoelectrophoresis and radial immunodiffusion. The relative amounts of the serum protein components in the uninfected ponies remained constant, whereas the albumin concentration decreased and the β -globulin concentration increased in the ponies with induced chronic infections of *S. vulgaris*. The immunoelectropherograms and radial immunodiffusion tests demonstrated that immunoglobulin T (IgT) was the principal component of increase in the β -globulin area. The concentration of IgG_a and b remained relatively constant throughout the experiment, whereas the IgT concentration increased fourfold.

Five weeks after the last serial dose of larvae was administered, a challenge dose of 5,000 *S. vulgaris* infective larvae was administered to each of the 5 ponies. The ponies exposed to the small doses of larvae before the administration of the challenge dose developed a disease syndrome with mild clinical symptoms which abated after a week. In contrast, the 2 ponies that had no prior exposure to *S. vulgaris* developed the acute syndrome characteristic of *S. vulgaris* infections and died 13 or 19 days later.

(133)

Schistosoma mansoni:
SEM Observations on Schistosomules
Grown *In Vitro* and *In Vivo*

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Vanderbilt University

Scanning electron microscopy was done on young schistosomules which were grown in a serum-enriched medium and on similar larvae obtained from the lungs of infected mice. The results will be presented in light of developmental similarities and differences and compared to similar studies on mature worms.

(134)

Negligible Leakage of Blood Proteins
into Gastric Contents from Calves
Infected with *Ostertagia ostertagi*
(Nematoda: Trichostrongylidae)
Correlated with Structure and
Function of Chief Cells

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USDA-Animal Parasitology Institute

The biochemistry of serum and gastric contents from 3 month-old calves infected with *Ostertagia ostertagi* was studied at 0-30 days after oral inoculation (DAI).

Plasma pepsinogens leaked negligibly in the present infections which allowed the effects of ostertagiasis on chief cells to be assayed biochemically. Albumin and globulin values in the gastric contents did not exceed those from control calves. Negligible amounts of horse-radish peroxidase leaked from the circulation into the gastric content. Serum pepsinogens were unusually high at 14-22 DAI onward. Gastric pepsin levels gradually increased to 14 DAI then abruptly decreased to nil at 22-30 DAI. The chief cells were generally stripped of their pepsinogen granules in severe infections as shown histologically, histochemically and ultra-structurally.

(135)

Immunogenicity of Developing Larvae of
Brugia pahangi Attenuated *In Vivo*
by Treatment of Infected Jirds with Mebendazole

JOHN W. MCCALL, JUNG JUN AND DOREEN DALESANDRO
University of Georgia

Twenty-nine male jirds (*Meriones unguiculatus*) were allocated to 3 groups of 7-11 jirds. Groups I and II were given injections of 200 and 125 infective larvae one month apart; each injection was followed by single doses of mebendazole (50 mg/kg) on days 7, 14 and 21. Eighty-four days after the first immunizing dose, the test (I) and challenge control (III) groups were given 50 infective larvae subcutaneously.

Immunization led to suppression of microfilaremia, reduction in worm burden and retardation of growth of male and female worms. The mean microfilaremia in the test group was much lower (4) than that in the challenge control (17) group. At necropsy 143-150 days after challenge infection, the challenge control group harbored a mean of 14 worms, whereas the immunization control group had a mean of 19 attenuated worms. The test group presented a mean of 16 worms which were, in general, smaller than the challenge controls. Females from the challenge control group measured 40 mm in length, whereas those worms in the test group which were larger than those in the immunization control group measured 23 mm.

(136)

An Analysis of the Helminth Parasites
from the Digestive Tract of
Tennessee Raccoons, *Procyon lotor* (L.)

KENNETH W. BAFUNDO, WALTER E. WILHELM AND
MICHAEL L. KENNEDY
Memphis State University

The stomach and digestive tract of 215 Tennessee raccoons (*Procyon lotor*) have been examined. Raccoons were trapped in all nine geographic regions of the state (as determined by the Tennessee Wildlife Resources Agency) in an effort to represent the entire raccoon population. All helminth parasites have been identified. Analysis of the number and kind of parasitic infections has shown considerable variation from region to region. Approximately 90% of the animals were parasitized with males being more heavily infected than females.

(137)

Host-Specificity and Zoogeography
Among Monogenetic Trematodes of
the Family Mazocraeidae

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Species of the family Mazocraeidae are gill parasites of marine and anadromous teleost fishes. Eighty percent of the mazocraeids are reported to be species-specific and 18% oligoxenous. The type species, *Mazocraes alosae*, is described from seven different clupeoid fishes. The subfamilies Kuhninae and Mazocraeoidinae are reported from more widely divergent hosts. Kuhninae species are the most speciose of the mazocraeids as is expressed by their circumtropical distribution. The genus *Mazocraeoides* is also circumtropical; however, its greatest expansion is restricted largely to North American forms. The Mazocraeinae, Kuhninae and Mazocraeoidinae show distributions remnant of the Tethys Sea.

Mazocraeid distributional patterns are similar to the tropical marine fishes and invertebrates as described in the literature. The utilization of a wide diversity of different hosts by the variety of worms has resulted in their broad range diversity. Areas of greatest species diversity and/or less host-specificity suggest their more ancestral origins.

(138)

Ultrastructure of *Cryptobia helicis*
(Zoomastigophorea: Kinetoplastida)
in the Snail Host

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Cryptobia helicis, a ubiquitous parasite residing in the spermatheca of land snails of the genera *Helix*, *Triadopsis*, *Anguispira* and *Monadenia*, was originally described by Leidy in 1846 from 3 species of *Triadopsis*. Preliminary light microscope observations revealed the *C. helicis* occurred not only within the spermatheca of *Triadopsis multilineata* but that a large number of these parasites appeared to also be firmly attached to the spermatheca itself. This observation set the stage for a number of studies attempting to elucidate some of the basic interactions responsible for this unique hetero-specific relationship. This paper presents an ultrastructural description of *C. helicis* and it describes an apparent extensive morphological transformation of the anterior flagellum which allows the parasite to attach firmly to the microvillus border of the spermatheca.

(139)

Helminths of Some Marine Birds
from North Carolina

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North Carolina State University

Examinations were made on a variety of birds from the coastal area of North Carolina. The hosts included members of the orders Procellariiformes and

Charadriiformes. This report is concerned primarily with the trematodes, cestodes and acanthocephalans from these hosts. Particular emphasis is given to the incidence of infection and new host relationships.

(140)

Some Aspects of Incidence and Transmission of
Toddia bufonis Franca 1911
(Protozoa: Sporozoa) in *Natrix sipedon sipedon*
and Other Species of *Natrix*

KATHERINE ANN BOOKER AND WILLIAM H. YONGUE, JR.
Virginia Polytechnic Institute and State University

An intraerythrocytic parasitemia of *Toddia bufonis* has been followed in northern water snakes, *Natrix sipedon sipedon* from July, 1976, through Fall, 1977. Of fifteen snakes sampled from Beaver and Garden Islands, Michigan, eight snakes exhibited *Toddia* in the blood. Among the infected snakes there were three gravid females in 1976 and one in 1977. From five to eleven young per litter (depending upon litter size) were bled to search for existence of transovarian infection of *Toddia*. There was no evidence that *Toddia* is transmitted transovarially. The mode of transmission is not known, but other species of *Natrix* can be infected mechanically. Thus it seems likely that a vector is the mode of transmission.

(141)

Intestinal Helminths of Fishes in the
Family Percidae from South Central Kentucky

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Western Kentucky University

Representatives of the Family Percidae from an area of South Central Kentucky were examined for intestinal helminths. Helminths parasitized 40.5% of the fishes. Eight species of parasites, representing 3 Phyla, were found in the infected fishes. A list of parasites (new host records) includes (fish species in parenthesis): Trematoda: *Crepidostomum isostomum*; *Podocotyle boleosomi* (*Percina caprodes*, *Etheostoma zonale*); Cestoda: *Bothriocephalus cuspidatus*; *Bothriocephalus formosus*; *Bothriocephalus* sp.; Acanthocephala: *Acanthocephalus dirus* (*Percina caprodes*, *Etheostoma bellum*, *E. bleimiodes*, *E. caeruleum*, *E. squamiceps*, *E. stigmaticum*, *E. zonale*); *Pomphorhynchus bulbocollis* (*Etheostoma bleimiodes*, *E. caeruleum*, *E. squamiceps*, *E. stigmaticum*, *E. zonale*); Nematoda: *Spinitectus* sp. (*Etheostoma squamiceps*, *E. stigmaticum*).

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(142)

Evolutionary History of the
Cestode Order Proteocephalida

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Based on a framework of cladistical relationships, the morphological, biogeographical and host relationships of the genera comprising the cestode order Proteocephala

idea parasitic in fish, amphibians and reptiles are examined. The new supra-specific classification scheme differs only slightly from previous classifications. Biogeographically, the proteocephalideans consist of one family endemic to South America and another exhibiting intercontinental patterns of vicariance. The dispersal-tracks of the second family are consistent with those of ostaryophysan fishes, primary hosts for proteocephalideans. Most proteocephalidcan genera, including the most primitive and the most specialized, occur in South America. The greatest concentration of species belonging to the most primitive genus occurs in the Northern Hemisphere where the fewest proteocephalidean genera occur. Proteocephalideans are postulated to have originated in South America. In the Southern Hemisphere, all but four piscine hosts are siluriforms, whereas in the Northern Hemisphere a great diversification of hosts has occurred. An hypothesis of the evolution of the host-parasite relationships of non-piscine proteocephalideans is proposed to explain the observed patterns of host relationships. Biogeographical and host relationships do not contradict the phylogenetic model based on characters of adult morphology. Additional support for the hypothesis that the cestode order Cyclophyllidea is di- or polyphyletic and is derived from proteocephalidean ancestors is also contained in the analysis.

(143)

Action Spectrum of the Shadow Response in
Schistosoma mansoni Cercariae
(Digenea:Schistosomatidae)

KENNETH S. SALADIN
Florida State University

The photosensitive cercariae of *Schistosoma mansoni* are demonstrably sensitive to shadows. In a backlighted Plexiglas cuvet of which the lower half was darkened by a 0.3 ND filter, cercariae passively drifting past the filter's edge experienced a 50% light intensity reduction ("shadow") and were considered responsive if they swam within 2.0 sec. Of 200 cercariae/trial, the percent responding (%R) proved to be a function of background intensity, I. A curve of %R vs. log I was obtained at each of seven wavelengths (λ) of monochromatic light, and from these curves the relative intensity (I_{r+1}) needed to elicit a 55% R at each λ was determined. The reciprocal of I_{r+1} is an index of relative photosensitivity, a plot of which vs. λ constitutes an action spectrum and suggests the absorption spectrum of the photoreceptor pigment. The action spectrum of the shadow response of *S. mansoni* cercariae peaks at 490 nm, suggesting a pigment in the rhodopsin family. This is typical among Metazoa, but is the first demonstrated action spectrum for a parasitic flatworm.

(144)

A Revision of North American *Najas*
(Najadaceae)

ROBERT R. HAYNES
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Najas, a group of submerged aquatic plants in the family Najadaceae, has been confused both taxonomically and nomenclaturally. This study attempts to

clarify this confusion and presents a distributional and evolutionary history of the genus in North America. The genus is recognized to contain nine species (11 taxa), including two new combinations. Data are primarily morphological and geographical and are based upon: (1) an examination of over 5000 herbarium specimens, (2) field studies in New England, southeast United States and the Great Lakes region and (3) a study of pertinent literature.

(145)

Taxonomy and Variation within
Leucothoe axillaris (Ericaceae)

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Leucothoe axillaris (Lam.) D. Don is a semi-woody, evergreen shrub distributed commonly in moist areas along the Gulf and Atlantic coastal plain of southeastern North America. The range extends continuously from southern Virginia through central Florida and into eastern Louisiana. Within this species range the morphology of the individual populations varies. The most obvious variation is found in the visibly obvious characters, such as leaf shape and stature, while the more conservative characters are primarily stable. Historically, these form changes resulted in the development of a complex system of nomenclature and taxonomic ranking at the specific and subspecific level. Results from a recent study indicate that the morphological variation of *L. axillaris* is of a clinal nature. The various entities split from *L. axillaris* proper actually do not display distinct variation, but instead, intergrades from one form into the other.

(146)

Taxonomy, Distribution and
Historical Considerations of *Echium*
(Boraginaceae) in North America

WILLIAM P. PUSATERI AND WILL H. BLACKWELL, JR.
Miami University, Ohio

Echium (blue devil), an introduced "weed" in North America, may actually be represented in the flora by more than one species. In addition, preliminary research indicates that *E. vulgare* L. (the common species) is probably composed of two distinct varieties and perhaps additional forms. There is good evidence that the distribution of these plants is closely correlated with the presence of limestone. The history of the occurrence of this complex in North America is especially interesting in that *Echium* is poisonous and has been associated with both dermatitis and internal poisoning. It is possible that distributional and taxonomic information concerning the nonnative (American) component of *Echium* will shed additional light on taxonomic problems in the native (European) component.

(147)

A Scanning Electron Microscope Study of Foliar Trichomes for Species of *Quercus* L. Subgenus *Lepidobalanus* Endl. in the Eastern United States

PAUL M. THOMSON AND ROBERT H. MOHLENBROCK
Southern Illinois University

A scanning electron microscope study of foliar trichomes occurring on species of eastern white oaks, *Quercus* L. subgenus *Lepidobalanus* Endl., is presented. Trichome types are enumerated along with a description of their structure and occurrence upon the leaf. Types are designated for each species and seen to be useful taxonomic characters for the purpose of making determinations in the field.

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Toward a More Biologically Meaningful Infrageneric Classification of *Vernonia* (Vernonieae:Compositae)

SAMUEL B. JONES
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The majority of the species of the largely tropical tribe Vernonieae belong to one genus, *Vernonia*, which has 1,000 of the 1,400 species. *Vernonia* is poorly understood and needs a revised classification. The first step in a revision of such a large and complex group is the development of an infrageneric classification. It has been known for some time that the pollen grains of Vernonieae exhibit striking patterns of variation exceeding all other Compositae in their complexity. Since differentiating morphological features are not abundant in Compositae, pollen morphology was enlisted to aid in the revision. When used in combination with other characters (particularly inflorescence types), pollen grains from over 600 species of *Vernonia* clearly demonstrated their value in developing a new infrageneric classification.

(149)

SEM of Pollen Grains of *Centratherum* (Vernonieae:Compositae)

L. KATHERINE KIRKMAN
University of Georgia

Centratherum is a small tropical genus with a distribution in South America, Africa, India, S.E. Asia., Australia and the Philippines. As a part of a revisionary study of the genus, the pollen grains were examined using scanning electron and light microscopy. Evidence from the external pollen morphology indicates that the genus, as presently recognized, is heterogeneous. This evidence, in combination with other features, suggests a need for a new classification of the genus.

(150)

External Seed Morphology of Selected Southeastern U.S. Taxa of *Arenaria* (Caryophyllaceae)

B. EUGENE WOFFORD
University of Tennessee

The genus *Arenaria* in the southeastern United States has recently received considerable taxonomic and nomenclatural attention. External seed morphology of selected southeastern U.S. taxa was examined by scanning electron microscopy and pertinent taxonomic characters for separating these taxa will be discussed. An undescribed *Arenaria* from the Cumberland Plateau of Tennessee and other new distributional data will be presented.

(151)

Variability in Oak Leaf Trichomes

JAMES W. HARDIN
North Carolina State University

Scanning electron microscopy of the leaf trichomes of the eastern U.S. *Quercus* species has shown that a given species has an invariable complement of trichome types. Obvious differences occur between adaxial and abaxial surfaces, and juvenile and mature blades. Ecotypic and ecophenic differences involve quantitative rather than qualitative variation in the vestiture. Hybrids and introgressants generally have a mixture of both parental types.

(152)

The Nomenclatural Implication of Biosystematic Studies in the *Polygonum hydropiperoides* Complex (Polygonaceae)

CHARLES B. McDONALD
North Carolina State University

Four wetland taxa, *Polygonum hydropiperoides*, *P. opelousanum*, *P. setaceum* and *P. hirsutum* make up the *Polygonum hydropiperoides* complex. Since they can all be found in the Southeastern states of North Carolina, South Carolina, Georgia and Florida, this area was selected to analyze morphological variability, phenotypic plasticity, chromosome variability, pollination biology and crossing compatibility of the group members. The results indicate that *P. hydropiperoides*, *P. setaceum* and *P. hirsutum* are distinct species while *P. opelousanum* is indistinct and should be merged with *P. hydropiperoides*.

(153)

Notes on the Endangered Alabama Endemic,
Jamesianthus alabamensis Blake & Sherff
(Asteraceae)

W. MICHAEL DENNIS
Tennessee Valley Authority

T. F. HALL
Alabama Wildflower Society

Jamesianthus alabamensis Blake & Sherff, a monotypic member of the Asteraceae, was first described in 1940 from material collected by Roland M. Harper in northwestern Alabama. It is listed as an endangered species on both state and Federal proposed lists. A survey of regional herbaria indicates the rarity of its collection and a review of botanical literature establishes the paucity of published information on this taxon. During the late summer and fall of 1977, field studies were conducted to determine the distribution and condition of extant populations and gather information on habitat characteristics and life history. All of the eleven populations discovered were within approximately six miles of the type locality (four miles north of Russellville, Franklin County, AL). Number of individuals per population ranged from 2 to 40 with the average being about 6 to 7. Plants were found primarily along open to partially shaded borders of small headwater streams that flow through a unique geologic area where Hartselle sandstone, Bangor limestone and Tuscaloosa gravels outcrop. *J. alabamensis* is a perennial herb with plants arising in the spring from conical buds located just below the soil surface on the overwintering caudex. No basal rosettes have been observed. Plants grow to a height of two meters and flower from late August until the first killing frost usually in late October. Achenes collected in the fall had a germination rate of over thirty percent within six weeks when placed indoors under favorable conditions.

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The Recognition of *Amblyolepis* DC.
and its Separation from
Subtribe Gaillardiiinae (Asteraceae)

MARK W. BIERNER
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Although *Amblyolepis* has generally been accepted as a distinct genus, at times it has been treated as congeneric with *Helenium* L. Almost all systematists have at least recognized it as belonging to the tribe Helenieae subtribe Gaillardiiinae, most closely related to *Helenium*. However, close examination reveals that *Amblyolepis* has almost nothing in common with the other genera included in the Gaillardiiinae. There are differences in flavonoid chemistry, chromosome morphology and number, and morphology of the trichomes, leaves, outer and inner involucre bracts, receptacle, achenes, pappus scales and disc corollas. The only major characteristics it shares with the other genera are a non-chaffy receptacle and truncated style branches. Therefore, the evidence strongly suggests that *Amblyolepis* is a distinct genus separate from *Helenium*; it is not even closely related to *Helenium*, and it should be segregated from the subtribe Gaillardiiinae.

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A Biosystematic Study of the
Hypericum denticulatum Complex
(Hypericaceae)

DAVID H. WEBB
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Within the past half century, the *Hypericum denticulatum* Walt. complex has received a variety of taxonomic treatments. The complex has been interpreted as consisting of two species, a single species with two varieties or a single species with three varieties. Cytological, biochemical, morphological (including SEM studies), ecological and distributional data are presented that support the recognition of three taxa within the complex.

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Laboratory Comparisons of
Two Species of *Liquidambar* (Hamamelidaceae)

LYNN H. WELLMAN AND JOE E. WINSTEAD
Western Kentucky University

Laboratory germinated seedlings of *Liquidambar formosana* Hance, obtained from Taiwan, showed no response to photoperiod under warm temperature cycles (32-24 C) differing from a Kentucky population of *Liquidambar styraciflua* L. tested under the same conditions. Growth chamber tests indicated a total dark requirement for the North American species of *Liquidambar* to go dormant while cooler temperatures (24-10 C) were necessary for the Asiatic species to form terminal buds. Seedlings of *L. formosana* differed from *L. styraciflua* seedlings in having significantly fewer stomata per leaf area, a significantly lower leaf area and lower seed weight. Tracheid elements of secondary wood tissue in *L. formosana* were significantly longer when compared with macerated wood samples of *L. styraciflua*. Certain morphological features of *L. formosana* show similarity to populations of *L. styraciflua* previously studied that were of Central American origin and those features provide speculations of past flora relationships.

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A Taxonomic Study of
the Genus *Cyperus* (Cyperaceae)
in West Virginia

JAN R. TAYLOR AND DAN K. EVANS
Marshall University

Thirteen species of *Cyperus* are attributed to West Virginia, two of which are new additions to the flora of the state. *Cyperus globulosus* is added to the flora from one collection in Monongalia County. West Virginia material formerly identified as *C. odoratus* is re-assigned to *C. ferruginescens* on the basis of a morphometric comparison of the two taxa. Polygonal graph analysis of these two closely related species showed culm width, achene length and spikelet length to be significantly greater in *C. odoratus*. Further, *C. odoratus* is a coastal plain element while *C. ferruginescens* has a more inland distribution. Other closely related

species subjected to polygonal graph analysis of variability were: *C. esculentus* and *C. erythrorhizos*, *C. rivularis* and *C. flavescens*, *C. lancastriensis* and *C. strigosus*, and *C. filiculmis* var. *filiculmis* and *C. filiculmis* var. *macilentus*. Mean values and pattern of variability of eight characteristics, culm height and width, scale length and width, achene length and width and spikelet length and width serve to demonstrate the close affinity and also to distinguish between the closely related species.

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Leaf Anatomy as a Basis for Classification
in Selected Species of *Carex* (Cyperaceae)

MARION MALLORY AND DAN K. EVANS
Marshall University

Closely related species of *Carex* have in the past been distinguished primarily by inflorescence, perigynium and achene characteristics. Leaf anatomy is seldom employed in identification and classification of these complex sedges. Leaf blade tissue from several wide spread locations was observed for similarities and differences among nine species representing three subgeneric sections: section *Bracteosae*, including *Carex convoluta*, *C. rosea*, *C. socialis*, *C. texensis* and *C. retroflexa*; section *Squarrosae*, including *C. frankii*, *C. squarrosa* and *C. typhina*; and section *Multiflorae*, including *C. vulpinoides*. Number of epidermal cells per unit area, length and width of epidermal cells, nature of bulliform cells, number and location of silica bodies, type and location of sclerenchyma, mesophyll arrangement, shape and size of air cavities and leaf shape were among the anatomical structures that serve to distinguish subgeneric sections and closely related species. Polygonal graph analyses of these anatomical characters were used in demonstrating species variability and taxonomic relationships.

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Chromosome Evolution in the Amaryllidaceae

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The probable basic chromosome number in Amaryllidaceae is 11. Evidence is presented for supporting this statement. Other evidence is summarized pointing to the part played by polyploidy, aneuploidy, a combination of polyploidy and aneuploidy, fission (Robertson's law), hybridity and various combinations of these phenomena in the evolving of new species and new genera in this family.

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A Morphological Comparison of
Clitoria guianensis and *Clitoria laurifolia*
(Leguminosae)

PAUL R. FANTZ
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Clitoria guianensis (Aubl.) Benth. is superficially similar to *C. laurifolia* Poir. (synonym: *C. cajanifolia*

(Presl.) Benth.). Numerous specimens have been misidentified leading to erroneous reports on the distribution of these species. Keys typically separate these species by the leaflet shape, the pubescence of the lower leaf surface and/or the shape of the bracteoles, characters which are apparently misinterpreted. *Clitoria guianensis* is distinguished easily from *C. laurifolia* by the larger flowers, longer stipules, bracteoles, and calyx, the glaucescent, sparsely pubescent lower surface of the leaves, and the occasional production of unifoliate leaves. *Clitoria laurifolia* is commonly collected near the coast, frequently found in grasslands behind the dunes, infrequently from inland savannas, ranging from eastern Venezuela to southern Brazil, in the West Indies east of Haiti, and introduced into the paleotropics. *Clitoria guianensis* is commonly collected in savannas, pine forests and rocky cerrados, ranging from Brazil to southern Mexico, and from western Cuba.

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Ampelothamnus Revisited:
Its Singular Climbing Habit Occurs Also
in *Clethra* and *Leucothoe*

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The Ericaceae is known for the diversity of vegetative growth represented in the family. One of the more intriguing taxa, considered to be essentially unique, is *Pieris* (*Ampelothamnus*) *phillyreifolia* (Hook.) DC. Individuals are encountered as members of pond cypress stump and buttress communities and occur either as erect shrubs, or as lianas with climbing stems which penetrate within the fibrous bark of the cypress.

Field studies of pond cypress buttress communities in South Carolina indicate that this peculiar climbing habit is not so restricted. Similar, although not so dramatically far-reaching sub-rhizidomal climbing stems have been observed in both *Leucothoe racemosa* and *Clethra alnifolia*. These finds reduce the generic importance of this characteristic as well as increase interest in the function of this peculiar growth pattern.

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The Herbarium of the
Geological Survey of Alabama

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University of Alabama

The Herbarium of the Geological Survey of Alabama was founded in 1878 with the contacting of Charles Mohr by the State Geologist, Eugene Allen Smith. The Herbarium remained active until the death of Mohr in 1901 and was directly utilized in the 1901 publication, *Plant Life of Alabama*. An investigation of its contents reveals that the Herbarium is more than a repository for Alabama plants as it contains 47 types, including 34 topotypes, four holotypes, six isotypes, two syntypes and one paratype.

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Correlation of
Selected Chemical and Physical Parameters
and the Distribution of the
Nymphaeaceae sensu lato in Alabama

JOHN H. WIERSEMA
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A thorough description for any aquatic species should include ecological factors influencing the distribution. Little information of this nature is available on the aquatic plants of the Southeast, especially within the State of Alabama. Water samples from 141 locations in Alabama containing members of the *Nymphaeaceae*, *Cabombaceae* and *Nelumbonaceae* (including the genera *Nymphaea*, *Nuphar*, *Cabomba*, *Brasenia* and *Nelumbo*) were analyzed for certain chemical and physical parameters (hydrogen ion concentration, total alkalinity, chloride concentration, total hardness — calcium and magnesium, nitrates, conductivity and turbidity). The data were statistically analyzed with the intent of relating the distribution of each species studied to certain ecological limits.

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The Life History and Ecology of
Carex misera Buckley and
C. purpurifera MacKenzie (Cyperaceae)

LINDA C. ANDERSON
North Carolina State University

Carex misera and *C. purpurifera* are two rare and endangered species endemic to the Southern Appalachians. Studies were initiated in May, 1977, to locate the populations in North Carolina and Tennessee, to study the phenology and to analyze the associated vegetation of these species. Included in the analysis of each site were species lists by strata, a description of the soil and measurements of slope, elevation, exposure and aspect. Further studies were initiated in the field to establish the primary method of reproduction and conditions necessary for seed germination and seedling survival. Transplanting of mature plants into a variety of other habitats was used to determine if the species are restricted to particular habitat types. Results to be presented include: 1) the distribution and habitats of each species, 2) their phenological life cycle and 3) the results of the germination and transplant studies.

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A Survey of the Algae
Inhabiting Three Mile Creek,
Mobile County, Alabama

MARGARET MILLER AND ROBERT NESTER
University of South Alabama

This survey was designed to identify the genera of freshwater algae, excluding diatoms, of Three Mile Creek located in Mobile County, Alabama. The Chlorophycophyta (Greens) were by far the most prolific group of algae present. The order Zygnematales was

best represented and most of these were members of the family Desmidiaceae. Other Divisions of algae present were Cyanochloronta (Blue-greens), Pyrrophytophyta (Dinoflagellates), Euglenophycophyta (Euglenids) and Chrysophycophyta (Golden-brown algae).

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Some Interesting Freshwater Algae
from South-Central Kentucky

GARY E. DILLARD
Western Kentucky University

Continuing studies on the freshwater algal flora of the southeastern United States have revealed the presence of a number of infrequently encountered taxa in Kentucky. Of several reported and illustrated, the following are particularly noteworthy — Chlorophyceae: *Gloeotaenium loitlesbergerianum* Hansg.; Xanthophyceae: *Chadefaudiothrix gallica* Bourr.; and Chrysophyceae: *Chrysodidymus* spp. Prowse, *Chrysothraella longispina* Laut., *Cyclonexis annularis* Stokes, *Tetrasporopsis perforata* (Whitf.) Bourr., *Phaeoplaca thallosa* Chodat and *Chrysothraephosphaera globulifera* Scherff.

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Observations on the Ecology and Morphology
of a Marine Epizoic Diatom

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Harbor Branch Foundation, Inc.

The epizoic diatom *Pseudohimantidium pacificum* Hustedt & Krasske has been found in waters off the Florida east coast. This represents a new record of this taxon in the western North Atlantic. *P. pacificum* cells were attached by dichotomously-branching, mucopolysaccharide stalks to the copepods *Corycaeus subulatus* Herrick, *Farranula gracilis* (Dana) and *Euterpina acutifrons* (Dana). Stalks were primarily attached to copepod appendages and body segments involved in the mating process. The non-silicious stalk material was extruded from apical lamellar fields on the valve mantle. These extrusions appeared to have no relation to the labiate processes at the ends of the recurved axial area. Rows of labiate processes were observed to coincide with narrow slits on the external valve face. These grooves were always longer at the valve end in which the axial area was strongly inflexed.

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Cytokinesis in
Cryptomonad (Cryptophyceae) Algae

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The cryptomonad algae possess several unique features which have confused an understanding of their phylogenetic relationships and at the same time have stimulated interests among taxonomists, morphologists and physiologists alike. Flagellated algae generally divide beginning either at the posterior or anterior, either while freely swimming or in palmelloid state, and the pattern of cytokinesis can be a useful criterion for de-

termining phylogenetic relationships. In this presentation are described salient features of cell division in the freshwater *Cryptomonas ovata* var. *palustris*. When cultured on agar base medium, *C. ovata* became palmeloid and encased in copious mucilage; in agitated liquid medium, cells were mobile without apparent mucilage. Cell division began at the posterior, following an enlargement of the cell and the appearance of four active flagella extending from the gullet. Within an average of two hours, cleavage progressed through the plane of the gullet. Following an initial quiescent period, and as cleavage progressed, the dividing cell became actively motile. Daughter cells were comparable in size to the parent cell. These features of cytokinesis in *C. ovata* are compared to those of other flagellated taxa.

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The Occurrence of Glycolate Enzymes in Some Coccoid Green Algae

KENNETH W. BULLOCK AND TEMD R. DEASON
University of Alabama

A number of species of coccoid green algae representing diverse genera and reproductive forms were assayed for glycolate oxidase, a peroxisomal enzyme of land plants and some algae, and glycolate dehydrogenase, a functionally analogous enzyme in many green algae. The correlation of this glycolate enzymology with certain ultrastructural features of these algae including cell division and motile cell structure will be examined in light of the evolutionary lines suggested for the green algae based on cytological and biochemical data. The effects of various culture methods on the glycolate enzymology of these algae will also be discussed.

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Some Coprophilous Species of Myxomycetes

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Wright State University

Moist chamber cultures of cow dung have yielded abundant sporangia of some interesting species of Myxomycetes that appear in a succession beginning with a species of *Perichaena*, followed by *Licea fimicola*, *L. alexopouli*, and lastly a new species of *Didymium*. *Didymium difforme* also was harvested from several cultures. The specimens of *Perichaena* appear very close to *P. liceoides* but final determination must wait until the type of *P. liceoides* can be examined. *Licea alexopouli* can easily be recognized by its milky white protoplasmodium that gives rise to a single shiny black sporangium. Plasmodia of *Licea fimicola* were transferred from dung to 2% water agar and observed continuously until sporulation. The plasmodium is a typical phanero-plasmodium with a fan-shaped, advancing feeding edge, and trailing reticulate veins in which the protoplasm undergoes a rhythmic, reversible streaming. This plasmodium is easily seen with the naked eye due to its pale orange-yellow pigmentation, three-dimensional appearance and extension of several millimeters over the agar surface. Following a period of migration, the plasmodium sporulates, giving rise to a cluster of usually 20 to 30 spindle-shaped sporangia. Examination of sporangia with both light microscopy and the scanning

electron microscope revealed short capillitial threads attached to the inner surface of the peridium. The genus *Licea* is based largely on the absence of a capillitium and to a lesser degree the type of plasmodium which is characteristically a protoplasmodium. The taxonomic and phylogenetic significance of a capillitium and a phanero-plasmodium in *Licea fimicola* will be discussed in relation to other species in the genus *Licea*. Supported by Grant BMS 75-19098 and DEB 75-19098 AO1 from the National Science Foundation.

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Spore to Spore Cultivation of a New Species of *Didymium* (Myxomycetes) in Association with an Acarid Mite, *Tyrophagus putrescentiae*

DAVID M. SMITH AND HAROLD W. KELLER
Wright State University

An acarid mite, *Tyrophagus putrescentiae*, was observed feeding on fruiting bodies of myxomycetes in moist chamber cultures. The feeding habits of this mite include the selective ingestion of spores (other parts of the sporangium such as the peridium, capillitium and columella are apparently not ingested) from myxomycete sporangia belonging to *Stemonitis flavogenita*, and a new species of *Didymium*. On one occasion, this mite ingested portions of a bright yellow, sclerotized phanero-plasmodium. A new species of *Didymium* found on bovine dung was used to study the mite-myxomycete relationship. Intact spores were observed passing through the mite's digestive tract with phase microscopy and also in fecal pellets following defecation. Spores within the fecal pellets germinated readily in hanging drop slide preparations. A large percentage of spores appear to germinate when derived from fresh sporangia and also from mite-passed fecal pellets. This new species of *Didymium* will be described and details of its cultivation from spore to spore will be discussed. To our knowledge, this represents the first published record of viable myxomycete spores disseminated by mites via the fecal route. Supported by Grant BMS 75-19098 and DEB 75-19098 AO1 from the National Science Foundation.

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The Bryophyte Flora of Savage Gulf, Grundy County, Tennessee

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A preliminary examination of the bryophyte flora of Savage Gulf, Grundy County, Tennessee, has been completed. The Gulf, a narrow gorge on the western escarpment of the Cumberland Plateau, contains approximately 200 hectares of virgin forest area as well as secondary forest cover. Over one hundred and fifty taxa including five species new to Tennessee have been found in the bryophyte flora of Savage Gulf. *Plagiochila dubia* Lindenb. et Gottsche, *Lejuenea minutiloba* Evans, *Nardia lescurii* Underw., *Telaranea nematodes* (G. ex Aust.) Howe and *Cephalozia macrostachya* Kaal. represent both montane and coastal plain elements. It is expected that Savage Gulf houses over 200 taxa which will extend the distribution of bryophyte species into as well as within Tennessee.

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Mosses of the Alto Rio Buritaca, Colombia

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In July, 1977, the first penetration by botanists was made of the north-facing slopes of the Sierra Nevada de Santa Marta in northeastern Colombia. Extensive plant collections, including bryophytes, were made from 1500 to ca. 4000 meters elevation. Following the course of the upper Rio Buritaca, investigators gathered ecological information and specimens along a life-zone gradient ranging from lower montane cloud forest to páramo. The mosses collected along the transect included a high percentage (60-65 per cent) of wide-spread pan- and neotropical forms. The remaining species were of strictly Andean affinities or are as yet undetermined. On bare mineral soil were found *Fissidens*, *Dicranella*, *Campylopus* and *Hookeriopsis*. On downed logs *Hookeriaceae* and *Leucomiaceae* predominated, the most frequent genera being *Callicostella*, *Cyclodictyon*, *Hookeriopsis* and *Leucomium*. On erect tree trunks were found species of *Syrhopydon*, *Octoblepharum*, *Porotrichum*, *Pilotrichum* and *Acroporium*.

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Flavonoids of the
Psilotaceae, Stromatopteridaceae and
Other Primitive Ferns and
Their Phylogenetic Significance

JAMES W. WALLACE
Western Carolina University

The classical system in which the Psilotaceae and the ferns are classified as unrelated taxa, primarily at the Divisional level, was challenged on morphological and anatomical grounds by Bierhorst (1968). Based on this data the genera of the Psilotaceae have been interpreted as being closely related to the primitive fern *Stromatopteris*. Therefore, the family Psilotaceae was positioned near the Stromatopteridaceae with the leptosporangiate ferns. The flavonoid chemistry of representative species of the Psilotaceae, Stromatopteridaceae, Schizaeaceae, Gleicheniaceae and Hymenophyllaceae does not support the latter contention. Species of the Psilotaceae appear to be unique in the plant kingdom in synthesizing 0-glycosides of amentoflavone. The Psilotaceae do not produce detectable flavonols which are the major constituents of typical ferns. In contrast, the ferns examined produced flavonols as their major components. Traces of amentoflavone could not be detected.

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Reversal of
IAA and GA Induced Pea Epicotyl Elongation
by Alternate Electron Transport Inhibitors
and Concanavalin A

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Austin Peay State University

A study was conducted to determine the roles of alternate electron transport and cell membrane receptors

in hormone induced epicotyl section elongation of *Pisum sativum* variety "Little Marvel." An inhibitor of alternate electron transport system, 8-hydroxyquinoline, was effective in blocking epicotyl elongation in tissue treated with indoleacetic acid and gibberellic acid. Elongation was not reinstated upon addition of ATP. The lectin concanavalin A was also effective in inhibiting the hormone enhanced elongation. This inhibition could be reversed by the addition of mannose. These data suggest that both the alternate electron transport system and cell membrane receptors are involved in hormone enhanced elongation of epicotyl sections.

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Effects of Light Quality upon
the Growth of *Avena* Coleoptiles

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Growth of decapitated *Avena* coleoptile segments, of apical segments (including the tip) and of coleoptiles of intact seedlings, was compared in darkness and in light of different wavelengths. Growth of coleoptiles of intact seedlings exceeded that of decapitated segments, with apical segments showing least elongation under all conditions. Expansion of decapitated segments is insensitive to light, being comparable to that of dark controls. Growth of apical segments is inhibited at 510-565nm, and stimulated at 605-700nm. In intact seedlings, light inhibition of expansion occurs at 465-565nm and at 660-700nm, though not at intermediate wavelengths. Possible interpretations of these different responses will be discussed.

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Preliminary Studies on the Effects of
Acrylonitrile and Potassium Thiocyanate
on the Seagrass, *Ruppia maritima*
(Potamogetonaceae)

PAUL F. GARRISON
University of West Florida

The seagrass, *Ruppia maritima* L., was cultured in controlled, artificial conditions to determine the effects of two industrial pollutants on the rate of photosynthesis, respiration and growth. The pollutants were added to the water column in concentrations ranging from 10 ppb to 10 ppt. Acrylonitrile applied in concentrations greater than 100 ppm caused complete cessation of photosynthesis and respiration, measured in ppm dissolved oxygen, while concentrations below 100 ppm had no apparent effect. Potassium thiocyanate depressed the rate of photosynthesis and respiration throughout the range of concentrations tested. The growth rate of *R. maritima* was measured as an increase in node number, leaf number, root number and biomass (g wet weight). Both acrylonitrile and potassium thiocyanate, in all concentrations tested, caused a reduction in the growth rate of shoots (nodes and leaves), but seemed to stimulate root growth when less than 1 ppm acrylonitrile was applied or when less than 10 ppt potassium thiocyanate was applied.

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Glyphosate Effects on Phenylalanine Ammonia-Lyase in Three Crop Species

STEPHEN O. DUKE AND ROBERT E. HOAGLAND
Southern Weed Science Laboratory

The herbicide glyphosate, N-(phosphonomethyl) glycine, was found to induce increases in the activity of phenylalanine ammonia-lyase (PAL) in dark-brown seedlings of maize (*Zea mays* L.), soybean [*Glycine max* (L.) Merr.] and cotton (*Gossypium hirsutum* L.). Three-day-old seedlings were transferred from water to 10^{-4} M (cotton) or 10^{-3} M (maize and soybean) herbicide (free acid) for 3 additional days at 25 C. Seedlings (root and shoot tissue) were sampled for enzyme determinations at 12 or 24 h intervals during this period. In all species PAL activity levels of treated plants were greater than controls after 24 h by these criteria: specific activity, activity per plant and activity per g fresh weight. The induced PAL activity preceded decreases in growth caused by glyphosate in all species. In maize and soybean, PAL activities remained stable or decreased in controls, while increasing in glyphosate treatments during the 3 day time course. In cotton, PAL activity decreased in controls and glyphosate-treated seedlings during the 3 days, but remained higher in glyphosate treatments during this period. The possible role of PAL activity induction in the mode of action of glyphosate is discussed.

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Effects of Glyphosate on Growth and Levels of Phenolic Compounds, Proteins and Amino Acids in Three Crop Species

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Southern Weed Science Laboratory

The herbicide glyphosate [N-(phosphonomethyl) glycine] influenced the growth and the levels of phenolic compounds, soluble protein, and amino acids in root and stem tissues of maize (*Zea mays* L.), soybean [*Glycine max* (L.) Merr.] and cotton (*Gossypium hirsutum* L.). Dark grown seedlings (3 days old) were transferred to glyphosate (free acid, 10^{-4} to 10^{-3} M) solutions or to water and maintained in liquid culture for 72 h at 25 C in the dark. Plant tissues (root plus stem) were analyzed for hydroxyphenolics (water soluble and ethanol soluble), soluble protein, and composition of free pools of amino acids at intervals of 12 or 24 h. Growth measurements (fr. wt, dry wt and length) were also determined. Seedling growth was significantly reduced with time in all glyphosate treated plants when expressed by all three criteria. Hydroxyphenolics increased (per g fr. wt basis) in all species prior to detectable growth differences. Concomitant with increases in phenolics, a disproportionate decrease in levels of phenolic amino acids was found. Soluble protein increased in glyphosate treated tissue (per g fr. wt basis). These results are discussed with respect to modes and mechanisms of glyphosate action.

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Effects of n-Triacontanol on Seed Germination and Early Growth

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Seeds of 15 weed and crop species were treated with 10^{-5} M n-triacontanol to determine the effects of this plant growth regulator on germination, morphology and early growth. Seeds were dark-incubated in petri dishes with distilled water or triacontanol. Germination (radicle protrusion) was determined after 24 and 48 hr. Lengths of root plus shoot were measured after 48 hr. Germination was not significantly affected in any of the 15 species, but inhibition of root plus shoot length was significant in three species: lettuce (*Lactuca sativa* L.), $t = 99\%$, 20% reduction in length; sicklepod (*Cassia obtusifolia* L.), $t = 99\%$, 17% reduction; and cotton (*Gossypium hirsutum* L.), $t = 95\%$, 13% reduction. No significant stimulation or inhibition in growth was noted in: corn (*Zea mays* L.), sesbania [*Sesbania exaltata* (Raf.) Cory], sorghum [*Sorghum bicolor* (L.) Moench], spurred anoda [*Anoda cristata* (L.) Schlecht], purslane (*Portulaca oleracea* L.), radish (*Raphanus sativus* L.), barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], soybean [*Glycine max* (L.) Merr.], sida (*Sida spinosa* L.), velvetleaf (*Abutilon theophrasti* Medic.), pigweed (*Amaranthus retroflexus* L.) and cantelope (*Cucumis melo* L.). This research shows that n-triacontanol, previously shown to increase growth at $\sim 10^{-8}$ M, can also cause inhibitory growth effects in a selective matter at higher concentrations.

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In Vitro Nitrate Reductase Activity and In Vivo Phytochrome Measurements of Maize Seedlings as Affected by Various Light Treatments

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Southern Weed Science Laboratory
and University of Wisconsin

Concomitant *in vivo* assays of phytochrome and *in vitro* assays of nitrate reductase (NR) were made on mesocotyls of 3.5 to 5.5-day-old maize (*Zea mays* L.) seedlings. NR assays were also made using the potentially chlorophyllous portions (leaf and coleoptile) of the same shoots. A negative correlation was found between phytochrome levels and NR activities in response to various light treatments. No qualitative differences occurred between the NR responses of mesocotyl and potentially chlorophyllous or chlorophyllous tissues. Exposure of dark-grown seedlings to continuous white light caused rapid losses of assayable phytochrome accompanied by rapid increases in NR activities. Subsequent return of the seedlings to darkness produced increases in assayable phytochrome with decreases in NR activity. A brief, red-light treatment given at the end of the white light treatments resulted in more NR activity and less assayable phytochrome in the subsequent dark period than in seedlings treated with far-red light. These data suggest that modulation of NR activity is not directly influenced by photosynthetic photoreceptors and that phytochrome is involved in the photocontrol of NR activity. Our results also indicate that end of day light quality influences night NR activity as well as affecting

the time required for maximal NR activity on the subsequent day.

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Flavin-Mediated Photooxidation of Plastocyanin from *Protosiphon*

JAMES W. ROSS, J. C. O'KELLEY AND J. K. HARDMAN
University of Alabama

An *in vitro* reaction which involves a light-mediated reduction of flavin coupled to the oxidation of plastocyanin is being studied. There is biological evidence that this reaction is part of a reversible photosystem which regulates cell division in *Protosiphon*. We are investigating the specificity of this reaction for different forms of flavin, including flavoproteins from *Protosiphon* and from other sources (e.g., diaphorase from *Clostridium* and glucose oxidase from *Aspergillus*). Of the flavin derivatives tested, FMN uses light at 460 nm most effectively. Flavoproteins from *Protosiphon* and also from other sources show activity. FMN-containing flavoproteins are more active than those that contain FAD. Supported by Grant No. PCM 75-22783 from NSF.

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SEM Analysis of Red Rice and Several Rice Cultivars

ROBERT E. HOAGLAND AND REX PAUL
Southern Weed Science Laboratory

Scanning electron microscopy (SEM) was used in a comparative study of seeds and coleoptiles of several conspecific rice (*Oryza sativa* L.) varieties including the weed, red rice. Cultivars were: Mochi-Gommi, LA-110, Starbonnet, Labelle and Bluebelle. Seed surfaces of red rice, LA-110 and Mochi-Gommi possessed trichomes that were more numerous at the seed apex than on other seed parts. A large central awn, with spines along its axis, extended from the seed apex of red rice. These characteristics were absent in the other varieties. No significant differences were noted in seed-surface tubercles or in the quantity or structure of wax on seed surfaces of all six samples. The coleoptiles of all samples had several similarities: stomata were arranged in parallel rows on both the adaxial and abaxial surfaces; epicuticular wax structure on both surfaces was rodlet; prickly hairs were found only on the adaxial surfaces; spines were present on the edge; and two types of papillae (based on size and shape) were present on both surfaces. Although there were varietal differences among coleoptiles on a macroscopic scale, significant morphological differences were not discernible at the SEM level.

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Use of an Aeroponic Culture System for Studying Copper Toxicity to Soybeans (*Glycine max* (L.) Merrill)

JOHN RUNNINGWOLFE, BETTYE R. STOKES AND
VALERIE J. POSTMAN
South Carolina State College

An aeroponic culture system was used to study the effects of various concentrations of copper in nutrient

solutions. It was found that the presence of 2.0 ppm of copper has a significant effect upon the root systems.

(185)

Threatened Eastern North American Shrimps and Crayfishes (Decapoda:Atyidae, Palaemonidae and Cambaridae)

RAYMOND W. BOUCHARD
University of North Alabama

Three species of threatened Eastern North American shrimps and five species of crayfishes have been proposed for inclusion on the United States list of endangered and threatened wildlife and plants. Four are troglolobites and include the shrimps *Palaemonetes cummingsi*, Alachua County, Florida; *Palaemonias alabamiae*, Madison County, Alabama; *P. ganteri*, Edmonson County, Kentucky; and the crayfish *Procambarus acherontis*, Seminole County, Florida. These species are regarded as threatened due to limited ranges, low population levels and restriction to a fragile, simple ecosystem which is vulnerable to groundwater pollution. The epigeic crayfishes *Cambarus bouchardi*, Scott County, Tennessee and McCreary County, Kentucky; *C. obeyensis*, Fentress, Overton, Putnam and Cumberland Counties, Tennessee; *Orconectes jeffersoni*, Jefferson, Oldham and Bullitt counties, Kentucky; and *O. shoupi*, Davidson and Williamson counties, Tennessee, have been recommended as threatened due to their limited ranges and occurrence in streams proposed for modifications or in waters susceptible to possible pollution from urban areas or coal mining.

(186)

Dietary Protein Requirements of Red Swamp Crawfish, *Procambarus clarkii* (Girard) (Decapoda:Cambaridae)

JAY V. HUNER AND SAMUEL P. MEYERS
Southern University and Louisiana State University

Young crawfish (3.3 cm — total length, 0.63 g) were fed four diets with varied protein levels: Diet 1 = 43%, Diet 2 = 35.4%, Diet 3 = 24.6%, and Diet 4 = 42%. Diets 1-3 had alginate binders while Diet 4 had a starch binder. Survival and intermolt periods for each diet were: Diet 1 = 73%, 12.1 days (n = 58, SD = 2.070); Diet 2 = 73%, 12.0 days (n = 68, SD = 2.812); Diet 3 = 80%, 11.1 days (n = 66, SD = 2.304); and Diet 4 = 100%, 12.7 days (n = 67, SD = 2.112). Differences in growth increments per molt did not differ significantly ($P \geq 0.05$) nor did food conversion. These values were: 0.72 cm (total length) (n = 260, SD = 0.897), 1.71 g (n = 255, SD = 1.134), and 1.03 (n = 32, SD = 0.343). Final lengths and weights did not differ significantly between diets nor were there sex differences. The values were: males, length — 7.0 cm (n = 25, SD = 2.337) and weight — 9.67 g (n = 25, SD = 2.390); females — 7.1 cm (n = 21, SD = 2.817) and weight — 9.26 g (n = 21, SD = 2.353). It appears that the optimal protein level for artificial crawfish diets in closed systems is below 25%.

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Comparison of the Growth and Survival of
Red Swamp Crawfish
(*Procambarus clarkii* (Girard))
and White River Crawfish
(*Procambarus acutus acutus* (Girard))
(Decapoda:Cambaridae)

R. A. BEAN AND JAY V. HUNER

Louisiana State University and Southern University

Red swamp crawfish (*Procambarus clarkii* (Girard)) and white river crawfish (*Procambarus acutus acutus* (Girard)) were stocked in modified 220 liter containers with constant water flow at the following ratios (total 12 crawfish per container): 100%:0% (*P. clarkii*: *P. a. acutus*), 67%:33%; 50%:50%; 33%:67%; and 0%:100%. Initial size (total length) was approximately 2.5 cm for both species. The experiment began on 8 January, 77 and ended on 29 April, 77. Comparison of growth revealed that *P. a. acutus* grew slightly larger than *P. clarkii* (6.2 cm versus 6.0 cm after 9 weeks; 9.1 cm versus 8.7 cm after 15 weeks). Survival of each species was similar (no significant differences — $P \geq 0.05$) regardless of the original ratios at the beginning of the experiment. These values were: 9 weeks, *P. clarkii* — 66% and *P. a. acutus* — 55%; 15 weeks, *P. clarkii* — 24% and *P. a. acutus* — 13%. Mean densities through time were start — 54/sq. meter; 9 weeks — 33/sq. meter; and 15 weeks (end) — 10/sq. meter.

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Survival of Pond Snail Embryos
Treated with Four Insecticides

ANNE M. CUSIC AND ELLEN W. McLAUGHLIN

Sanford University

Various concentrations of four insecticides were tested for their effects on survival and development of *Helisoma* embryos. These insecticides were malathion, chlordane, mirex and sevin. All embryos treated with 125 ppm malathion or more died within 48 hours. No effects from concentrations of malathion at or below 10 ppm were noted when compared with the controls. All embryos died in 5 ppm chlordane but at 0.1 ppm no toxic effects were observed. All embryos died in mirex concentrations of 50 ppm or greater but embryos treated with 12.5 ppm showed no harmful effects. With the insecticide sevin, all embryos died in 25 ppm but in concentrations of 1.0 ppm or less, they showed normal development.

(189)

Sex Identification, Sex Ratio and
Social Organization in the Thalassinid Shrimp,
Upogebia affinis (Crustacea:Decapoda)

CHARLES E. JENNER

University of North Carolina

Female *Upogebia affinis*, juvenile and adult, have appendages on the first abdominal segment, but males lack these. I collected 226 adults and 102 immatures and

identified their sex, using this character. The immatures included 58 females and 44 males, but there were 199 adult females to 27 adult males. Males, females and juveniles were sorted into separate containers. Females and juveniles did not fight, but adult males were extremely aggressive to each other. Males placed with juveniles or females did not fight.

Upogebia lives communally in burrow systems with constricted openings that prevent adults from moving in or out. Social organization within burrows has not been known, but the extreme aggression between males would preclude more than one per burrow. Juvenile males approaching maturity must leave or fight the resident male. Each burrow harbors about seven adult females. *Upogebia* is thus the first invertebrate known to have a harem.

(190)

Pseudohermaphroditism:
A Major Sexual Phenomenon in
the Neogastropoda (Mollusca)

MARTHA G. JENNER

University of North Carolina

Females of certain *Ilyanassa obsoleta* populations have a penis; females of other populations lack it. Genetic isolation is unlikely and recruitment is high, but populations remain the same year after year. Penis-bearing females are not simultaneous hermaphrodites. Nor are they protandric, as rearing experiments have shown. In normal populations, half the immatures have a penial bump; these become males. The half lacking a bump become females. Where females all have a penis, all immatures have a bump. Only half these immatures become males; the rest develop directly into penis-bearing females. These females are thus pseudohermaphrodites. Data from transfer experiments support the hypothesis that environmental factors control the expression of the traits.

Anomalous sex traits occur in numerous other neogastropoda. In all I have studied, the pattern is the same as in *Ilyanassa*. The strong similarity suggests that the same sexual phenomenon, pseudohermaphroditism, occurs in all these species.

(191)

The Life Cycle of
Anomalocera ornata Sutcliff (Copepoda)
in North Carolina Waters

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University of North Carolina at Wilmington

Between 1965 and 1977 there have been seven incursions of vast numbers of *Anomalocera ornata* into Wrightsville Sound, N.C. These intrusions took place in February or March and involved adult, reproductive individuals. In February, 1976, a dense population was located a few miles offshore from Wrightsville Beach. By mid-March they had vanished. No developmental stages were taken in the plankton from March to September, but in late September, nauplii were present. In

mid-October copepodites were taken and during November, the first adults were found. Adult females in the laboratory laid single bluish-green eggs which rapidly darkened to brown. None of these eggs hatched immediately but a few of the eggs laid in February hatched in late September. It is proposed that *Anomalocera ornata* is a winter-spring species with an annual life cycle maintained by an egg diapause during the summer months.

(192)

Observations on Mollusk Populations in the Leadenwah Salt Marsh System, Wadmaw Island, South Carolina

JULIAN R. HARRISON
College of Charleston

An investigation of the diversity, distribution and abundance of the molluscan species in the study area was initiated in January, 1976, and is continuing at present. Habitat or community types sampled include intertidal oyster beds, *Spartina alterniflora* marshes and sand-shell banks. Within the study area, microhabitat and/or resource partitioning has produced a number of identifiable species assemblages marked by relatively little overlap. Studies to date have yielded a total of 47 species representing at least 33 families from the area as a whole; these include one chiton, 31 gastropods and 15 bivalves. Several snails, including the ellobiid *Marinula* cf. *M. succinea* (Pfeiffer), are reported from the area for the first time. Seasonal trends in abundance and activity were evident in several species; data for the snails, *Odostomia impressa* (Say) and *Hydrobia* sp., and the bivalve, *Gemma gemma* (Totten), will be presented. Supported by a grant (R-804-688-01) from EPA.

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Preliminary List of Species from Recent Collections of Fresh-water Mussels (Bivalvia:Unionacea) from the Atchafalaya River Drainages in Louisiana

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University of Southwestern Louisiana

DANIEL J. BEREZA
Academy of Natural Sciences of Philadelphia

The confluence of the Red, Ouachita, Little, Tensas and Black Rivers, all major drainages in Louisiana, forms in part the Atchafalaya River and Basin, a vast region of interconnected waterways and wetlands. The following fresh-water mussels (Mollusca:Unionacea:Unionidae) have been collected in these drainages in the past five years: *Anodonta suborbiculata* Say, *A. imbecilis* Say, *A. grandis* Say, *Strophitus subvexus* (Conrad), *S. undulatus* (Say), *Arcidens confragosus* (Say), *Pleurobema cordatum* (Rafinesque), *Elliptio dilatata* Raf., *Fusconaia undata* (Barnes), *Amblema plicata* Say, *Quadrula apiculata* Say, *Q. quadrula* (Raf.), *Q. pustulosa* (Lea), *Q. nodulata* Raf., *Plectomerus dombeyanus*

(Valenciennes), *Tritogonia verrucosa* (Raf.), *Megaloniais gigantea* (Barnes), *Unio merus tetralasmus* (Say), *U. declivus* (Say), *Ligumia recta* (?) (Lamarck), *L. subrostrata* (Say), *Lampsilis hydiana* (Lea), *L. teres* (Raf.), *L. satur* (Lea), *Leptodea fragilis* (Raf.), *Truncicella truncata* Raf., *T. donaciformis* (Lea), *Carunculina parva* (Barnes), *Glebulula rotundata* (Lamarck), *Proptera purpurata* (Lamarck), *P. laevissima* (Lea), *Villosa lienosa* (Conrad), *Oblivaria reflexa* Raf. and *Obovaria* (castena complex).

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New Host and Locality Records for the Water Mite, *Unionicola serrata* (Wolcott) (Arthropoda:Acarina:Unionicolidae)

MALCOLM F. VIDRINE
University of Southwestern Louisiana

Nominal *Unionicola serrata* (Wolcott), a water mite infesting the labial palp regions of freshwater mussels (Mollusca:Unionacea:Unionidae) in North America, is here reported from the following hosts and locations: *Lampsilis satur* (Lea) (Calcasieu River, Allen Parish, and Anacoco Bayou, Vernon Parish, Louisiana); *Popenaias popei* (Lea) (Devil's River, Val Verde County, Texas); *Lampsilis hydiana* (Lea), *Amblema plicata* Say, *Proptera purpurata* (Lamarck) and *Fusconaia askewi* (Marsh) (Anacoco Bayou, Sabine River, Vernon Parish, Louisiana); *Fusconaia undata* (Barnes) and *Tritogonia verrucosa* (Rafinesque) (Tangipahoa River, Tangipahoa Parish, Louisiana); *Villosa lienosa* (Conrad) and *Carunculina parva* (Barnes) (Kisatchie Bayou, Red River, Natchitoches Parish, Louisiana); and "*Lampsilis*" *ochracea* (Say) (Lake Waccamaw, North Carolina). *U. serrata* appears to be site specific to the labial palps of unionacean mussels; as yet not found in any margaritifere unionaceans, it appears to lack host specificity among all other major groups of unionaceans north of Mexico. The author acknowledges the use of lots of mussels from the Academy of Natural Sciences of Philadelphia and the Ohio State University Museum.

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Distribution of *Latreutes fucorum* (Decapoda:Caridea) and the Branchial Parasite, *Probopyrinella lateuticola* (Isopoda:Epicaridea)

DANIEL L. ADKISON
University of West Florida

The shrimp, *Latreutes fucorum* (Fabricius, 1798), and the bopyrid isopod, *Probopyrinella lateuticola* (Gissler, 1882), show a variable distribution in an area off the Carolinas. Samples were collected along a transect from the Gulf Stream into the Sargasso Sea and back to the Gulf Stream in September, 1972. *P. lateuticola* was found on 324 out of 6454 *L. fucorum*, an infection rate of 5.5%. The occurrence of *L. fucorum* on the seaward and landward transects was found to be significantly different while the occurrences of gravid shrimp and parasitized shrimps were not different at the 0.05 level.

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Home Range and Movement Patterns of
Chrysemys scripta (Reptilia:Emydidae)
in a Thermally Altered Lake in South Carolina

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Savannah River Ecology Laboratory

Home range and movement patterns of *C. scripta* were studied in Par Pond, a thermally altered lake, in South Carolina. Turtle locations were monitored employing both trapping records (trap-capture-recapture) and locational transmitters placed on individuals during the study. Results from trapping records over a ten-year period are compared with data obtained using radio-telemetry. Home range and movement patterns of *C. scripta* in Par Pond are compared to similar studies conducted in natural habitats.

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The Status of the Panther, *Felis concolor*,
in North Carolina

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North Carolina State Museum

BEN A. SANDERS
U.S. Forest Service

For the last three years we have been attempting to determine the status of the occurrence of the panther, *Felis concolor*, in North Carolina. By searching bounty records, compiling place names and examining diaries and newspapers, we were able to document a statewide distribution within historic times. Recent sightings were solicited by articles in local newspapers and magazines and by posters distributed in public recreational areas and at deer check stations. Over 200 recent sight reports were compiled and analyzed, about 20% of which were made by reliable observers under optimum conditions. Records of this type present an obvious dilemma of reliability and supportive evidence like photos, tracks or hair samples are practically non-existent. However, the clustering of sightings and their correlation with the distribution of expanding deer populations is interesting and supports the validity of these reports. We are presently employing a professional lion hunter from the western United States to search some of these key areas.

(198)

When the Wolves Went

FRAN ROBSON
Chesapeake Audubon Society

The former distribution and decline of most species of large, widely extirpated mammals is poorly documented. North American wolves are a good case in point. The literature and specimen records that document the historical distribution of wolves are few and widely scattered. The complete lack of information for many areas is difficult to understand. Nevertheless, plotting known sites and times of occurrence reveals in-

teresting patterns of correlation between extirpation rates, expanding human populations and changing technology. Factors determining accelerated extirpation as well as those affecting survival of isolated populations will be discussed.

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Movements and Home Ranges of
the Cotton Rat (*Sigmodon hispidus*) in
Relation to Habitat Type

ALBERT K. LANSLEY, JR.
Emory University

The movements of cotton rats (*Sigmodon hispidus*) were monitored over a yearly cycle by live-trapping in three habitat types of the Georgia Piedmont. Home range size and distances moved were larger in a pine plantation than in an abandoned pasture and an abandoned agricultural field. Population density was lowest in the pine plantation and nearly equal in the two old fields. Male *Sigmodon* moved farther and had larger home ranges than females particularly in the pine plantation. Several methods of computing home range sizes were used and the relative merits of each will be discussed.

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Loggerhead Sea Turtle Tracking by Satellite,
Preliminary Report

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Tennessee Technological University

DANIEL L. STONEBURNER
National Park Service

NORMAN MCCOLLUGH
University of Tennessee

Life history information on the Loggerhead Turtle (*Caretta caretta*) is limited since only twice during its life cycle is the turtle available for observation on land; first when the turtle is hatched and second when it returns to spawn. Activities other than these are relatively unknown. One approach to gaining knowledge of important life functions is by radio tracking once the animals leave the spawning grounds. Past attempts at tracking these sea turtles have been generally unsuccessful since researchers were required to actively follow the turtle during tracking. To overcome these limitations a passive tracking system using radiotelemetry and *Nimbus* satellite retrieval of site specific locations of the turtle is being developed. This is accomplished by measurements of doppler frequency shift patterns presented by the turtle transmitter. Transmitters and associated electronics (microprocessor) will be attached during the summer of 1978. Preliminary construction of the radio transmitter for attachment to the turtles reveals a variety of problems which must be accommodated for successful tracking at sea by satellite. These problems will be discussed in light of its use as a tool to study the Loggerhead's life history, as well as discussing alternative uses.

(201)

Nesting Success and Mortality of Nestlings
in a Coastal Alabama Heron-Egret Colony, 1977

PAUL G. JOHNSON AND MIKE DARDEAU
Dauphin Island Sea Lab

A heronry at Cat Island, Alabama, was surveyed for the second consecutive breeding season to determine colony structure and survival of young Ardeidae. A total of 171 nests were tagged and each clutch monitored until the nestlings left the nest. Dominant nesting species, in order of abundance, were the Cattle Egret, Louisiana Heron and the Snowy Egret. Little Blue Herons, Green Herons, American Egrets and the Glossy Ibis also nested on the island. Nestling survival of the three species surveyed were much higher than last year due to more favorable weather conditions during this year's nesting season. Higher egg mortality for Cattle Egrets, due to predation by Fish Crows, may be correlated with a higher mean nest height than other species nesting on Cat Island.

(202)

Preliminary Findings of
Population Structure and Movements in
a Lagoonal Sea Turtle (Cheloniidae) Population

MARY T. MENDONCA AND LILWELLYN M. EHRHART
Florida Technological University

A lagoonal population of sub-adult sea turtles, located on the central Florida east coast, is being sampled to determine population size, structure and composition. Temporal and spatial movements of individual turtles are also being considered. Turtles are usually captured in large mesh (30.5-40.5 cm) nets ranging from 180-640 m in length. Three species of turtles, *Caretta caretta*, *Chelonia mydas* and *Lepidochelys kempi* have been caught in the nets. The presence of a fourth species, *Eretmochelys imbricata*, is indicated by a carcass found washed ashore. Turtles are weighed, measured, tagged, photographed and released at capture site. Population sizes for the two most abundant species, *Caretta* and *Chelonia*, are estimated and population structures discussed. Greatest minimum distance between recaptures is 28 km with recapture intervals ranging from 5-230 days. Ultrasonic tracking is underway to obtain more detailed movement data.

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Excavation of
Hibernating *Cnemidophorus sexlineatus*
(Lacertilia:Teiidae) and Other Lizards
from Alabama and Georgia Highway Roadcuts

STANLEY E. TRAUTH AND ROBERT H. MOUNT
Auburn University

Between January, 1976, and April, 1978, over 150 *C. sexlineatus* were taken from individual burrows or from communal hibernacula in Alabama and Georgia. The most typical hibernation sites were found along sec-

ondary highways in sandy, red-clay embankments. Other lizards (*Eumeces fasciatus*, *Scincella laterale*, *Anolis carolinensis* and *Sceloporus undulatus*) were occasionally unearthed from well-constructed burrows in close proximity to *C. sexlineatus* burrows (cohabitation within a single burrow between *Scincella laterale* and *Anolis carolinensis* was observed in Louisiana).

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Raccoon Predation on Sea Turtle Nests,
Canaveral National Seashore

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Observations suggest that raccoon (*Procyon lotor elucus*) predation is responsible for the destruction of 95% of loggerhead turtle (*Caretta caretta*) nests at the Merritt Island sea turtle rookery. To develop management strategies for the protection and enhancement of turtles at Canaveral National Seashore, a significant portion of this important rookery, a study of raccoon predation on turtle nests has been initiated. Raccoon activities are being monitored with small mammal transmitters equipped with activity switches. This feature offers not only location data, but also relative activity information. Movement of raccoons tagged prior to and during the nesting season will be used to determine behavioral changes due to increased food resources. Raccoon population estimates are being made with mark-recapture techniques. Raccoon dietary preferences are being determined by stomach content analysis. Turtle nests will be monitored with transmitters equipped with tilt switches. When a nest is disturbed, the switch will close and initiate transmission, giving a nearly instantaneous indication of nest disturbance.

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Paleocology of the Late Pleistocene,
Orange Lake HIA Local Fauna,
Marion County, Florida

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Florida State Museum, University of Florida

A preliminary analysis of the sinkhole-cavefill deposit reveals a fauna that probably inhabited an environment much like that of present-day Florida. The presence of land mammals with South American affinities (*Megalonyx* sp., *Tapirus veroensis*, *Chlamytherium* sp., *Dasylops bellus*, *Didelphis virginiana*, and *Mylohyus* sp.) designates a late Pleistocene age for the fauna. *Synaptomys australis*, *Mesomphix* sp. and a thin-shelled *Terrapene carolina* represent evidence of a cooler climate. Fossils of *Plethodon glutinosus*, *Myotis* sp., *Neotoma floridana* and many rodent gnawed large bones suggest an active fauna within the sinkhole deposit. Barn owl use is implied by many *Blarina* and *Sorex* skulls with the braincases removed. *Chrysemys scripta*, *C. nelsoni*, *Alligator mississippiensis* and *Neofiber alleni* infer a nearby pond environment with permanent water. Coarse, sandy sediments imply a relatively rapid rate of deposition. Faunal changes through the section indicate a wet cave which became drier as it was filled.

(206)

Vascular Flora of Three Ridges Mountain,
Nelson County, Virginia

FRANCIS D. WATSON
North Carolina State University

Three Ridges Mountain is located in the southwest portion of Nelson County, Virginia, on the eastern escarpment of the Blue Ridge Mountains. The study area encompasses approximately twenty square miles of land ranging from 850 to 3970 feet in elevation. A total of 571 species representing 342 genera of 97 families of vascular plants were collected and identified. Two hundred seventy three species constitute new county records, and one species, (*Calystegia sericata* (House) Bell) has not previously been reported as occurring in the state of Virginia. Background information is provided on the location of the study area and on geology, climate, soils and vegetation.

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Sanicula odorata (Raf.) Phillippe, comb. nov.
(Umbelliferae)

LOY R. PHILLIPPE
University of Tennessee

In 1817 C. S. Rafinesque published "Flora Ludoviciana" in which more than 400 species were enumerated with 30 genera and 196 species being cited as new to science. Most of the new genera and species have no standing today other than as synonyms. A study of one of the descriptions has resulted in the new combination, *Sanicula odorata* (Raf.) Phillippe, which replaces the name. *Sanicula gregaria* Bickn., for one of our common eastern U.S. species. Although no original specimen exists, the concise description and our present "law of priority" makes this change unfortunate but necessary. A neotype has been selected from southern Louisiana and deposited in the herbarium at the University of Tennessee.

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Root Parasitism in *Schoepfia* Schreb. (Olacaceae)

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Miami University, Ohio

LYTTON J. MUSSELMAN
Old Dominion University

Schoepfia schreberi J. F. Gmel. is a small tree or shrub which grows in coppets and hammocks in Florida and the West Indies. Several plants have been excavated and have been found to be hemiparasitic, possessing haustoria similar in morphology to those of other Santalales. The haustoria vary in width from less than 0.5 mm to 4.5 mm. They tend to be conical in shape and produce what appear to be numerous collapsed layers. Ten hosts have been identified, and, as is the case with most phanerogamic root parasites, it appears that the plants are not host specific at all. This report brings to five the number of known parasitic genera of the Olacaceae, a family of some 35 genera.

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The Genus *Prenanthes* (Cichorieae: Asteraceae)
in Virginia

MILES F. JOHNSON
Virginia Commonwealth University

This paper is a continuation of reports by the author leading to a Flora of Virginia. *Prenanthes* consists of 13 species in North America; 6 species occur in the Virginia flora. *Prenanthes roanensis*, endemic to higher elevations of southwestern Virginia and adjacent states, shows the most restricted distribution. *P. alba* is found primarily west of the Blue Ridge and *P. autumnalis* is present on the southern Coastal Plain and the lower Piedmont. *P. serpentaria*, associated with woods and wood borders, *P. trifoliata*, a weedy species of disturbed habitats and *P. altissima*, common on wooded slopes, are distributed generally throughout the State. The type of *P. serpentaria* f. *simplicifolia* is from Sussex County.

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Studies in the Virginia Flora:
Species New to Virginia

MILES F. JOHNSON
Virginia Commonwealth University

This paper is the initial report of three species of vascular plants occurring wild in Virginia. *Brunnichia cirrhosa* Gaertn. (Polygonaceae) is widely distributed in the southeastern U.S. and was found in Norfolk, approximately 475 km from the nearest documented location. *Firmiana platanifolia* (L. f.) Marsili (Sterculiaceae) is widely cultivated along the East Coast, but occurs without cultivation in Richmond. *Silybum marianum* (L.) Gaertn. (Asteraceae) is widely distributed across the U.S. and adjacent Canada and is common on the Pacific Coast of the United States. It is present in Goochland County. It is speculated that ships and the railroad have played a part in introducing these species to Virginia.

(211)

Information Systems for Use in
Studying the Biological Status of
Threatened and Endangered Plant Populations

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University of North Carolina

The preservation of threatened and endangered plants should be founded upon biologically sound population information. The urgency to efficiently acquire and evaluate comparable population data augurs for the development of a comprehensive information and procedural program.

A model system is described which systematically provides organization and direction to the acquisition of specific information essential to evaluate the biological status of identified populations. The population status is determined by the identification, substantiation and analysis of the characteristics for the four basic life cycle stages — reproduction, dispersion, establishment and maintenance. The model system consists of a series

of priority questions to direct investigations, a comprehensive information system of related answers, accommodations for documentation and suggested data acquisition procedures.

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Species Biology Studies — Products

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*University of North Carolina and
University of Northern Iowa*

The species Biology program, in addition to stimulating considerable thought and discussion as well as initial species studies, has resulted in two other products — an Ecological Atlas and a scheduled Species Biology Workshop. Both deal with the threatened and endangered species of the Southern Appalachians. Sample Atlas pages and the Workshop program will be discussed.

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A Comparative Biological Study:
Pellaea × *wrightiana* Hooker,
an Endangered Disjunct in North Carolina

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Pellaea × *wrightiana*, found primarily in the south-west United States, occurs in two distinct populations in North Carolina. One population, growing on granite, has exhibited very little change in population structure since its discovery in 1956. The second, discovered in 1974 growing on slate, has an entirely different population structure and dynamics and appears to be expanding. In order to understand the biology of the species, a series of standard questions relating to Reproduction-Dispersion-Establishment-Maintenance have been applied to each population. Data on the answers to these initial questions will be given along with a discussion of the next levels of investigation necessary to illustrate the biology of the species and subsequently to develop a program of management for its preservation.

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Some Aspects of Species Biology:
Nestronia umbellula Rafinesque

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Occurring from Virginia to Alabama in the Piedmont Province, *Nestronia umbellula* Rafinesque is a small, colonial shrub found in dry, upland mixed forests. Along with three other genera, *Comandra*, *Buckleya* and *Pyrularia*, *Nestronia* represents the Santalaceae or sandalwood family in the Carolina flora. All are considered to be hemi-parasites on host roots. At this time, *Nestronia* is on both Federal and state rare, endangered and threatened species lists (Al., Ga., N.C., S.C. and Va.). Priority for study is given through application of species biology cornerstones: reproduction, dispersion, establishment and maintenance. Research is planned on *Nestronia* considering sexual expression, pollination and fruit-set.

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Species Biology and Convergent Evolution
in *Aruncus* and *Astilbe*

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Aruncus (Rosaceae; Goatsbeard) and *Astilbe* (Saxifragaceae; False-goatsbeard) are remarkably similar, yet unrelated vascular plants which grow together, often intimately, in the Southern Appalachians. Their similarity in so many characteristics often obscures their key differences and leads to confusion in the field and herbarium. *Aruncus* and *Astilbe* provide not only an example of extreme morphological convergence, but also they show almost identical functional adaptations in the following important aspects of Species Biology: Reproduction, Dispersion, Establishment and Maintenance. Although these plants are neither rare nor endangered, study of their life histories can help answer questions about their evolutionary and ecological relationships.

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Natural Diversity as a Systematics Course

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Natural Diversity requires a holistic, comprehensive classification of the biotic and abiotic features in our environment for basic inventory and conservation of species, communities and habitats. The fundamental components of the Diversity Classification System presented herein are: (1) Biotic, (2) Climatic, (3) Pedologic, (4) Geologic, (5) Hydrologic, (6) Hydrographic, (7) Topographic and (8) Physiographic. This Classification System is based on the following assumptions:

1. Each species is selectively and uniquely adapted to a habitat.
2. Species diversity is related to habitat diversity within an area.
3. Habitat diversity is related to the diversity of climate, geology, soils, hydrology and topography within an area.
4. Species assemblages are recurring combinations under similar habitat conditions within an area at a given time.
5. Species assemblages are the result of interaction of species and habitat diversity in an area through time.

A course study of diversity according to a standardized classification scheme is basic to an understanding of: floristics, vegetation, distribution, species biology and evolution of species, floras and faunas.

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Principles and Application of
Natural Diversity Study

DEBORAH K. S. OTTE
University of North Carolina

Natural diversity study based on a holistic, standardized classification system provides the key to conservation of national Natural Heritage and to preservation of

total species community/habitat diversity. Basic inventory resulting from such a study will furnish baseline data and fundamental information for:

1. Conservation of species, community, habitat diversity.
2. Ecological characterization of species, communities, habitats.
3. A predictive system for species, communities, habitats (i.e., what's where under what conditions).
4. Perspective in species biology studies (e.g., threatened), community analyses, habitat significance.
5. Interpretation of origin, migration, evolution of species, floras, faunas, communities.
6. Research in applied and advanced problems in many fields (e.g., pedology, habitat cover).
7. Integrative classifications of many types (e.g., map systems, habitat productivity).
8. Decisions on and establishment of priorities for land use, impact evaluation, land classification, management problems, natural area acquisition, resource protection.

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Some Vegetational Relationships of Plant Communities near Bee Branch Wilderness Area, Cumberland Plateau of Alabama

R. DAVID WHETSTONE
University of North Carolina

Plant communities occurring on Pottsville sandstone vary with respect to topography and soils. Dry, exposed ridges support an Oak-dominated community with *Quercus* spp. having a collective importance value of ca. 80%. *Pinus* and *Carya* comprise most of the remaining 20%. The shrub layer is primarily *Vaccinium vacillans*. On steep (30°) slopes, *Liriodendron*, *Quercus* spp. and *Pinus* form the overstory while *Kalmia* dominates the shrub stratum. *Liriodendron* and *Tsuga canadensis* co-dominate the canopy in the gorge. The herb and shrub strata are sparse. Soils are shallow on the ridge but much shallower on the steep slopes and boulder fields near the stream. The ridge and steep slope vegetation are representative of topographically and edaphically similar areas in Alabama. The gorge community, in addition to its virgin status, is unique in having *Tsuga* as a canopy dominant as well as having *Magnolia macrophylla* present as a canopy species.

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Element Distribution Index: A Technique for Assessing Nutrient Cycling Changes in Aquatic Microcosms

JOHN W. LEFFLER
University of Georgia

Empirical evaluation of hypotheses describing ecosystem dynamics are difficult to achieve because of long time scales, difficulty of parameter measurement, lack of replicate ecosystems and inadequate control over

extraneous environmental gradients. This is especially true if one wishes to characterize ecosystems by their nutrient cycling behavior. Aquatic microcosms permit testing of such hypotheses by overcoming most of these problems. A technique termed the element distribution index is a static measure useful for characterizing nutrient cycling dynamics of microcosms. Radioisotopes are introduced into an ecosystem. After a fixed time system components are isolated and measured for radioactivity. A similarity index compares the proportion of isotope in each component with the mean isotope distribution for all replicate control microcosms. This describes percent similarity between a specific microcosm and the mean condition for all replicate systems. Iron-59 and phosphorus-32 were used to characterize nutrient cycling in an assessment of the diversity-stability hypothesis.

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Sediment Redox Potentials of East Bay, Pensacola, Florida

JOHN SHERIDAN AND LARRY TUCKER
University of West Florida

The redox potentials (Eh) were measured at various depths in sediment cores taken from East Bay, Pensacola, Florida, in order to relate the sediment conditions to the growth of the seagrass *Ruppia maritima* L. (Potamogetonaceae). Measurements were taken from natural beds, transplanted beds and areas void of seagrass growth. The potentials of the water column above the sediment were indicative of oxidizing conditions having potentials of +350 to +50 mv (Pt vs S.C.E.). The sediment conditions were found to be reducing with potentials ranging from -100 to -450 mv. The reducing conditions increased with depth in the sediment. The pH was about 7.0 with little or no variation with depth. The sulfide and total iron concentrations were found to range from zero to 135 ppm and 0.02 to 0.13 ppm, respectively. The concentrations of both species increased with depth in the sediment.

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Diatom (Bacillariophyceae) Communities of a Louisiana Salt Marsh

LAWRENCE L. COOK AND STEPHEN A. WHIPPLE
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Variations in density and composition of epipellic diatom communities were determined along a gradient from brackish to saline marsh. Diatoms were extracted from mud samples at five sites, cleaned, slide-mounted, identified and counted to determine composition and density. Vascular plant composition, soil pH, soil salinity, tidal flushing rates, available forms of nitrogen, phosphorus and silicon were recorded at each site and it was found that diatom densities are lowest in areas of high tidal flushing and high salinity and greatest in areas of low tidal flushing and low salinity.

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A Floristic Comparison Between Periphytic Diatom Communities in Four Hydrologic Watersheds

DEAN B. RADTKE AND THOMAS N. RUSSO
U.S. Geological Survey

Nine sites representing four hydrologic watersheds within the Warrior Coal Field in Alabama were sampled monthly. Collections were obtained by representative scrapings taken from natural rock substrates within riffles at each site. Close monitoring of physical and chemical data at each site were compared with collections and correlations between biotic responses and these data were attempted. Ninety-seven species of diatoms were collected representing 24 genera. Distribution and abundance of important species will be illustrated and compared with pertinent physical and chemical values. Temporal and spatial variations among various diatom populations will also be discussed.

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Emergent Vegetation as Indicators for Estimation of the Mean High Water Level of Freshwater Lacustrine Systems

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MICHAEL C. APPLGATE
Florida Department of Environmental Regulation

Plant communities in freshwater lakes in the southeastern United States may vary according to geographic location, configuration, age, water characteristics, nutrient import and frequency of seasonal water fluctuations. Emergent vegetation of many lakes may be characterized by submerged land species such as *Taxodium ascendens*, *T. distichum*, *Nyssa biflora*, *N. ogeeche*, *N. aquatica* and associated vegetation. Generally, these species occur waterward of the lake mean high water line, whereas species just landward of the mean high water line may include *Cephalanthus occidentalis*, *Salix nigra*, *S. caroliniana*, *Acer rubrum*, *Ilex cassine* and associated floodplain species. Other lake communities include the submerged land species, *Typha* sp., *Nuphar* sp., *Sagittaria* sp., *Orontium aquaticum*, *Pontedaria lanceolata*, *Cladium jamaicensis* and *Nelumbo* sp. Species lying at or landward of the mean high water line may include *Panicum virgatum*, *Phragmites communis*, *Pinus elliotti* and sedges including the genera *Cyperus*, *Eleocharis* and *Rhynchospora*.

Other lake vegetation may be comprised of combinations of the previously mentioned plants composing often distinct communities which can be utilized for mean high water determination.

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Estuarine Shoreline Vegetation as Indicators of the Mean High Water Line

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Florida Department of Environmental Regulation

Numerous emergent littoral plants can be utilized as indicators approximating the mean high water line of estuaries. Determination of the mean high water line is frequently necessary for commonwealth and sovereign states to distinguish private property from state owned submerged lands and to establish regulatory environmental jurisdiction over publicly owned submerged lands. Various littoral species have different growth and habitat preferences as is evident in shoreline plant zonation. Typically the mean high water line can be approximated in *Spartina patens/Spartina alterniflora*, *Juncus roemerianus/Spartina alterniflora* and *Avicennia germinans/Rhizophora mangle* communities. The mean high water line generally can be located in such communities by locating the zone separating the landward species from the waterward species. Areas of very little geographic relief present obvious obstacles in the determination of the mean high water line by vegetation; however, vegetated shorelines of average geographic relief can be successfully examined for mean high water line approximation.

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An Analysis of Edaphic Blue-Green Algal Communities of a Mississippi Gulf Coast Salt Marsh

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Edaphic blue-green algal communities were sampled from 5 monotypic angiosperm zones in Graveline Bay Marsh near Ocean Springs, Mississippi. Samples and environmental data were taken on a quarterly basis for a period of one year from October, 1976, to June, 1977, beneath the following marsh spermatophytes: *Distichlis spicata*, *Scirpus olneyi*, *Spartina patens*, *S. alterniflora* and *Juncus roemerianus*. The algae in each sample were identified and counted in random microscope fields in order to define both taxonomically and statistically the blue-green algal communities of a Gulf Coast salt marsh. Results showed that communities in all 5 zones of Graveline Bay Marsh were dominated by *Schizothrix calcicola* throughout the year, while the sub-dominant species varied according to season. The number of individuals in all zones was greatest in the summer and lowest in the winter. The *Spartina alterniflora* and *Juncus roemerianus* zones contained the highest number of individuals during each season. Species diversity (H') was calculated for each community on a seasonal basis and the structure of the various communities were compared by means of a selected similarity index (SIMI).

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Summer and Winter Attached Algae of a Brown-Water Lake

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Glass slides were used to study attached algae at depths of 16, 46, 76 and 106 cm in Lake Mize, Florida, during the winter of 1968-69 and the summer of 1969. Forty-two species of algae were distinguished in the periphyton during the winter and 26 during the summer. Chlorophytes were generally numerous or abundant only on slides suspended at depths of 16 and 46 cm during the winter and at 16 cm during the summer. Diatoms were frequently numerous at the 16 cm depth but usually reached maximum densities on slides at the 46 cm depth, especially in the summer. Cyanophytes became abundant in the summer and a species of *Euglena* only appeared during the winter when it became abundant on most suspended slides. Species diversity was higher during the winter, mainly because of the greater incidence of rare metaphytonic desmids. A majority of the species present were chlorophytes during both seasons.

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The Ecesis of Two Species of the Salmonidae in an Isolated Stream

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In 1969 it was determined that Bee Tree Creek did not have any fish in it. The stream contained adequate food to support salmonid fish and the pH and summer temperature were adequate for cool water fish. A waterfall in Bee Tree Creek prevents fish from coming upstream. In November, 1969, thirteen brook trout, *Salvelinus fontinalis* (Mitchill) and three brown trout, *Salmo trutta* L., were introduced into Bee Tree Creek. Periodic sampling since then shows that both species are reproducing and that the brown trout population is increasing at a greater rate than the population of brook trout. This result indicates grave implications for the future of the brook trout in its natural habitat. Remedial measures are advocated.

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The Effect of Total Residual Chlorine on Goldfish (*Carassius auratus*) Previously Exposed to Long-Term Sublethal Metal Stress

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Tennessee Technological University

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The effect of a 24-hour exposure to total residual chlorine on goldfish (*Carassius auratus*) previously exposed to 30-day long-term, sublethal metal stress was studied under continuous flow bioassay conditions. De-

chlorinated Cookeville, Tennessee municipal water was used for both acclimation and bioassay dilution water and had the following basic water quality characteristics (ranges): 25-28 C; 6.8-7.7 pH; 33-59 mg/l, as CaCO₃ total hardness; 104-142 mg/l, as CaCO₃ total alkalinity; 6.7-8.0 mg/l dissolved oxygen. Groups of goldfish were exposed for 30 days to a conglomerate of 0.01 mg/l cadmium, 0.05 mg/l chromium, 0.05 mg/l copper, 0.30 mg/l iron, 0.05 mg/l lead and 0.10 mg/l zinc. The selected "safe" concentrations of metals were the Tennessee State standards for maximum allowable levels of total metal in water. No statistically significant ($P < 0.05$) differences in survival between metal-treated (99.5%) and reference fish (98.1%) were found after the exposure period. Following termination of the 30-day bioassay, groups of *C. auratus* from the metals and reference treatments were subjected to 0.00, 0.04, 0.08, and 0.12 mg/l total residual chlorine for 24 hours. Total survival of metals and reference pre-stressed goldfish was greater at lower total residual chlorine concentrations than at higher chlorine levels. A significant difference was found between survival of experimental groups at the median (0.08 mg/l Cl₂) chlorine treatment, where survival was higher among reference pre-treatment goldfish. The results of this study indicate that fish residing in aquatic systems receiving low levels of metal pollution from various point-sources, may be more susceptible to an additional, chlorine insult, at total residual levels commonly occurring in sewage and wastewater treatment effluents, than fish naturally inhabiting pristine environments. Supported by Cities Service Company, Tennessee Technological University Aquatic Ecology Fund, Oyster House Publishing Institute and Scientific Society of Estuarine Research.

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The Acute Toxicity of Soluble Copper to Tidewater Silverside, *Menidia beryllina* (Cope), at Constant and Cyclic Temperatures

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Copper toxicity tests were conducted on the tidewater silverside, *Menidia beryllina* (Cope), acclimated and tested at three constant temperatures (20, 25 and 30 C) and one symmetrically fluctuating temperature with a 12-hour ascending (20 to 30 C) and descending (30 to 20 C) phase. Tidewater silversides were exposed at each acclimation temperature to six concentrations of soluble copper under continuous flow bioassay conditions. Preliminary toxicity curves of the constant temperature acclimated fish indicate that the toxicity of soluble copper increases as acclimation temperatures increase from 20 to 30 C. The toxicity curve of the cyclic acclimated fish was similar to that of the 25 C constant acclimated fish. It appears that the lethal threshold concentration of soluble copper falls intermediate between the low and high lethal threshold concentrations of the constant acclimated fish rather than toward the high concentration, as has been suggested for fish that may be exposed to cyclic temperatures.

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Temperature Preference of
the Bluntnose Minnow, *Pimephales notatus*,
in Maryland

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University of Maryland
and
Frostburg State College

Temperature preference tests were conducted with one to two year old bluntnose minnows, *Pimephales notatus*, collected from the Monocacy River in Maryland. Results of temperature preference tests conducted with bluntnose minnows during falling field temperatures showed that specimens acclimated to 18, 24 and 30 C selected temperatures of 15.7, 26.8 and 28.4 C, respectively.

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Automated Breathing Rate Monitor for
Measuring Respiratory Synchrony in
Schooling and Non-Schooling Fish

KATHRYN J. HARGIS, KENNETH W. EAGLESON AND
ERIC L. MORGAN
Tennessee Technological University

Breathing rates of green sunfish (*Lepomis cyanellus*), a non-schooling fish, were monitored to determine whether non-schooling fish will breathe in synchrony. Breath rates of three groups of 4 fish per aquarium were monitored for five minutes each hour for 4 consecutive days. The breath rates of 3 additional groups of 1 fish per aquarium were monitored at the same time to serve as controls. Initial results showed no respiratory synchrony. Continuing studies are in progress to determine if schooling fish will show synchronous breathing behaviors under selected conditions. *Supported by the Aquatic Ecology Fund, Tennessee Technological University.*

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An Improved Design for an
Inexpensive Backpack Electrofishing Unit

JOHN R. ROBINETTE AND ERIC L. MORGAN
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Gasoline powered backpack electrofishing units have proven to be expensive and unreliable when used in high altitude streams. To alleviate this problem an inexpensive unit was designed by the Environmental Biological Research Center at Tennessee Technological University. A belt driven Tiny Tiger generator was used in conjunction with a small McCulloch Mini-Mac 25 chainsaw motor. The chain, bar and centrifugal clutch were removed from the Mini-Mac 25. Pulleys were mounted on the drive shaft of the chainsaw motor and on the armature shaft of the Tiny Tiger generator. The chainsaw motor and generator were mounted side by side on the base of a backpack frame and connected with a 19

× ¼ inch belt. A small rectifier was mounted on the backpack frame directly above the chainsaw motor and generator. The generator producing 115 volts was plugged into the rectifier to increase the voltage. A selective switch on the rectifier controls the amount of voltage being put out; another switch is used to select A.C. or D.C. This unit has proven to be very effective for electrofishing small inaccessible high altitude streams in the Smoky Mountains.

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Temporal Distribution of Ichthyoplankton Drift
in the New River in the Vicinity of
Glen Lyn, Virginia

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JAY R. STAUFFER, JR.
University of Maryland

Ichthyoplankton drift was collected with stationary nets from mid-May through August, 1976, and 31 March through May, 1977. Peak densities were related to the presence of carp (*Cyprinus carpio*) larvae during May and July, 1976, and May, 1977. The seasonal distribution of other taxa collected is discussed. Ichthyoplankton densities were generally higher in dusk and dawn samples than during daytime samples.

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The Importance of Drift
and Benthic Food Sources to
Rainbow (*Salmo gairdneri*) and
Brown Trout (*Salmo trutta*) Diets in a Stream

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The purpose of this study was to determine drift's importance in rainbow (*Salmo gairdneri*) and brown trout (*Salmo trutta*) diets in an Appalachian mountain stream. Trout prey were classified according to the location in the stream vertical profile; surface drift, column drift or benthic components. Drift components supplied 50 to 70% of the energy for trout growth; rainbow trout received approximately 60% more energy from drift components than brown trout. Trout foraging methods in the stream were probably modified by current velocity and invertebrate drift availability. Moreover, trout were marked to determine individual food habits and to determine the ecological consequences of specialization. Generally, individual trout which showed less selective foraging behavior were more successful feeders in the stream. Strong foraging preferences for *Goniobasis*, a major benthic component, or invertebrate exuvia were found among several individuals; these trout were energetically disadvantaged. Members of Ephemeroptera, Trichoptera and Diptera were the most abundant drift diet items, in decreasing order of importance.

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Spring and Fall Food Habits of the
Shorthead Sculpin, *Cottus confusus*, from the
Big Lost River, Idaho

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Murray State University

The shorthead sculpin, *Cottus confusus*, was collected in the Big Lost River, Idaho, on the Idaho National Engineering Laboratory site. Food habits were examined from 60 sculpins in the fall of 1976 and 184 sculpins in the spring of 1977. The fish were broken down into four size classes for comparative purposes. The major food items were dipterans, ephemeropterans, trichopterans, plecopterans, notonectids and other sculpins were utilized by the largest size class. The major difference in food habits between the seasons was the more extensive utilization of trichopterans in the spring. A selectivity index was calculated and the sculpins were shown to be opportunistic feeders with a trend for an increase in the size and importance of a food item with a simultaneous increase in the size of the fish.

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Age, Growth, and Fecundity of
Shorthead Sculpin, *Cottus confusus*, from the
Big Lost River, Idaho

KENNETH W. GASSER
Murray State University

The shorthead sculpin, *Cottus confusus*, was collected in the Big Lost River, Idaho, on the Idaho National Engineering Laboratory site. Sculpins were collected in the fall of 1976 (291) and in the spring of 1977 (222). A total of six year classes were identified using otoliths to age the fish. Otoliths were shown to be directly proportional in size to the standard length of the fish. The length-weight relationship was calculated to the $\text{Log}W = -5.03 + 3.25 \text{ Log}L$ for the fall 1976 group and $\text{Log}W = -4.83 + 3.17 \text{ Log}L$ for the spring 1977 group. Male sculpins matured at age class 2 while female sculpins matured at age class 3. Fecundity was shown to be directly proportional to the size but not the age of the fish.

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Avoidance Behavior of Fish to
Intermittent Chlorination in
Thermally Influenced Waste Water

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J. CAIRNS, JR. AND K. L. DICKSON
Virginia Polytechnic Institute and State University

The avoidance response of fish populations to intermittent chlorination in a thermally influenced discharge was studied at the Glen Lyn power plant in southwestern Virginia. Field responses were observed over a temperature range from 36 to 16 C during summer to winter conditions. Avoidance was determined by comparing the number of fish seined at peak chlorine levels to the number found on days when chlorination was omitted. Chlorine concentrations in the field ranged from 0.000 to 0.710 mg/l total residual chlorine (TRC). Preliminary data, when considered through the whole tempera-

ture range, indicated that avoidance generally occurred at TRC concentrations greater than 0.15 (FRC \cong 0.04) mg/l. Field data for the most abundantly sampled species were compared to results obtained from avoidance responses carried out in a field laboratory located at the plant site. *Notropis spilopterus* (spotfin shiner), the most abundant species sampled, apparently avoided field TRC concentrations greater than 0.15 mg/l (FRC \cong 0.03) while the laboratory threshold avoidance was 0.20-0.22 mg/l TRC (FRC = 0.07-0.14 mg/l) when tested at acclimation temperatures of 12, 18, and 30 C. Comparisons of the field and laboratory determinations are discussed. Supported by the American Electric Power Service Corporation, Canton, Ohio.

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A System to Monitor Ventilatory Activity of
the Fathead Minnow, *Pimephales promelas*

CHRISTINE KING AND KENNETH L. DICKSON
Virginia Polytechnic Institute and State University

A flow through chamber containing an internal shelter has been developed for monitoring the ventilatory activity of the fathead minnow (*Pimephales promelas*). A photobeam directed through the shelter, and electrodes located adjacent to the shelter pick up the ventilatory activity of the fish while in or out of the shelter. The presence of the shelter mitigates the high level of activity of the fathead, and, thus, allows for the monitoring of the ventilatory signal without electrical noise caused by body movement. After the signal is picked up by the electrodes, it is transmitted via a biopotential amplifier to a PDP 8/e minicomputer where the signal is analyzed and the ventilatory activity recorded. This system is being used to test the utility of fish ventilatory response to predict the concentration of a toxicant causing changes in growth and reproduction upon chronic exposure.

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Effects of Strip Mining on Aquatic Communities
in Streams in the New River Basin
of Eastern Tennessee

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University of Tennessee

Four streams in the New River Basin in East Tennessee (one undisturbed and three disturbed) were sampled monthly to determine the effects of strip mining for coal on aquatic communities. Insect, fish and diatom communities were considered in this study. Various environmental parameters were measured at the time of sampling to help determine factors that are the probable causes of changes in community composition in streams disturbed by strip mining. Samples for each community type were analyzed monthly, seasonally, yearly and for the total sampling period (2½ years) to determine effects on the number of species and individuals and on species diversity. Data were analyzed using Shannon-Weaver diversity indices, multiple regression and analysis of variance. All three communities showed significant reductions in species, individuals and diversity with mining disturbance. Parameters analyzed varied directly with the duration and extent of disturbance. Siltation and stream flow were the primary factors responsible for community changes. Supported by ERDA Contract #E-40-1-4946.

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A Comparative Vegetational Analysis of Cove Hardwood Communities

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Western Carolina University

In 1936, an analysis of the forest types in the Great Smoky Mountains National Park was directed by Frank Miller, a forester commissioned by the Park Service. One thousand five hundred sites in 27 watersheds were examined in the then newly-acquired park lands. The data collected was used to draw up a Vegetational Type Map of the Park, delineating 12 different forest types. The present study is a comparison of current data on the cove hardwood forest type with data collected by Miller. Sites which had been cut over shortly before acquisition of the Park, as well as sites which were older at that time, are compared. Miller's 20 × 40 m sites were relocated as closely as possible and permanently marked. The same data — tree species by height and diameter class as well as shrub coverage — were recorded for this plots and for 20 × 50 m plots, the current standard for work in the Park.

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Comparisons Among Three Classification Techniques Using Simulated Coenoplanes

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Southern Illinois University

A systematic evaluation of three classification techniques using simulated coenoplanes having two noise (sampling error) levels, three sampling designs and three levels of beta diversity was made to determine the suitability for use in plant community analysis. The three classification techniques are MINFO, which employs an information theory measure, MDISP, which uses a standard distance similarity measure, and CLUSTER, which uses a Pearson product-moment similarity measure. MINFO was least affected by noise while CLUSTER displayed the greatest distortion. All methods identified groupings along the highest beta diversity dimension when the coenoplane had 4.5×1.5 half changes. At 1.5×1.5 half changes, fewer groups of samples were identified than at 4.5×4.5 half changes. For all coenoplanes, CLUSTER exhibited more chaining than either MINFO or MDISP. Classification techniques which use either standard distance or Pearson product-moment similarity measures are less suitable for ecological data than those which contain a logarithmic term.

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Anatomical and Histochemical Characteristics of *Ruppia maritima* L. (Potamogetonaceae)

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University of West Florida

The recent disappearance of *R. maritima* from polluted habitats has potentially severe ecological and economic impact as this seagrass is an important food source for many animals. Tissues in this plant differ-

entiate little from promeristems in accord with the supportive and conductive characteristics of the aquatic environment. Stomates are absent, and the leaves are characterized by a single central vascular bundle which remains largely procambial. Phloroglucinol reveals traces of lignified elements, and aniline blue demonstrates callose deposits characteristic of phloem. The leaves and rhizomes are characterized by lacunae. Lacunae origin was not clearly resolved by this study. Roots had little vascular differentiation and lacked lateral roots. Young leaves and old rhizomes contained substantial carbohydrates as indicated by P.A.S. Carbohydrates were most abundant in the epidermis and vascular bundle sheath of leaves and in amyloplasts in the rhizome. Amorphous and granular tannin-filled cells were found in leaves and less commonly in rhizomes.

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A Preliminary Investigation of Theories of Island Biogeography with the Floristics of the Aleutian and Other Beringian Islands

RAYMOND A. MCCORD AND EDWARD E. C. CLEBSCH
University of Tennessee

Data on the distribution of native vascular plant species in the islands of the Bering Sea were derived from the literature. The relationships between the number of species per island and the Alaskan and Kamchatkan Peninsulas and the following island characteristics were examined: distance from source areas and other islands, maximum elevation, island area and the distribution of surface area among altitudinal belts. Linear, semi-log and log-log models were used in correlation and multiple regression analyses. Correlation and regression techniques were also used to test the relationship between matrices of inter-island distances and inter-island floral similarities. The island biogeographical theory of MacArthur and Wilson is partially supported by this investigation.

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Scalesia, *Wilkesia*, *Argyroxiphium* and *Hesperomannia* of the Family Compositae in the Galapagos and Hawaii

SILENI OLSON AND PAT H. LEWIS
Wesleyan College

The highly specialized Compositae family has aborescent representatives in two geologically young oceanic island chains; *Scalesia*, an endemic species of the Galapagos Islands, and *Wilkesia*, *Argyroxiphium* and *Hesperomannia*, endemic genera of the Hawaiian Islands. The Compositae family's characteristic projections and weediness serve in the organisms' dispersal and colonization on these oceanic islands. Trees with disadvantageously heavy seeds and poor colonizing ability are usually lacking from such isolated islands as those of the Galapagos and Hawaii thus leaving a niche which the normally herbaceous species of the Compositae have adapted to in the form of woody plants. *Scalesia*, as well as the Hawaiian genera, exhibit a seeming loss of the dispersal ability, no longer an advantage in the limited area of the archipelago. Their distribution within

the islands suggests a pattern in the evolution of the individual endemic species.

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Ecotypic Variations in *Cannabis* (Cannabaceae)

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Plant populations of *Cannabis* (Cannabaceae) were studied in the remote, isolated parts of the Himalayas, known to have wild or relatively wild populations of this taxon. Data on morphological features and habitat variations were recorded in the field. These presumably wild populations of *Cannabis* in their probable home in Central Asia exhibited a great phenotypic plasticity ranging from prostrate condition in the semi-sandy soils to a large, 15 ft high plant size in the nitrogen-rich soils in the same general area. Variations in other gross morphological features such as leaf size, texture, and color, and stem size and form were found to be significant. Cuticular features such as stomatal frequency, stomatal size and trichome frequency and type indicated ecotypic differentiation in varied habitats. However, some gross morphological and anatomical features remained constant under varied environments.

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Fossil Flora of the Friar Branch and Boyd Buchanan School Sites

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Excavations for the construction of Friar Branch Lift Station, Contract 47A of the City of Chattanooga's Interceptor Sewer Program, and for interceptor sewer lines near Boyd Buchanan School revealed the existence of an organic deposit below a 14-foot depth along South Chickamauga Creek at Chattanooga, Hamilton County, Tennessee. Logs were dated at 10,270, 9,515, 4,475 and 4,465 years (before 1950), at a time when late Paleo-Indian and subsequently Archaic peoples could have occupied the area. The flora of the deposit was examined, and leaves, fruit, seed, wood and thorns were used to determine the 32 plant taxa found. The flora approximates one which would be found today.

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A Study of the Host Range of *Aureolaria pedicularia* (L.) Raf. (Scrophulariaceae)

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Hemiparasitic Scrophulariaceae generally exhibit a wide host range. However, species of *Aureolaria* L., a genus endemic to North America, have been thought to

be host specific on subgenera of *Quercus* L. *A. pedicularia* plants from Virginia and South Carolina were excavated and the hosts identified to family by the morphology of the root segments. Most haustoria were found to be attached to Fagaceae, but a few were found on Ericaceae. Based on these data, and considering the findings of Musselman that these plants will grow on non-Fagaceous hosts, it is suggested that there exists a physiological preference for Fagaceae, although not an absolute host specificity.

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Grace Forest, A Mixed Mesophytic Stand on Long Island, New York

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Grace Forest is a 0.32 km² wooded tract in the North Hills of Western Nassau County, on Long Island, N.Y. It is a five-layered upland forest, with *Liriodendron tulipifera*, *Fagus grandifolia*, *Quercus borealis* var. *maxima*, *Acer rubrum* and *Betula lenta* dominating the canopy. *Cornus florida* dominates a conspicuous, well-developed understory. A tall shrub layer is poorly developed and consists primarily of *Acer rubrum*, *Fagus*, and *Fraxinus* saplings. *Viburnum acerifolium* is widespread and is an areally dominant member of the medium shrub layer. *Rubus allegheniensis* enters the medium shrub layer on hills, where it is often a local dominant. The herb layer is well-developed where *Viburnum acerifolium* cover is sparse. Ferns (*Athyrium filix-femina*, *Thelypteris noveboracensis*, and *Osmunda claytoniana*) occur in large, uniform stands in bottomlands. On sunny slopes, the herb layer achieves its greatest floristic richness, in addition to *Athyrium* and *Thelypteris*, *Aster divaricatus*, *Collinsonia*, *Circaea quadrisulcata* and *Parthenocissus quinquefolia* are common constituents.

This is the first application of "mixed mesophytic" to a Long Island forest and the second published description of the type there. The close relationship of the Oak-Chestnut Forest and Mixed Mesophytic Forest types is discussed. An alternative classification, which considers these types as units of an Oak-Tuliptree Mixed Forest, is supported.

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A Natural Diversity Classification and Description of the Rocky River Bluffs Natural Area, Stanly County, North Carolina

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The Rocky River Bluffs Natural Area is characterized by a southwest-facing 100-foot slate bluff dropping to a narrow floodplain. Above the bluff is a gymnosperm forest dominated by *Pinus virginiana* Miller and *Juniperus virginiana* L. The bluff proper provides a unique habitat for *Pellaea wrightiana* Hooker, a disjunct fern found primarily in the southwestern United States. It is the only locality in North Carolina with *Arabis lac-*

vigata var. *missouriensis* (Greene) Ahles and one of the few localities with *Aster commixtus* (Nees) Kuntze, the Slate-belt Aster. The bluffs were described and classified according to Radford's Natural Diversity Classification System, which provides an effective method for inventory, storage and retrieval of information on natural areas, vegetation, floras and rare, endangered and threatened species.

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Quantitative Analyses of the Vegetation and Abiotic Factors of a Beech (*Fagus grandifolia*)-Hemlock (*Tsuga canadensis*) Forest in Bankhead National Forest, Alabama

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The gorge from which data were gathered occupies an area of 331 km² in the Bee Branch Scenic (Wilderness) Area of Bankhead National Forest located in Lawrence County, Alabama. This and surrounding gorges occur in pockets of the Pottsville Sandstone in the Cumberland Plateau. *Tsuga canadensis* occurring in this area is near the extreme of its southern geographical distribution. Computer analyses of tree data gathered by the Random Pairs method show that the tree species with highest Importance Values are *Fagus grandifolia*, *T. canadensis* and *Liriodendron tulipifera*. Shrub data from five by five meter nested quadrats at each point show that *Smilax* sp., *Vitis rotundifolia*, *Kalmia latifolia*, and *Viburnum acerifolium* have the highest Importance Values for shrubs while data from 1 × 0.5 meter nested quadrats show that the species with highest Importance Values in the herbaceous canopy are *Carex* sp. and *Mitchella repens*. Differences in species composition occur between the lower-middle and upper portion of the gorge and between east and west facing slopes of the gorge. The vegetation does not show correlation to relative humidity, soil temperature, soil texture, soil moisture or soil pH.

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Blue Ash-Oak Savanna-Woodland of the Inner Bluegrass Region of Kentucky

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Early vegetation descriptions in the Inner Bluegrass Region of Kentucky mentioned extensive canelands, meadows and open forests that were markedly different in physiognomy and composition from the closed forests that characterized the more familiar Appalachians, Piedmont and Coastal Plain. Factors thought to be involved in the formation and perpetuation of these savanna-woodlands have included wildfires, fires set by Indians, intensive grazing by large herbivores and substrate properties confined to this physiographic region. Old-growth vegetation that indicates an original open forest still exists as small, scattered remnants in the Inner Bluegrass. Dominant mature trees of these communities are *Fraxinus quadrangulata*, *Quercus macrocarpa* and *Q. muehlenbergii*; cane and prairie grasses have been replaced by cultivated, cool-season grasses that now dominate the herbaceous ground cover.

Long-term survival of these blue ash-oak savanna-woodlands is in doubt because of continued grazing pressure, low seed production by the old trees and high fruit and seed mortality. These factors in combination with continued urbanization of the Inner Bluegrass in the form of subdivisions, industrial parks, highways and commercial development lead to the recognition of this rather unique vegetation as a series of scattered, endangered plant communities.

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The Relation of Heavy Metal Concentrations in Tree Tissues and Sludge Amended Mining Spoil

GENE A. SMOUT AND GEORGE T. WEAVER
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Pyritic mining spoil at the Palzo site in Williamson County, Illinois, received varying treatments of anaerobically digested sewage-sludge from an industrial source. Woody and herbaceous vegetation was established in 1976 to contain degradation, on and off site.

The accumulation patterns of Cd, Cu, Fe, Mn, Ni and Zn have been determined for *Betula nigra* L., *Fraxinus pennsylvanica* Marsh., *Liriodendron tulipifera* L., *Platanus occidentalis* L., *Quercus alba* L. and *Q. macrocarpa* Michx. Tissue concentrations (root, stem, foliage) of trees planted on site and harvested after one growing season are correlated to those concentrations in the sludge-spoil rooting medium.

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Thirty-Year Tree Growth on Surface-Mined Lands

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Spoil banks in Illinois resulting from loosening and mixing of surface and deeper overburden materials were typically slightly acid to alkaline. Planted black walnut, black locust, red oak and silver maple survived and grew well. Tulip tree and sweet gum performed well in southern Illinois. Sweet gum excelled on the most acidic soils. All pines performed best in the southern counties, with loblolly best followed by Virginia, pitch and shortleaf. Only jack pine survived on all northern plots. Vigorous volunteer tree invasion was noted on all plots and varied in species composition. Darkened surface layers, breakdown of rocks left from mining, and levels of extractable P and K comparable to productive forest sites were found.

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Sand Dune Revegetation Following Pedestrian Perturbation at Santa Rosa Island, Gulf Islands National Seashore

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Uncontrolled pedestrian dune crossings at Santa Rosa Island have resulted in destruction of the sea oat (*Uniola paniculata*) vegetation cover along well defined path-

ways. In response to this the National Park Service has erected boardwalks at a number of the areas. A study has been initiated to determine rates of revegetation subsequent to the installation of boardwalks. A comparative analysis between boardwalk and non-boardwalk control areas is being performed to determine the efficacy of the boardwalk placement. Field observations of distances from boardwalk to the nearest vegetation, vegetation densities by basal area coverage, and vegetation composition in disturbed and nondisturbed areas are in progress. Aerial photographic interpretation is being used to evaluate revegetation of disturbed areas, and for comparisons between boardwalk and non-boardwalk areas.

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The Effect of Thermal Effluents on the Germination and Growth of Baldcypress

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Vegetation of the bottomland and swamp forest of the Savannah River Plant (SRP) have been greatly influenced by thermal effluents which have increased the water temperatures, raised the water level and increased the siltation rate. Areas within the SRP once covered extensively by cypress-tupelo forests have received thermal effluents from production reactors, thus resulting in death of some trees. If other conditions are not inhibitory, cypress, being somewhat heat tolerant, might be reintroduced into some areas of lesser temperature elevation. This study investigates the germination and growth of baldcypress, (*Taxodium distichum*), under different temperature regimes created by production reactors. Total percent germination, the rate of germination, total biomass production and survivorship are discussed.

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Plutonium Contents of an Old-Field Ecosystem Near a Nuclear-Fuel Reprocessing Facility

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Savannah River Ecology Laboratory

A. L. BONI, J. C. COREY AND J. H. HORTON
Savannah River Laboratory

The ^{238}Pu and $^{239} + ^{240}\text{Pu}$ contents were determined in loblolly pines, herbaceous vegetation, litter and 0-5 cm, 5-15 cm and 15-30 cm soil depths in an old-field receiving aerial deposition of Pu released from a near by nuclear-fuel reprocessing facility. The amount of Pu which could be resuspended from the soil surface by a $6 \text{ m} \cdot \text{sec}^{-1}$ wind velocity was also measured. The total Pu content was approximately $400 \text{ nCi} \cdot \text{m}^{-2}$ and decreased as the distance from the reprocessing facility increased. The majority of the Pu ($> 95\%$) was in the soil. Pu contamination of the vegetation was apparently surface contamination and appeared to be primarily the result of recent releases. The relative amounts of Pu in vegetation, litter and resuspendible materials was modified by the structure of the vegetation. Once deposited, Pu may remain on the soil surface and be capable of resuspension for more than one year.

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Prenatal Effects of 2,4,5-T and Related Compounds in Mice

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The herbicide, 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T), and two structurally related compounds, phenoxyacetic acid (PA) and 2,4,5-trichlorophenol (TP), were suspended in a 1:1 solution of honey:water and administered by gavage to pregnant mice on one of gestation days 8-15 (copulation plug day = day 1) or on three consecutive days (7-9, 10-12 or 13-15). Doses were 800-900 mg/kg for single and 250-300 mg/kg/day for multiple treatments. Controls were given the solvent or were untreated. Dams were sacrificed on day 18. Prenatal mortality, fetal weight and gross, visceral and skeletal malformations were assessed. Randomly selected fetuses were given a histopathological examination. Only 2,4,5-T treatment significantly decreased fetal weights and increased prenatal mortality. Although low incidences were seen in all treatment groups, only 2,4,5-T significantly increased cleft palate or other gross malformations. These results indicate that both the carboxyl group and chlorination of the aromatic ring are essential for an unambiguous teratogenic response. Supported by the University of Alabama Research Grants Committee, Project #906.

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Thyroxine and Toxicity of Trypan Blue in the Fetal Rat

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Female Sprague Dawley rats were pretreated with thyroxine to reduce fetal toxicity of injected Trypan Blue. Seventy female rats, weighing between 200 and 240 grams were mated and then injected with saline; thyroxine; Trypan Blue; or a combination of thyroxine and Trypan Blue. Trypan Blue, administered in doses of 65 and 100 mg/kg on day 9 of gestation, produced 22.2% fetal resorptions. Thyroxine, at levels of 1.5 and 5.0 x's normal, administered from day 1 to 10 of gestation, reduced the toxicity of an injected 65 mg/kg dose of Trypan Blue to about 12% fetal mortality. The same levels of thyroxine reduced fetal resorptions to around 15% when rats received an injection of 100 mg/kg Trypan Blue.

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Sustained Alteration of Cardiac and Circulatory Dynamics by Brief Intense Social Stress (Fighting) in Mice

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Male mice were made aggressive by individual caging for 3 months post-weaning, then placed together to fight

for 10-15 min daily and returned to isolation. Heart ventricular weight increased 10% within 3 days and was sustained. Ventricles were not separated, but by visual inspection the left enlarged most. Auricular weight increased significantly only after 2 weeks and was differentially expressed (up to 50% left, 30% right); excess of right auricular weight over left originally prevailing in undisturbed isolated mice (16.7%) was thereby abolished. Sustained elevation of systolic blood pressure (17 mm Hg) 24 hr after a fighting episode became significant only after 2 weeks. Hence, sustained blood pressure elevation preceded hypertrophy of auricles but not ventricles. Repeated brief episodes of intense social stress produced profound sustained changes in cardiovascular dynamics, thereby lowering viability.

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Aldehyde Dehydrogenase Isozymes of the Mongolian Gerbil, *Meriones unguiculatus*

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The gerbil is becoming the animal of choice for many toxicological testing protocols. However, knowledge of the biochemistry and genetics of the species is still rudimentary. We have demonstrated in rats that changes in the hepatic aldehyde dehydrogenase (Aldehyde:NAD(P) oxidoreductase E. C. 1. 2. 1. 5., A1DH) isozyme system are useful indicators of cellular changes induced by toxic chemicals and/or carcinogens. This study was undertaken to establish the normal hepatic A1DH phenotype of the gerbil in anticipation of its increasing use in toxicological and carcinogenicity testing. The specific activity of gerbil liver A1DH is 21.02 ± 6.67 mIU/mg protein with propionaldehyde as substrate and NAD as coenzyme. Activities are lower with NADP and/or benzaldehyde. A single isozyme is detectable by gel electrophoresis. Gel electro-focusing resolves two major isozymes with pIs near 5.7 (4 C). Immunochemically, gerbil liver A1DH is partially identical with normal rat liver A1DH. Gerbil liver A1DH appears more stable at low pH and less stable at high pH than rat or mouse liver A1DHs.

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The Effects of Nutritional Depletion of 5-Hydroxytryptamine in Rat Gut

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Previous investigations of the nutritional depletion of 5-hydroxytryptamine (serotonin) and its effects upon gastrointestinal motility in the rat were complemented by quantitative studies employing gas-liquid chromatography (GLC) of the trimethylsilyl (TMS) derivative of serotonin. It was found that when 1-tryptophan, the precursor of serotonin was omitted from the diet there occurred a significant decrease ($P < 0.005$) in gastrointestinal motility. No differences in frequency of contractions were observed due to diet. The quantitative analysis of serotonin content in the intestine was found to decrease to non-detectable levels ($P < 0.005$) by the sixth week of dietary maintenance. Decreases in the area of motility which have a constant frequency sug-

gest changes in the amplitude of contraction normally attributed to the longitudinal muscle. These data were suggestive of a specific mechanism of action by which serotonin, a putative neurotransmitter, affects peristalsis in the normal animal through its regulation of longitudinal muscle activity.

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Erythropoietic Alterations in Sublethally Irradiated Mice

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Bone marrow and spleen are pivotal in the process of erythrocyte production. This erythropoietic process is known to be highly sensitive to the actions of ionizing radiation. Studies reported here deal with the effects of low dose irradiation on radioiron (^{59}Fe) uptake into spleen and peripheral erythrocytes of ICR mice. Following X-ray exposure (Day 0), ^{59}Fe uptake percentages were determined on the subsequent four days. Three days after 20 and 40 roentgen (R) exposures, splenic uptakes were clearly greater than those of controls, suggesting a stimulatory effect. No such elevation was noted for circulating erythrocytes. After 80, 160 and 320 R treatments, ^{59}Fe uptakes were abruptly reduced for both spleen and erythrocytes by Day 2. The responses differed, however, in that splenic suppression was shorter-lived and recovery was more rapid and complete compared to erythrocyte suppression and recovery. These data suggest that of the erythropoietic components, the spleen is the less vulnerable one to radiation-induced depression.

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The Prophylactic Effects of Retinyl Acetate on Cancer of the Urinary Bladder

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Two hundred seventy-five virgin C3H/He mice were fed a ration that included 0.1% N-4-(5-nitro-2-furyl)-2-thiazolyl formamide (FANFT) and retinyl acetate. The mice were divided into 5 groups. Groups 1-4 received 300, 600, 1200 and 2400 IU of retinyl acetate per kilogram of feed plus FANFT. Group 5 received 300 IU/kg and no FANFT. After 11 months the bladders were removed and inspected for carcinoma. It was found that a 600 IU/kg dose of retinyl acetate inhibited the formation and severity of tumors. There were no tumors found in any of the mice from group 5.

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An Electrophoretic Study of Transferrin in X-irradiated Mice

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The gel electrophoretic pattern of transferrin *b* in *Mus musculus* is multibanded with the major transferrin component staining intensely and the minor components

staining moderately or faintly. A modified transferrin *b* electrophoretic pattern has been observed to occur in the C57B1/6J strain under the stress of x-irradiation at a dose of 500 R. The focus of this investigation was on the time of onset and duration of the modified *b* pattern. Plasma samples from the mice were electrophoresed in a polyacrylamide gel. Results indicate that the modified *b* pattern appears on the second day after irradiation and persists for eleven days, after which recovery to the standard type *b* pattern occurs. Data on body weight and hematocrit values reflect the time of onset and duration of the modified *b* electrophoretic pattern and its recovery to the normal type *b* pattern.

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Developmental Effects of Neonatal Hormone Treatment Upon Uterine Responses in the Prepubertal Rat

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Neonatal rats injected with a single dose of estradiol benzoate (EB) or testosterone propionate (TP) exhibit significantly reduced uterine growth compared to controls in response to estradiol administration on day 21 of life. The augmented reduction in uterine responsiveness in EB compared to TP treatment may be explained by an apparent reduction in available uterine estrogen binding sites. Additionally, the degree of reduction in ovarian weights in the neonatally treated rats correlates with the degree of reduced uterine responsiveness. This suggests that reduced endogenous estradiol secretion may be a causative factor. Neonatal ovariectomy confirmed this plausibility as uterine weight responses in such animals mimicked that seen in rats treated neonatally with steroid esters. Furthermore, ovarian transplants during infancy between control and TP rats suggest an impairment of hypothalamic control of gonadotropin secretion prior to puberty which impairs ovarian function and subsequent uterine responsiveness. Hence, endogenous estrogen secretion during infancy may be important in the development of hormonally responsive tissue.

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Effect of Submaximal Exercise on Recovery Frontalis Muscle Tension and Occipital Alpha Wave Production in College-Aged Males

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Relaxation techniques are frequently used to reduce muscle tension and to elicit alpha wave production. Exercise has been reported to lower tension; after exercise many report feeling more relaxed. This study examined the effect of 6 minutes of submaximal exer-

cise on a bicycle ergometer on frontalis muscle tension and alpha production. These were measured in 10 minute sessions immediately before and after exercise. Both sessions were conducted with the subject lying down in an isolated darkened room. Alpha was measured as total seconds/10 min that exceeded 20 μ V. The 10 subjects, aged 21.5 ± 0.8 yrs., showed considerable variability (range = 0-600 secs) in alpha production at rest. Subjects exhibiting alpha averaged 213 ± 78 sec of alpha production, pre-exercise; and although this increased to 298 ± 74 sec following exercise, the difference was not significant. Frontalis muscle tension was unchanged by exercise (9th minute: Resting 14.8 ± 1.0 vs. Exercise 14.7 ± 0.9 μ V). Supported by Georgia Southern College Research Fund.

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Circulating Antibodies to Bovine Serum Albumin and Ovalbumin in the Serum of University Students

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Foods are known as sources of many types of reactions. Thus it can be expected that antibodies to food antigens would be found in circulation. Although human antibodies to food allergens have been investigated by skin tests, studies on circulating antibodies are meager. Since milk and eggs are every day food in the U.S. diet, we chose the two antigens for this study.

The incidence and amount of anti-bovine serum albumin (anti-BSA) and ovalbumin (OA) was evaluated in the sera of 57 adults by means of the passive hemagglutination test. Antibody to BSA was detected in 73.7% of the individuals. Antibody to OA was detected in 77.2% of the sample population. The incidence of persons with anti-BSA was comparable among the allergic and nonallergic individuals; whereas, the incidence of people with anti-OA was slightly higher in the allergic group.

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Nuclear Binding of 17β Estradiol in Thyroid Inhibited Golden Hamsters

LARRY ROBINSON AND WILLIAM B. KEITH
University of Mississippi

Preliminary data previously reported indicated a reduced uptake of ^3H -Estradiol- 17β by proteins of cell nuclei in reproductive tissues of thyroid inhibited golden hamsters. This report presents data on the "specificity" of the nuclear binding of ^3H -Estradiol- 17β by cell nuclei of these tissues. The reduced nuclear binding of estrogen by target tissues is discussed as a possible explanation for some of the reproductive abnormalities which occur in hypothyroid animals.

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The Effect of Aging on Levels of Nuclear Receptors of Thyroid Hormone in the Rat

DAVID ERKENBRACK AND WILLIAM B. KEITH
University of Mississippi

A decrease in thyroid activity with age has been documented by various investigators using such established indicators of thyroid activity as BMR, minimal oxygen consumption, α -GPDH activity, and nucleoside incorporation. This investigation explores the possibility of changes in nuclear hormone receptor levels as a mechanism of action for this phenomenon. Radioisotope methodology is employed to determine the effects of aging on levels of thyroid hormone nuclear receptors in Wistar rats. The possibility of synergistic contribution to this effect by growth hormone is explored by an identical investigation of hypophysectomized specimens.

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Progesterone Effects on Skin Allografts in *Peromyscus*

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Base levels of circulating progesterone from two species of *Peromyscus* were compared during estrous using radioimmunoassay. *P. polionotus* (old-field mouse) showed a significantly higher blood serum progesterone level than *P. maniculatus* (deer mouse). Hybrid crosses between the two species are relatively productive using female *P. maniculatus*, but the reciprocal hybrid cross utilizing *P. polionotus* females have greatly reduced fertility and viability, with the F_1 progeny generally resorbed late in gestation. Since histoincompatibility has been invoked as a hypothesis for fetal rejection, the effect of progesterone on tissue rejection time was investigated in *Peromyscus* males. Animals injected with 2 mg of medroxyprogesterone daily following skin grafting were compared with control groups for mean survival time of the allografts. The progesterone-treated group showed a significant increase in mean survival time compared to the control animals with no injections, as well as to the group sham-injected with sesame oil only.

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Aflatoxicosis and Dietary Zinc Interactions in Hamsters

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Aflatoxins (Af), fungal metabolites, have been demonstrated to cause liver cancer in various test animals. Carcinogenic studies in our laboratory have focused on mycotoxin-heavy metal interaction. Of these metals, zinc (Zn) which has an important role in liver metalloenzymes, was tested at various levels in the current study. Dietary Zn (zinc carbonate) in combination with mixed Af were fed male golden hamsters. Body weights (wts), feed consumption and water consumption were

taken weekly. Control diets; A (Zn at 58 ppm); B (Zn at 3000 ppm); and C (Zn at 12 ppm) were mixed with Af contaminated feed to give desired test concentrations for the mycoiotoxin ($B_1 = 8 \mu\text{g/g}$ feed; $G_1 = 36.9 \mu\text{g/g}$ feed; and $G_2 = 0.2 \mu\text{g/g}$ feed). Mean body wts for all groups at the start of the experiment was 44.6 g. After 6 wks, mean body wts increased at a slower rate for all animals on Af diets. Change in body wts for this period are as follows: A = 62.2 g; A + Af = 20.3 g; B = 74.4 g; B + Af = 20.7 g; C = 42.4 g; C + Af = 9.9 g. The animals on normal (A) and high Zn (B) diets showed larger weight gains than low Zn (C) treatment even in the Af groups. Mean feed consumption appears to reflect the above listed body wt data. After 6 wks of treatment, C and C + Af animals showed the highest water consumption. The lowest water consumption was found in the A + Af and B + Af animals.

No animals succumbed during the treatment. It appears that neither Zn deficient diets nor Zn supplemented diets provide significant protection against aflatoxicosis in hamsters, but there were some interactions observed.

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The Effects of Xanthopterin and Its Isomer on the Biosynthesis of 5-Hydroxytryptamine in the Rat Gut

L. B. WEEKLEY AND T. DANIEL KIMBROUGH
Virginia Commonwealth University

It has been reported that the hydroxylation of tryptophan, the rate-limiting step in the biosynthesis of 5-hydroxytryptamine (serotonin), requires molecular oxygen, Fe^{++} , and a tetrahydrobiopterin cofactor. Preliminary work has indicated that isoxanthopterin inhibits biosynthesis of the indoleamine. Since tetrahydrobiopterin undergoes a reduction to a quinoid-dihydrobiopterin form during the hydroxylation of tryptophan, it is suggested that this may reflect the inhibitory action of isoxanthopterin. The corollary effects of xanthopterin and isoxanthopterin on erythropoiesis have also been studied.

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The Effect of Different Photoperiods on the Mitotic Rhythm of Mouse Bone Marrow Cells

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To determine if photoperiod plays a role in controlling the mitotic rhythm of bone marrow cells, two groups of male mice, strain DUB (ICR), were exposed to different light-dark regimens. One group was exposed to 12 hours of light and 12 hours of dark beginning at 6:00 am while the other group was reversed — 12L and 12D beginning at 6:00 pm. Following adjustment to this schedule, the mice were sacrificed at various times of the day and the bone marrow preparations scored for dividing cells. A definite mitotic rhythm was noted in both groups with one major peak of dividing cells per 24 hours. In both cases this peak occurred during the first part of the light cycle and, thus, seems to be dependent on photoperiod rather than time of day. Since these mice are nocturnally active, the peak of cell division also corresponds to the period of inactivity.

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Palmitic Acid Metabolism by
Guinea Pig Thymocytes, *In Vitro*:
Relationship to Steroid Resistant Populations

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University of Mississippi

Thymocytes which remain viable (steroid resistant cells) following exogenous administration of either cortisol or estradiol-17B to intact guinea pigs show a significantly greater ability to metabolize palmitic acid-1-¹⁴C, when incubated *in vitro*, than do thymocytes of untreated controls (steroid sensitive cells). The addition of 2.7×10^{-6} M cortisol to the incubation medium of cells from either cortisol treated or control animals results in decreased metabolism of labeled palmitic acid, with a significantly greater depression occurring in control cells. This effect is noted both in the presence and absence of 78×10^{-6} M competing palmitic acid. These data suggest reduced fatty acid metabolism as a possible mechanism for explaining the killing effects of steroids in sensitive populations of thymocytes.

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Lead Acetate-Induced Leukocytosis
in Female Mice

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Lead Acetate (PbAc) is known to exert deleterious effects upon a wide variety of biological systems, including the erythropoietic system. These studies show that both 10 and 20 mg PbAc/100g body weight dosages stimulate a striking leukocytosis in young adult female mice. The mean leukocyte count for the higher dosage treatment group on Day 4, following lead injection, is approximately 50% greater than that mean of the control. The mean differences continue to be elevated by about 35% over the control values on Days 6 and 8. For the 10 mg treatment group, the total white cell counts are significantly different from control counts only on Day 4. At both treatment levels, lead also decreased the ratios of peripheral agranulocytes to granulocytes at all sampling intervals compared to ratios obtained from controls. The leukocytosis and ratio shifts of lead-treated animals were due primarily to an increase in the number of circulating granulocytes.

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Transuterine Migration in the Rat

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AND FLOYD DENNEY
University of Tennessee at Chattanooga

Transuterine migration is well documented in a number of species, but its occurrence in rats has been highly doubtful. This doubt is based on anatomical structure plus a paucity of documented occurrences. Evidence for a case of transuterine migration in a Long-Evans rat has been obtained in our laboratory. A virgin rat, uni-

laterally ovariectomized at about 30 days of age, was first mated at 62 days of age and bore 11 young. Two weeks later during a routine laparotomy 15 nidation (implantation) sites were found, 13 on the non-surgically treated side and 2 on the other. These two sites were small as were two others, indicating early reabsorption of the embryos. The uterus was removed, preserved in 10% formalin, cleared for 4 weeks in changes of hydrogen peroxide and then toluene. The pigmented sites persist and no explanation other than reabsorbed nidation sites seems plausible.

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Age-and-Growth and Reproduction of
Notropis signipinnis and *N. hypselopterus*
(Pisces: Cyprinidae)

KAREN A. BROCKMAN
University of West Florida

Life history information was obtained for the flagfin shiner, *Notropis signipinnis*, and the sailfin shiner, *N. hypselopterus*, from three streams in Northwest Florida. Maximum age of both species appears to be one to one and one-half years. Both species have prolonged breeding seasons. *N. signipinnis* initiates vitellogenesis in early March, while *N. hypselopterus* matures eggs in April. Both species appear to be fractional spawners with peaks throughout spring and summer. There is spatial and temporal separation of spawning between these species. During spawning season both species contain three or four clutches of maturing ova, ranging in size from 0.24 to 1.13 mm in diameter. Larger females (35-50 mm SL) contain maturing ova earlier in the season and spawn more eggs than smaller individuals. No female below 25 mm SL contained maturing ova at any time. Spawning ceases by late September as evidenced by regressed ovaries and atretic ova.

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Habitats of Small Fishes of the
South Canadian River, Oklahoma:
Occurrence with Respect to
Physico-Chemical Factors

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The occurrence of *Notropis lutrensis*, *N. girardi*, *N. atherinoides*, *Hybognathus placitus* and *Gambusia affinis* over available ranges of eight physico-chemical factors was quantified during all seasons of the year in the South Canadian River, Oklahoma. The species differed in distribution in ranges of temperature and pH, but showed no clear trends of separation over ranges of dissolved oxygen and total dissolved solids. All except *N. atherinoides* selected habitats with current speeds below 30 cm/sec, and all avoided water shallower than 20 cm. Locations without shelter were avoided by all species, but none had a strong tendency to congregate about structures in the water. Unstable sand substrates were generally avoided. During periods of environmental stress all of the species responded somewhat similarly to physico-chemical conditions; overall spatial partitioning was thus diminished.

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Sun Compass Orientation in Juvenile American Alligators

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Juvenile American alligators (*Alligator mississippiensis*) use solar and lunar cues for compass orientation. Test animals exhibited strong directional preferences when solar or lunar cues were available, but were disoriented under 100% cloud cover. When animals were subjected to a 6 hour change in the light cycle, their orientation was altered in the expected direction. Y-axis orientation to the home shoreline is indicated by the results. Thermoregulation and/or predator avoidance are proposed as possible selective forces for the development of compass orientation in juvenile alligators.

(280)

The Conservation Status of Southeastern Herpetofauna

C. KENNETH DODD, JR. AND CORINNE MITCHELL

U.S. Fish and Wildlife Service

There are presently 5 amphibians and 17 reptiles under consideration by the Fish and Wildlife Service for protection under the Endangered Species Act of 1973 in the Southeast. Already 11 species of amphibians and reptiles are afforded Federal protection in this region. Problems associated with the status of these species tend to indicate that loss of habitat is paramount, with over-collection or harvest of much less importance, although with notable exceptions. Ecosystem protection is seen as the major approach to ensuring the continued survival of most species and emphasis is placed on the need for much basic biological information for both status determination and appraisal of potentially damaging impacts. Finally, a brief review of Fish and Wildlife Service activities in both the Southeast and Caribbean will stress recent and proposed land acquisitions and current data assessment by the Office of Endangered Species.

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Factors Affecting the Hatching Success of Loggerhead Sea Turtle Eggs

ANGIE MCGEHEE

Florida Technological University

Clutches of eggs were collected from nesting loggerhead sea turtles (*Caretta caretta caretta*) on Merritt Island, Florida, June-August, 1977. Of these, 30 clutches were selected for experimentation to determine the extent to which certain factors affect hatching success. Ten clutches were divided into subsamples which were incubated at 0%, 25%, 50%, 75% and 100% moisture. Another 10 clutches were divided into subsamples kept moist with the following percentages of seawater: 0% (distilled water), 25%, 50%, 75% and 100%. Seven clutches were divided into subsamples which were kept in incubators maintained at 20, 24, 27, 30, 32, 35 and 38 C. Three clutches were selected for handling studies; samples of eggs were removed from each clutch every

4 hrs following deposition, ranging to 48 hrs afterwards. Handling did not seem to affect hatching success. The optimum values indicated in the experiments closely approximated values for moisture, salinity and temperature obtained from natural turtle nests on the beach.

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Documentation of Autumnal Denning Behavior in the Aquatic Turtle, *Chrysemys scripta*

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Savannah River Ecology Laboratory

During a radiotelemetric study of body temperatures of free-ranging yellow-bellied slider turtles, *Chrysemys scripta*, autumnal denning behavior was documented for a number of individuals. Turtles collected from a marshy cove of a reactor cooling reservoir of the Savannah River Plant near Aiken, South Carolina, showed a tendency to move into a single small subterranean cave whose underwater entrance opened into a small spring-fed stream which flowed into the cave. The denning location was in an area of mixed pine-hardwood forest, several hundred meters upstream from the marshy part of the reservoir. It seemed unlikely that the number of turtles found to occupy that particular cave was due to chance encounter by wandering individuals. Several displaced turtles were found to return independently from the open water of the reservoir to the den cave, moving distances of over 1 km in less than 24 hours.

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Rain Induced Mortality of Loggerhead Sea Turtle (*Caretta caretta*, Cheloniidae) Eggs on the Georgia Coast

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University of Georgia

It has been demonstrated that some sea turtle nests, in a natural hatchery, suffer complete mortality due to excessive rainfall events on the Georgia Coast. All developmental stages appear equally vulnerable to rain induced suffocation. Nests in flat, poorly drained areas are more vulnerable than those situated in elevated dune areas. There is no evidence that adult females time their nesting activity to avoid the high incidence of excessive rainfall in September. It is suggested that laying multiple clutches during a nesting season is an adaptation to the sporadic occurrence of heavy rains.

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Do Reptiles Really Have Indeterminate Growth?

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A paradigm in vertebrate zoology is that homeotherms (birds and mammals) characteristically have a determinate growth pattern whereas poikilotherms (fishes, amphibians and reptiles) have indeterminate growth. Although the assertion has been made repeatedly in textbooks and other general works, empirical evidence has frequency fallen short of supporting a clear distinction

between the two growth patterns. Long term studies on turtles on the Savannah River Plant provide a data-based opportunity to critically examine growth phenomena and address the issue of whether the determinate-indeterminate growth concept is valid.

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Body-Organ Weights for Three Basking Sharks, *Cetorhinus maximus*, from North Carolina Waters

FRANK J. SCHWARTZ
University of North Carolina

Body-organ weights were obtained for three (2 ♀, 2143 and 3805 cm FL, 1 ♂ 4100 cm FL) basking sharks, *Cetorhinus maximus*, captured in North Carolina waters April, 1971, and January, 1977. Relationships in percent of body weight were: head and gills 32 ♀, 19.25 ♂; dorsal and pectoral fins 3.15-3.30 ♀, 1.87 ♂; caudal fin 3.39-3.82 ♀, 2.18 ♂; heart 0.23-0.29 ♀, 0.25 ♂; liver 11.57-14.16 ♀, 12.81 ♂; spleen 0.12-0.34 ♀, 0.81 ♂; stomach 2.25-5.98 ♀, 1.31 ♂; intestines 2.80-4.27 ♀, 2.50 ♂; gonads 0.30-0.67 ♀, 0.25 ♂. Internal organs accounted for 21.58-25.61 ♀ and 19.81 ♂ of the body weight; the males being considerably heavier than the immature females examined. Heart and other organ weights were higher than reported for other elasmobranchs or bony fishes.

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Recent Records of *Pomacentrus planifrons*, *Holacanthus ciliaris* and *Pomacanthus paru* from North Carolina (Pisces:Pomacentridae, Chaetodontidae)

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University of North Carolina

Three species of tropical marine fishes, *Pomacentrus planifrons*, *Holacanthus ciliaris* and *Pomacanthus paru*, were collected in North Carolina during 26 hr of SCUBA diving in the fall of 1977. Three specimens each of juvenile Threespot Damsel fish (*P. planifrons*) and Queen Angelfish (*H. ciliaris*) were collected from depths ranging 16-19 m on the wreck Suloide (WR 13) while a juvenile French Angel (*P. paru*) was captured along the rock jetty at Cape Lookout at a depth of 5 m. Collections were made using nets, quinaldine and pole spears. Our specimens of *H. ciliaris* are the first confirmed records of the species in North Carolina, although a photograph of the Queen Angel may have been taken previously.

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Investigation into the Natural History of *Pseudacris ornata* in North Central Florida

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North Carolina State Museum

DAVID DEITZ
University of Florida

Adult *Pseudacris ornata* were captured in and around cypress head breeding sites at the beginning of the winter breeding season. Frogs were tagged subcutaneously

with Cobalt 60 radioactive wire and released. Movements were monitored at 24-48 hour intervals using a Tnyac III scintillation probe. Calling sites, microhabitat, movements, burrowing behavior and other activities were noted during and after *P. ornata* completed breeding activities. This behavioral data is being correlated with weather data, including barometric pressure, using various SAS programming techniques. During breeding, males utilized grass clumps as major calling sites. During the day and when temperatures and humidity were too low, males burrowed into the grass clump bases, 12-18 cm below the water surface. When water temperatures dropped below 10 C, males left the ponds and burrowed at the base of vegetation clumps. Burrows up to 8 cm in depth were dug by utilizing the hind feet in *Scaphiopus* fashion. The only tagged female was originally captured at the edge of the breeding pond. After tagging, this individual moved into an open field 55 m from the site. Eight days later the female returned to the pond and was observed during breeding with a non-tagged male. Immediately following egg deposition, the female remained dormant for 5 days just under the leaf litter at the edge of the pond. Temperatures at this site were 6-8 C. At the end of this period the female moved back into the previously used open field where it remained for 2 months. Males remained near the breeding pond edge during this time, never venturing more than 15 m from the pond. Males were subject to high predation during this period.

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Brain Study in Four Genera of Family Plethodontidae

D. I. PAV AND R. J. COWIE
East Tennessee State University

Previously, we reported a pilot study on brain to body weight ratios in family Plethodontidae and to our knowledge it was the first such project undertaken. Recently, we enlarged our series to include six species which were selected according to their habitat preference: *Leurognathus marmoratus*, almost totally aquatic, living in mountain brooks; *Desmognathus fuscus*, a semi-aquatic species found in or near slower, less rocky streams; *Desmognathus quadramaculatus*, a semi-aquatic group that prefers rocky, mountainous areas; *Desmognathus monticola*, a semi-terrestrial salamander, found in undergrowth near streams; *Eurycea bislineata*, a mostly terrestrial species, which returns to water for reproduction; and *Plethodon glutinosus*, a wholly terrestrial species with no aquatic larval stage. The results show an increased relative brain weight correlated with increased used of terrestrial habitats.

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Histological Examination of Integumental Glands of Plethodontidae Salamanders

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East Tennessee State University and
Edinboro State College

In a previous histological study of the integument of 16 species of salamanders of the family Plethodontidae, our group reported a description of the numbers and

types of glands found. It has been previously believed that periodic acid Schiff (PAS) will not color mucous glands except in freshly-killed specimens. Contrary to this, we showed in our present study that in specimens preserved in 10% formalin for 2-5 years, Alcian blue-PAS stain distinguishes clearly between mucous and poison glands. The mucous glands stain dark purple, indicating that the mucous contains acidic groups and oxidizable vicinal hydroxyl groups. The poison glands contain light pink granules. These findings coincide with those shown by our former microscopic examination of preparations stained with Harris hematoxylin and eosin. However, by using the AB-PAS staining technique, the glands of specimens preserved for 2-5 years are identified more easily than when using Harris hematoxylin and eosin.

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Anatomy of the Heart of *Cryptobranchus alleganiensis*

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Davidson College

Gross morphology of the heart and associated vessels in *Cryptobranchus alleganiensis* is examined. This work is the first comprehensive study of the heart in this species or in Cryptobranchioidea. Modern observations correct and clarify previous investigations. Modifications of this heart are noted as adaptations to non-pulmonic respiration.

The heart of *C. alleganiensis* is composed of the sinus venosus, two atria, ventricle and conus arteriosus. The truncus arteriosus is transitional between cardiac and vascular systems. Various features of the heart are studied, including the position of the chambers relative to one another, apertures, interchamber valves, septation and general organization of each chamber's tissue. A complete septum in the sinus venosus is described for the first time and a new interpretation of the morphology of the interatrial septum is presented. The heart is compared to other families of urodeles.

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Growth and Food Consumption in the Corn Snake, *Elaphe guttata guttata* (Reptilia:Squamata)

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The relationship between innate growth rate and food consumption was investigated in the corn snake (*Elaphe guttata guttata*). Hatchling snakes were fed weighed mice once per week. Snout-vent length, body weight, dry weight of feces and dry shed skin weight were recorded for more than eighteen months. During this period, the mean growth efficiency (snake weight/total mouse weight consumed) approached 35%. The dry weight of feces was less than 5% of the total ingested food weight. Shed skin weight accounted for less than 1.5%. There was a linear relationship between snake weight and total mouse weight consumed. However, the relationship between snout-vent length and total food consumption was nearly parabolic with the length increase rate decreasing in the later months of the study. This decrease corresponds with the attainment of sexual

maturity. The significance of the shift in growth processes is discussed.

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Some Patterns of Snake Activity on a Florida Highway

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Snake activity was monitored weekly for 4 years, 10 months, on U.S. Hwy 441 across Paynes Prairie, Alachua County, Florida. Preliminary analysis of data on 1,931 snakes involving 12 species reveals: (1) *Natrix fasciata*, *N. cyclopion*, *Regina alleni*, *Seminatrix pygaea* and *Farancia abacura* to represent 97% of the sample; (2) snake activity concentration within certain areas along the highway; (3) fluctuations in the total number of snakes, as well as in abundance of particular species, from year to year; (4) seasonal patterns in certain species; and (5) temperature, precipitation and water levels influencing the overall activity.

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Growth and Reproduction in the Brown Watersnake, *Nerodia taxispilota* (Reptilia:Serpentes, Colubridae)

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Georgia College

Data on growth and reproduction from combined laboratory dissections and field observations on a marked population of the brown watersnake in central Georgia are presented. Males become sexually mature at the approximate age of 21 months and have attained snout-vent lengths between 50-60 cm. Females mature during their third full season of activity at snout-vent lengths between 80-95 cm. In 1977, mating was observed during the last week of April and the first week of May. Litter size is apparently correlated with the size of the females. Parturition occurs between August 15 and September 15. Newborn brown watersnakes average 23.3 cm snout-vent length and grow little before entering hibernation. Sexual dimorphism in adult body size is evident with females attaining larger body lengths and weights.

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Ultrastructure of the Protozoan *Ambiphrya ameiuri* and its Attachment to the Gills of *Ictalurus punctatus*

MALINDA E. FITZGERALD AND LEWIS B. COONS
Memphis State University

Ambiphrya ameiuri is a ciliated peritrich found attached to the gill tissue of warm water fishes. These protozoans are filter feeders on bacteria in water that passes over the gills. With the aid of scanning electron microscopy and transmission electron microscopy, the ultrastructure of this protozoan and its attachment to the gills were investigated. At low densities *Ambiphrya* has no apparent harmful effect on the fish. However, densities may develop such that large areas of gill tissue

are covered, possibly impeding respiration. Ultrastructural studies did not reveal any evidence of this organism receiving nourishment from the host tissue.

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Distribution of Meiotic Bivalents in the Sterile Hybrid *Lilium* × 'Black Beauty' (Liliaceae)

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Lilium × 'Black Beauty' is a sterile hybrid of the cross *L. speciosum punctatum* × *L. henryi*. Meiosis is partially asynaptic in this hybrid with an average of only 6.24 of the 24 chromosomes associated as bivalents in metaphase I. An examination of cells from diplotene to metaphase I has revealed that the two large pairs of chromosomes pair far more frequently than would be expected if pairing were randomly distributed among the chromosomes, while the three pairs of small chromosomes pair with much less frequency than would be expected. From this work it was concluded that failure of homologue recognition in interspecific hybrids of *Lilium* is not a whole genome phenomenon, but may be the result of individual homologous pairs failing to synapse.

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Induction and Analysis of Meiotic Banding Patterns in the Chinese Hamster (*Gricetulus griseus*)

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Austin Peay State University

Banding of meiotic bivalents of the male Chinese hamster was induced by a modification of existing techniques used on mitotic preparations. The banding patterns of the two bivalents comprising group A were analyzed in diplotene, diakinesis and metaphase I stages. Induced banding patterns were consistent and allowed differentiation between each of the two bivalents. Identification of the bivalents as either number one or two was possible by comparing metaphase I stages to banded mitotic preparations.

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Modified Expression of Y Chromosome Fertility Factors Located on a X-Y-Fourth Chromosome Rearrangement in *Drosophila melanogaster*

D. B. BENNER
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Male *Drosophila* carrying a complex rearrangement involving the X, Y, and fourth chromosomes show reduced fertility. The rearrangement was X-ray produced, and it contained the proximal two fertility factors of the long arm of the Y chromosome, designated *K1-1* and *K1-2* (Brousseau, 1960, Genetics, 45:251). In combination with the *K1-1* and *K1-2* tester chromosomes 80% and 60%, respectively, of the males were fertile. The fertility was 90% or better when complete Y chromosomes were present. The number of progeny produced

by fertile males was only 50% that of control values with *K1-1*, *K1-2*, or a normal Y chromosome, and only 15% of normal when a *sc⁸,y⁺* Y chromosome was present. When males were reared at 18°C the fertility dropped to near zero with any chromosome combination. These results suggest that a mechanism other than Y chromosome hyperploidy is responsible for the observed fertility reduction.

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Effects of X-rays on the Mitotic Rhythm in Mouse Bone Marrow

SHIRLEY COX AND P. S. RUSHTON
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Mitotic indices in the bone marrow of mature, male mice DUB(ICR) show a pronounced 24-hour rhythm which attains a maximum value in the morning about 7 a.m. These mice also show a strong nocturnal activity pattern. Irradiation at noon with 200 R and 400 R of x-rays caused a mitotic delay the following morning of 2 and 4 hours respectively. After an initial fall, the mitotic index rose above the control level and subsequently fell back to normal. The initial deficiency of mitotic cells in relation to the controls was approximately compensated for by a later excess of mitotic cells.

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Isoleucine-Valine (*ilv*) Enzyme Levels in Lysogens Carrying λ dilvADE and λ dilvCB Plus a Valine Resistant Marker

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There are conflicting data concerning the *ilv0* position in the *ilv* cluster. Since the *val^R* phenotype is thought to correspond with the operator constitutive (*0^r*) phenotype for the *ilv* cluster, valine resistant derivatives were isolated from these lysogens. Enzyme analyses were made on these λ -lysogens. The results indicated that there was normal multivalent regulation in these lysogens without the valine resistant marker. Upon introducing the valine resistant marker into these strains, it was found that the gene products failed to respond to excess branched-chain amino acids. In addition, there was a striking increase in the resistance to valine (10^{-3} M) for the AHAS in both derivatives. Transduction data indicated that the *val^R* marker for strain CU427 (λ dilvADE) was carried on the phage, whereas *val^R* marker for strain CU428 (λ dilvCB) was maintained on the bacterial genome. Thus, in each strain, the lesion appears to affect the *ILV-ADE* genes and is presumably linked to this cluster.

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Hormonal Requirements for Growth of a Mammary Tumor in Chemically Defined Media

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The Jackson Laboratory

CaD1 mammary tumor cells from DBA 21 mice were cultured in MPG 43BS medium plus 5% fetal calf serum and MAB 87/3S medium plus 5% fetal calf serum. Re-

removal of the serum and supplementing the media with combinations of six hormones, the cells grew best in the MAB 87/3S — supplemented medium. The hormones used included insulin, hydrocortisone hemisuccinate, prolactin, somatotropin, progesterone and β -estradiol. The combination providing best growth consisted of insulin (2.0mg/l), hydrocortisone hemisuccinate (1.0mg/l), prolactin (5.0mg/l) and somatotropin (1.0mg/l). Cultures in this medium have been maintained longer than cultures in serum-supplemented media alone.

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The Effects of
Crude *Staphylococcus aureus* Toxin on
Mammary Explants: An Ultrastructure Study

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Mouse mammary explants were incubated in crude *Staphylococcus aureus* 305 toxin (0.1, 1.0 and 10.0 μ g/ml) for two and four hours. Light microscopy and electron microscopy revealed that the toxin caused swelling of cells, lack of tissue and organelle organization and degeneration. Ultrastructure damages included pyknotic nuclei, lighter and less dense euchromatin, distended nuclear membranes, vesiculated endoplasmic reticulum and abnormal mitochondria. No abnormalities were observed in control explants incubated in culture medium lacking the toxin. Effects were more pronounced with higher concentrations and longer exposure to staphylococcus toxin.

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Aggregation Patterns Between
Unincubated Chick Blastoderm Cells and
Cells from Older Embryos

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Unincubated chick blastoderms, plus neural retina cells and heart ventricle cells from 7-day old chick embryos were dissociated by repeated pipetting or enzymatic treatment (0.1% trypsin in calcium-magnesium-free Hank's solution). Freshly dispersed cells were then incubated in varying proportions for different lengths of time (up to 48 hours) on a gyratory water bath shaker (rotation speed, 80 rpm; temperature, 37.5 C). General morphology was characterized for each cell type used. Aggregation of heterotypic cell combinations was observed with both light and electron microscopy. Initially cells associated at random and later sorted out according to cell type within a common aggregate. The degree of sorting out in heterotypic aggregates was determined by the quantity of each cell type mixed at the start of the incubation period. No specialized junctions were observed between different cell types nor was there any apparent induction of one cell type by another. In other words, each cell type retained its morphological characteristics throughout the experimental period.

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Inductive Tissue-Interactions During
Avian Scale Development

CHRISTOPHER FISHER AND R. H. SAWYER

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In combination with feather-forming epidermis, 9-11 day scale forming dermis supports feather development, while 12-15 day scale-forming dermis supports scale development. From these results, Rawles (1963, J. Embryol. Exp. Morph., 11:765-789) concluded that the scale-forming dermis is biopotential, able to stimulate feather development at one time and scale development at a later time.

We have reexamined the inductive ability of the scale-forming dermis using the highly plastic chorionic epithelium (CE) as the responding tissue, thereby eliminating any influence by the feather-forming epidermis. We find that 12-15 day scale-forming dermis is fully capable of eliciting scale formation in combination with 8 day CE. However, the 10 or 11 day scale-forming dermis is unable to induce either scale or feather formation in combination with 8 day CE indicating that the epidermis plays a significant role in early scale induction.

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Substructure and Composition of
Cell Envelopes (Loricae) of
Trachelomonas hispida var. *coronata* Lemm.
(Euglenophyceae)

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Oak Ridge National Laboratory*

The substructure and composition of cell envelopes of the euglenoid flagellate *Trachelomonas hispida* var. *coronata*, were characterized by cytochemistry, SEM, TEM, energy-dispersive x-ray analysis (EM-EDX), analytical EM (including electron-diffraction analysis), electron probe microanalysis (EPM), x-ray fluorescence (XRF) and atomic absorption spectrophotometry (AA). The envelopes exhibit a "fibrous mat" substructure and are composed of electron-dense fibrillar, or sometimes granular, structures ca. 40-100 A thick and electron-lucent anastomosed mucilage. SEM observations revealed single and anastomosed strands comprising the envelope surface and its ornamentations. Alcian Blue and PAS staining revealed the presence of mucoidal envelope components. TEM observations on envelope sections revealed needle-like fibrous components, and TEM observations of envelope whole mounts indicated that the fibrils may be mucilage-strand inclusions. Electron diffraction analyses verified the crystalline nature of fibrillar constituents, and analyses with XRF, EPM, AA and EM-EDX demonstrated the presence in envelopes of Mn, Si, Ca and several other elements whose presence was capricious.

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Preliminary Observations on
Lorica Structure and Composition in
Pteromonas protracta (Volvocales)

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The unicellular green algal flagellate, *Pteromonas protracta* (Phacotaceae, Volvocales) is characterized by a strongly compressed, bivalved, alar lorica. The classical literature suggests that the lorica lacks cellulose and that it is highly impregnated with Fe, Ca and Mn salts. Cells of *P. protracta* were grown in biphasic and defined media, and lorica structure and composition were examined with phase-contrast, differential-interference-contrast, and bright-field optics, with transmission electron microscopy and with analytical scanning electron microscopy (SEM-EDX). Observations of cells of various ages grown under several culture conditions reveal that the cells remain green and, in contrast to cells of other phacotacean genera studied in this laboratory, do not turn brown or orange when nutrients are depleted. Investigations with TEM show the lorica to be porate, with hexagonal patterns on the surface. Preliminary elemental analyses of loricae with SEM-EDX suggest that, in contrast to earlier reports, Fe is absent, a fact further corroborated with autoradiographic studies, using the radioisotope ^{55}Fe . SEM-EDX studies also indicate that Si and Ca are the predominant elements in the lorica of this organism.

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The Effects of Mannitol and Lysozyme on
the Cell Wall of *Microcystis aeruginosa*

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Experiments were designed to determine the relative susceptibility of the L_{II} cell wall layer and the developing septum to lysozyme degradation. Mannitol was initially used in the experimental procedures to adjust the tonicity of experimental solutions to prevent cells from bursting upon the anticipated removal of peptidoglycan by lysozyme. All treatment combinations of lysozyme (from 0.0125 — 0.3%) and mannitol (0.25 — 0.5M) resulted in cell-wall rupture. Treatments with lysozyme concentrations as high as 0.3% (in 0.03M phosphate buffer, pH 6.8, 1.5hr, 28-30 C) in the absence of mannitol had little of the anticipated effect on the cell's ultrastructure. The only major detectable difference between control cells and lysozyme-treated cells was the presence in the latter of small electron-dense globules attached to and projecting from the L_{II} layer. Treatment with 0.25M mannitol, under identical conditions except for the absence of lysozyme, however, resulted in the rupture and, often, complete removal of walls from cells. In view of these results, the interpretation of the action of lysozyme, when in combination with mannitol, on the cell wall of some blue-green algae is questionable.

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Early Ovule Development,
Megasporegenesis and Megagametogenesis
in *Solidago canadensis* var. *canadensis*
(Asterales: Asteraceae)

L. K. JOHNSON AND BRUCE B. SMITH
York College

Differentiation of the single, hypodermal archesporial cell is concomitant with the initial stages of anatropous. Subsequent coordination of nucellar and integumental development is variable, meiosis occurring either before or after 180° curvature is attained. The heterotypic division is longitudinal and takes place in the center of the nucellus. The homotypic division is asynchronous, the micropylar member of the dyad dividing prior to the chalazal member. The linear tetrad is highly unique due to the consistent occurrence of polynuclearity in 1, 2, 3 or all 4 of its members. Disintegration of these supernumerary nuclei leaves the chalazal megaspore functional. Megagametogenesis is also asynchronous, and the progression of nuclear complementation in the developing embryo sac is thus alternately even and odd. The mature sac is characterized by polyantipodality, with varying numbers and arrangements of secondary and tertiary antipodal nuclei. Disintegration of all other members of the sac leaves the egg and the fusion nucleus in a linear position at the enlarged micropylar end, the former directly beneath the latter. Immediately prior to fertilization, the male gametes are oppositely juxtaposed to each, giving the zeta configuration.

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Ultrastructural Study of Cell Wall Development
and Cell Separation in *Microcystis aeruginosa*

WENDELL E. WALL AND DANIEL D. JONES
University of Alabama in Birmingham

An indentation at the cell surface is the first sign of cell division in *Microcystis aeruginosa*. At the place of indentation, the plasma membrane and L_I layer move inward and L_{II} begins to proliferate at the incipient septum. As indentation continues the incipient septum becomes transitorily diffuse and electron light. Subsequently, the structure broadens, incorporates intermediate electron dense materials and transforms into the septum. At this time, wall layer L_{II} is distinctly more electron dense than the septum, indicating a difference in their chemical properties. Prior to daughter cell separation a significant part of the septum becomes incorporated into the developing L_{IV} layer as the septum breaks down. This interpretation is provisional however, for in some earlier stages of septum development studied L_{IV} can easily be distinguished from the septum. The weight of data at this point indicates that the septum is not simply a proliferation of the L_{II} layer, but becomes a unique structure during cell division.

A Rapid Fixing and Infiltrating Procedure for Plant or Animal Histological Sections

IOLA T. McCLURKIN, D. C. McCLURKIN AND
CHARLES F. YOUNG
University of Mississippi



Modified Millonig's solution used as fixative plus a series of polyethylene glycol (PEG) water soluble waxes used as the infiltration and embedding medium yield sections of high quality for both plant and animal tissues. Overfixation is not a problem; deleterious dehydrating and embedding chemicals are avoided, and rapid staining is promoted. The problem of sectioning the highly hygroscopic PEG even at high humidities is overcome by controlling the block temperature, and the problem of floating intact PEG ribbons to stretch them free of wrinkles without disruption of the sections is overcome through use of a newly devised mounting medium.

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The Thursday Evening General Session

Pros and Cons of Legislation for Species Protection

The 1978 Thursday evening program features a panel of biologists eminently qualified to exchange differing views of the needs and effects of legislation for species protection. The panelists are *C. W. Hart, Jr.*, Smithsonian Institution; *Arnold Krochmal*, U.S. Forest Service; *Albert E. Radford*, University of North Carolina; *James D. Williams*, Office of Endangered Species; and,

Moderator, *J. Ralph Jordan, Jr.*, TVA Regional Heritage Program.

C. W. "Bill" Hart, Jr., ASB President 1970-71, is an invertebrate zoologist. At the Smithsonian Institution he is Assistant to the Director, National Museum of Natural History, and Program Limnologist, International Environmental Science Programs. He has been associated with the

Academy of Natural Sciences of Philadelphia (Director of Water Pollution Consulting Programs and Editor of Scientific Publications), Smith Kline and French Laboratories (Medical Editor), Randolph Macon Woman's College, Washington College and Kirksville College.

Arnold Krochmal is Principal Economic Botanist, U.S. Forest Service, and Adjunct Professor of Biology, UNC/Asheville. He has been a Fulbright Professor, Greece; Research Botanist, Virgin Islands; Research Director, Afghanistan; Senior Research Fellow, Wageningen University; and spent last fall in Columbia. Dr. Krochmal and his wife have authored 11 books published by N.Y. Times, Doubleday and Drake. He was Adjunct Professor of Botany at NCSU, 1972-1977.

Albert E. Radford, Professor of Botany, UNC/Chapel Hill, is Director, Herbarium of the University of North Carolina; Chairman, Natural Areas Advisory Committee for N.C. Department of Natural Resources and Community Development; Chairman, Board of Directors of the Highlands Biological Station; and Editor-in-Chief, *The Vascular Flora of the Southeastern United States*.

Dr. Radford is a major author of five books and co-author of *Endangered and Threatened Plants and Animals of North Carolina: Vascular Plants* (1977, pp. 56-142).

James "Jim" D. Williams is Staff Biologist, Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C. His responsibilities there include preparation of proposals to list and delineate Critical Habitat for Endangered and Threatened fishes. Dr. Williams has taught at Belmont College, Mississippi University for Women and Tuskegee Institute. His research interests include taxonomy, zoogeography and ecology of freshwater fishes and mollusks.

The Panel Moderator, J. Ralph Jordan, Jr., currently serves as project leader for the Tennessee Valley Authority Regional Heritage Program in Norris. He directs those activities of TVA which relate to threatened or endangered terrestrial vertebrate species. His primary interests are in vertebrate ecology and computer-assisted techniques for integrating data on sensitive or unique natural resources with land-use planning efforts to minimize critical environmental conflicts.

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
TREASURER'S REPORT

January 1, 1977 — December 31, 1977

I. SAVINGS ACCOUNTS

A. Regular Savings	\$6,241.34				
Interest	<u>186.66</u>	\$ 6,428.00			
To Contingence		3,264.73			
To Checking		<u>163.27</u>	\$ 3,000.00		
B. Contingence Savings	\$ 85.26				
From Regular Savings	3,264.73				
Interest	<u>27.96</u>	\$ 3,377.95			
To Checking		<u>3,377.95</u>	<u>— 0 —</u>		
TOTAL SAVINGS					\$3,000.00

II. CHECKING ACCOUNT

Balance on Hand — 1 January, 1977					\$ 1,356.49
A. Receipts					
Dues/Subscriptions	\$9,650.00				
Reprints/Back Issues	465.00				
Annual Meeting (Raleigh)	<u>987.38</u>	\$11,102.38			
From Savings		3,541.22			
Meritorious Teaching Award (SP)		<u>500.00</u>			
TOTAL RECEIPTS & BEGINNING BALANCE					\$16,500.09

B. Disbursements

Office

President	\$ 231.91				
Treasurer	7.39				
Nominating Committee	<u>73.05</u>	\$ 312.35			

Publishing

ASB Bulletin 24	\$6,107.50				
Programs	402.86				
Reprints	379.80				
Call for Papers	249.51				
Production/Mailing	<u>1,256.72</u>	8,396.39			

Awards

Student Travel	\$1,000.00				
Meritorious Teaching	500.00	1,500.00			
Interim Meeting (Atlanta, 1 October, 1977)		667.74			
AIBS Adherent Dues		750.00			
CPA Audit Fee		<u>850.00</u>			

TOTAL DISBURSEMENTS 12,476.48

BALANCE IN CHECKING — 31 December, 1977 \$4,023.61

TOTAL ASSETS — 31 December, 1977 \$7,023.61

Respectfully submitted,
(Signed) R. O. FLAGG
R. O. FLAGG, *Treasurer*

THE BURBANCK PRESIDENCIES AND THE DISTAFF SIDE

When the results of the annual ASB elections were announced in New Orleans in 1976, there was some speculation as to whether **Madeline P. Burbanck** was the first woman to be elected to the presidency of the organization. Actually, when she took office in 1977, she became the fifth woman to hold this position having been preceded by **Mary S. MacDougall** (1942), **Margaret N. Hess** (1952), **Mary E. Gaulden** (1958) and **Elsie Quarterman** (1966). There is, however, a unique aspect to her being President of the Association. Her husband, **William D. (Bill) Burbanck**, was President in 1964-65; thus Madeline and Bill represent the first husband-wife team to have held this office.

Although Madeline and Bill work together as a research team, they agree that being President of ASB has been an individual rather than a team effort. Bill maintains that the affairs of ASB

were much simpler in 1964-65 when he became President after having served on a number of committees and a term on the Executive Committee. Since then he has served on the Nominating Committee several times and was instrumental in arranging the annual informal meetings of Past Presidents of the Association. Before being elected President, Madeline, as Archivist, had been attending Executive Committee meetings as a non-voting member of that group, had served on regular and *ad hoc* committees and was Vice-President in 1975-76.

Through the years Bill and Madeline have reported at ASB meetings on their joint research on the isopod, *Cyathura*, and on other individual research projects. Bill was awarded the ASB Research Prize in 1961 for a paper on *Cyathura polita* in the marshes of Cape Cod, Massachusetts; Madeline was his research assistant at that time.

ASB Candidates for Office—1978

The Nominating Committee, composed of Dorothy C. Bliss, James Dent and Chairman Perry C. Holt, has selected the following slate of nominees for the ASB offices to be vacated this year. Voting will take place at the Business Meeting, Friday, April 14. Additional nominations may be made from the floor.

- President-Elect:* — James W. Hardin, North Carolina State University
— Clarence E. Styron, Monsanto Research Corporation
- Vice-President:* — Beryl C. Franklin, Northeast Louisiana University
— James L. Riopel, University of Virginia
- Executive Committee:* — J. F. Fitzpatrick, Jr., University of South Alabama
— Cornelia T. Hyde, Georgia Southern College
— Fr. John H. Mullahy, Loyola University
— Linda M. Stroud, North Carolina State University

Biographical sketches of the candidates follow.



James W. Hardin
(President-Elect)

Professor of Botany and Curator of the Herbarium at North Carolina State University, Dr. Hardin received his B.S. from Florida Southern College (1950), M.S. from the University of Tennessee (1951), and the Ph.D. from the University of Michigan (1957). He has been at N.C. State since 1957 and also has been Visiting Professor at Mountain Lake Biological Station during the summers of 1962 and 1964, and at the University of Oklahoma Biological Station in 1967 and 1970.

Dr. Hardin's research has dealt with the taxonomy of woody plants, hybridization and introgression of forest trees, and poisonous plants. He also serves on several important State committees dealing with the preservation of natural areas and the endangered and threatened plant species of North Carolina.

He was President of the Highlands Biological Station from 1963 to 1969 and is a member of and has held various offices in several honorary and professional societies including the ASB which he joined in 1951. He has served ASB as Co-Chairman of Local Arrangements for the 1966 meeting, Vice President 1968-1969, and Chairman of Local Arrangements for last year's meeting in Raleigh.



Clarence E. Styron
(President-Elect)

Dr. Styron, Senior Ecologist at the Mound Facility of Monsanto Research Corporation, received his B.S. degree from Davidson College in 1963 and M.S. and Ph.D. degrees from Emory University in 1965 and 1967, respectively. He received the Master's and Doctoral research awards from the Emory chapter of Sigma Xi and was awarded a post-doctoral appointment in the Environmental Sciences Division of Oak Ridge National Laboratory (1967-1969). Joining the faculty of St. Andrews Presbyterian College as Assistant Professor of Biology in 1969, he served as chairman of the Biology Program in 1976 and was elected a National Teaching Fellow (1969) and Outstanding Educator of America (1972 and 1974-75).

He is a member of the American Institute of Biological Sciences, American Society of Limnology and Oceanography, Ecological Society of America, Marine Biological Association of the United Kingdom, Society of the Sigma Xi, Health Physics Society, and the Association of Southeastern Biologists. Dr. Styron has served the ASB on the Travel Award Committee (1970-73), Executive Committee (1974-75), Conservation Committee (1974-76), and as Vice-President (1977).

Dr. Styron's research interests in radiation ecology include effects of ionizing radiation on freshwater and terrestrial arthropods, cycling of trace elements in marine systems, and impact of radioactive emissions from fossil-fueled power plants. He joined Monsanto Research Corporation in January, 1977, to develop an ecological research program for the laboratory.

Beryl C. Franklin

(Vice-President)

Educated at Kentucky Wesleyan College, University of Kentucky, and The Ohio State University, Dr. Franklin has been a member of the faculty at Northeast Louisiana University, where he is currently Professor of Biology, since 1959. His research interests are in mammalian reproductive physiology, and he is the author of several papers in this field. A member of several professional societies, including the American Society of Zoologists, he was President of the Louisiana Academy of Science in 1967-68. At present, he is a member of the Adjunct Faculty of the Center on Aging at Northeast Louisiana University. He has served the Association of Southeastern Biologists as Chairman of the Travel Awards Committee in 1973-74. He has also been a member of the Executive Committee since 1975, and has been active in securing private contributions for travel awards.

James L. Riopel

(Vice-President)

Dr. Riopel, Associate Professor of Biology at the University of Virginia, was Associate Dean of the Graduate School of Arts and Sciences (1968-69) and has been Co-Director of the Mountain Lake Biological Station since 1961. As a member of the ASB, he co-chaired the local arrangements committee for the Virginia meeting.

Dr. Riopel is a developmental botanist and author of *Experiments in Developmental Botany*. His research at Virginia has been concerned with positional patterns for lateral root initiation and the hormonal regulation of xylem differentiation in cell suspension cultures. Current studies are examining the physiology of haustorial development in parasitic angiosperms.



Franklin

Riopel

J. F. Fitzpatrick, Jr.

(Executive Committee)

Dr. J. F. Fitzpatrick, Jr., is Associate Professor of Biology at the University of South Alabama, in which capacity he has served since 1973. He received his B.S. and M.S. degrees from Tulane University where he studied with the late George Henry Penn. The University of Virginia awarded him the Ph.D. in 1964. His sponsor there was James N. Dent, and Horton H. Hobbs, Jr., was his research supervisor. Following receipt of his doctorate, he has taught at the University of Kentucky, Mississippi State University, Randolph-Macon Woman's College and the University of South Alabama.

A recognized authority on crawfishes, he has published many scholarly papers, mostly dealing with their systematics. He has received a number of honors and awards and has been elected a Fellow of the American Association for the Advancement of Science. He is a member of a number of professional societies, including the International Association of Astacology, of which he is a founding member. He has served regional, national and international societies of which he is a member. Dr. Fitzpatrick has served A.S.B. as News Editor for the *Bulletin* (1966-70), on the Place of Meetings Committee (1969-71; Chairman, 1970-71) and as a member of the Executive Committee (1971-74).

Cornelia T. Hyde

(Executive Committee)

Dr. Hyde received her B.S. degree from Valdosta State College and her M.S. and Ph.D. degrees from the University of Virginia. She has taught at the College of Wooster and at George Mason College. At present she is Associate Professor of Biology at Georgia Southern College.

Her research interests include the study of the development of the compound eye in hemimetabolous insects and she has studied this and other problems of the development of the Arthropoda with both graduate and undergraduate students.

Dr. Hyde has been a member of ASB since 1969 and is a member of five other scientific societies.

Rev. John H. Mullahy, S.J.

(Executive Committee)

Born in Baltimore, Rev. John H. Mullahy is chairman of the department of biological sciences at Loyola University in New Orleans.

A Fulbright Fellow at Manchester University in England in 1952, Fr. Mullahy received his A.B. degree from St. Louis University in 1937; his M.S. degree from Fordham University in 1941; his S.T.L. degree from St.

Mary's College (Kansas) in 1946; and his Ph.D. from Vanderbilt University in 1951.

After joining the Society of Jesus in 1932, Fr. Mullahy served as instructor of biology at Spring Hill College from 1939-47; assistant professor of biology from 1947-52 and associate professor from 1952. He was promoted to professor in 1955 at Loyola. He has served as chairman of the department of biological sciences since 1954 and director of graduate studies in biological sciences since 1956.

In addition, Fr. Mullahy has been guest investigator, British Association for the Advancement of Science, Stazione Zoologica, Napoli, in 1952. He was a visiting professor of phycology at the University of Washington in 1953.

Fr. Mullahy is the author of numerous papers in the fields of general biology, phycology and cytology.

He is a member of the British Phycological Society, the International Phycological Society, the International Society of Plant Morphologists; AAS-Fellow and council member; the American Genetics Association; the Botanical Society of America; the National Association of Biology Teachers; the American Phycological Society; the Sigma Xi-Tulane Chapter; the Torrey Botanical Club; Tri-Beta National Honorary Biological Society; the New York Academy of Sciences; the Southern Appalachian Botanical Club; the Tennessee Academy of Sciences; the Association of Southeastern Biologists; the Louisiana Academy of Sciences; the Louisiana Science Teachers Association; and the New Orleans Academy of Sciences.



Fitzpatrick



Hyde



Mullahy



Stroud

Linda M. Stroud
(Executive Committee)

Dr. Stroud is a Research Associate of Botany at North Carolina State University at Raleigh. She received her B.S. degree in biology from East Carolina University and M.S. and Ph.D. degrees in botany from North Carolina State University at Raleigh. Previous positions include an Instructorship of Botany at North Carolina State from 1969 to 1976. In 1976, she became a Research Associate on a joint grant with Drs. E. D. Seneca and U. Blum which she had been co-leader on since 1973.

She is a member of Sigma-Xi, Association of Southeastern Biologists, Botanical Society of America, Ecological Society of America, North Carolina Academy of Science, Phi Sigma, and Southeastern Estuarine Research Society.

Research interests include coastal ecology; specifically above and belowground productivity of marshlands along the North Carolina coast, comparisons of these wetlands to other wetlands along the coastline of the United States, environmental monitoring of coastal ecosystems in land use management programs, and aerial photographic interpretation of these ecosystems. In conjunction with her study of the effects of a nuclear power

plant on the marsh ecosystem she is involved in a long-term investigation of marsh angiosperms to determine if annual variation in primary productivity occurs in these natural ecosystems as it does in man-managed agroecosystems.



News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University

Florida — Vacant

Georgia — Fred K. Parrish, Georgia State University

Illinois — George T. Weaver, Southern Illinois University

Kentucky — Gary E. Dillard, Western Kentucky University

Louisiana — Harry J. Bennett, Louisiana State University

Maryland — Don Windler, Towson State University

Mississippi — Jon R. Fortman, Mississippi University for Women

North Carolina — Vacant

South Carolina — G. Thomas Riggan, Jr., Newberry College

Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College

West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *Editor*

Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

The following are new appointments to the Department of Biological Sciences at Florida State University: **Dr. Frances James**, Associate Professor in Ecology and Evolutionary Biology; **Dr. Gerald Schatten**, Assistant Professor in Developmental Biology; and **Dr. Bilgin Tozun**, Associate Professor from the Department of Botany, University of Istanbul. **Dr. Tozun** is spending a six-month sabbatical leave in the Department. Grants have also been received by the following faculty at Florida State University: **Dr. Norris Williams** and **James Ackerman**, American Orchid Society, "Training Orchidologists for the Future: Part II. Generic Considerations in the Zygopetalinae"; **Dr. A. Gib DeBusk**, National Institute on Aging, "Cell Surface Function and Cellular Aging"; **Dr. Margaret Menzel**, U.S. Department of Agriculture, "Genome Relationships of Roselle"; **Dr. Robert J. Livingston**, Environmental Protection Agency, Identification of Tropho-Dynamic Involvement in the Recovery of a Polluted Coastal System" and "Apalachicola Bay Water Quality Study"; Florida Sea Grant Program, "Sea Water Runoff in the Apalachicola Estuary"; **Dr. Robert J. Livingston**, Franklin County Board of Commissioners, "Studies in Apalachicola Bay"; **Dr. J. Herbert Taylor**, National Foundation-March of Dimes, for birth defects research; **Dr. Richard N. Mariscal**, National Science Foundation for two years; and **Dr. Margaret Menzel**, Southern Regional Education Board for the use of facilities not available on the FSU campus.

New faculty in the Biology Department, University of Miami, are **Dr. Julian Lee**, Assistant Professor in Herpetology and **Dr. Keith Waddington**, Assistant Professor in Behavior and Entomology. The following University of Miami faculty have been awarded grants: **Dr. C. H. Mallery**, National Science Foundation, "Regulation of NH_4/Na Exchange in Marine Teleosts Via a NH_4/Na Dependent ATPase"; **Dr. K. D. Waddington**, National Institution of Health, "Sociality and the Economics of Foraging" and a NSF Post-doctoral fellowship at the

University of California, Berkeley; and **Dr. D. H. Evans**, National Science Foundation, " $\text{Na}^+/\text{NH}_4^+ + \text{Na}^+/\text{H}^+$ Exchange in Marine Animals."

W. Clark Ashby and **Clay A. Kolar**, Department of Forestry, Southern Illinois University at Carbondale, have received the following grant: "Effect of Surface-mine Reclamation Practices on the Establishment and Growth of Trees and Other Plant Species" from Sahara Coal Co., Inc., \$41,400.

Dr. Courtney T. Hackney has left the Zoology Department at Mississippi State University and will become an Assistant Professor in the Biology Department at Southwestern Louisiana University, Lafayette.

Retirements from the Department of Zoology and Physiology, Louisiana State University, include **Dr. Nell B. Causey**, Invertebrate Zoology and **Dr. Blanche E. Jackson**, Mammalian Physiology. New appointments to the department are **Dr. E. William Byrd, Jr.**, Developmental Zoology; **Dr. John T. Caprio**, Neurophysiology; and **Dr. John W. Fleeger**, Invertebrate Ecology. LSU faculty receiving grants are: **Dr. William R. Lee**, "Mutagenic Effect of Radionuclei Incorporated into DNA *Drosophila melanogaster*," ERDA, \$20,490, and "Quantitative Genetic Study of Environmental Mutagenesis," Public Health, \$55,117; **Dr. Albert Meier**, "Interactions of Daily Environmental Cues in the Regulation of Vertebrate Metabolism and Reproduction," NSF, \$50,100; **Dr. Thomas H. Dietz**, "Ionic and Osmotic Regulation in the Freshwater Mussel," NSF, \$35,300, and, with numerous coprinciple investigators, a Zoology-Physiology Research Equipment Grant, NSF, \$26,700; **Dr. John T. Caprio**, research support from the National Institutes of Health Biomedical Support Grant awarded to the LSU Council on Research; and **Dr. William B. Stickle** and **Dr. Henry R. Mushinsky**, "Various Aspects of Man's Influence on the Quality of Life and Living Conditions in Southern Louisiana and the Mississippi River," Petroleum Refiners Environmental Council of Louisiana, \$34,468.

Dr. Ronald A. Fritzsche (Ph.D., University of California at San Diego) has joined the staff of the Department of Biology, University of Mississippi. **Dr. Fritzsche's** specialty is marine ichthyology and zoogeography. He will continue to do research on larval fishes and will serve as graduate director for the Department's marine biology students. His last position was with the University of Maryland, Chesapeake Biological Laboratory. **Dr. Fritzsche** has received a grant from the Maryland Department of Natural Resources for studies on the developmental osteology of striped bass (*Morone saxatilis*) and white perch (*Morone americana*). **Dr. Edmund D. Keiser**, Department Chairman, has grants for studies on reproductive biology of Mississippi snakes and for studies on herpetozoans in the Louisiana coastal cheniers. **Dr. Maeburn Huneycutt** has received a grant for his studies on Basidiomycete succession in forest litter and **Dr. William B. Keith** has a grant for examining the effects of oral contraceptives and other synthetic estrogens on guinea pig thymus glands. **Dr. H. Bailey Ward**, and his graduate student, **Mary Bowen**, presented an invited paper on the physiology of cryptomonad algae at the 9th International Seaweed Symposium in Santa Barbara, California, in August. **Mr. Dan Brooks** presented an invited paper on the evolution of tapeworms at the joint meeting of the Canadian Society of Zoologists and the American Society of Zoologists in Toronto, Canada, in December, 1977.

Three new appointments were made in the Department of Biology, Jackson State University, Mississippi, during the 1977-78 fall semester: **Dr. Abdul Mohamed**, Ph.D., Mississippi State University, Entomology; **Mr. Arthur Jones**, Ph.D. Candidate, Purdue University, Plant Pathology; and **Dr. Joy Morrill**, Ph.D., University of North Carolina, Marine Biology.

Dr. Glenn Ray Noggle, Department of Botany, North Carolina State University, will retire July 1, 1978. He will move to Washington, DC, to become the Executive Director of the American Society of Plant Physiologists. **Dr. Noggle** is the past Department Head of the Botany Department and is presently a Professor of Botany at NCSU.

Thomas G. Wolcott, Assistant Professor of Zoology at North Carolina State University in Raleigh, has been awarded \$40,000 from the National Science Foundation for a two-year study on "Uptake of Soil Water by Semi-terrestrial and Terrestrial Crabs."

Dr. Donald Kapraun of University of North Carolina-Wilmington presented a paper at the Ninth International Seaweed Conference recently.

Dr. Gene Van Horn and **Dr. Gary Litchford**, Department of Biology, University of Tennessee at Chattanooga, will teach at the Tech-Aqua Biological Station during the coming summer. **Dr. Van Horn** will teach Local Flora and **Dr. Litchford** will teach Parasitology of Aquatic Animals. **Dr. Charles Nelson** has received a grant from the National Park Service to research the

"Biosystematics of Plecoptera of the Great Smoky Mountains."

Dr. R. H. McCoy, Microbiologist, has been appointed Assistant Professor of Biology, Austin Peay State University. He received his Ph.D. from Oregon State University. **Dr. David H. Snyder** has been promoted to Professor of Biology. **Dr. Snyder** joined the Austin Peay State University biology faculty in 1962 and holds the Ph.D. from Notre Dame. **Dr. Haskell C. Phillips** retired from active teaching and as Chairman of the Biology Department. He has been appointed Professor Emeritus and is continuing his studies in lichenology.

New appointments in the Department of Biology, University of Virginia, are **Dr. Paul M. Adler**, Assistant Professor, Developmental Biology and **Dr. W. Otto Friesen**, Assistant Professor, Neurobiology.

William J. Matthews (Ph.D., Ichthyology, University of Oklahoma) has been appointed as an Assistant Professor in the Biology Department at Roanoke College. He will teach aquatic biology, field biology of the fishes and comparative morphogenesis.

Elizabeth Ann Bartholomew, Secretary of the Southern Appalachian Botanical Club, has retired as Curator of the Herbarium at West Virginia University. The new Curator is **Roy B. Clarkson**. **Linda Rader**, (M.S., University of Tennessee) has been hired as the Herbarium Assistant.

Lexemuel Ray Hesler, 1888-1977



Lexemuel Ray Hesler was born February 20, 1888, on a farm near Veedersburg, Indiana, and received his early education in the local schools. He was awarded a bachelor's degree from Wabash College in 1911 and a Ph.D. in Plant Pathology from Cornell University in 1914. There he was an Assistant Professor until he went to The University of Tennessee in 1919 as Professor and Head of the Department of Botany. He was appointed Dean of the College of Liberal Arts but retained the Botany Headship until 1946. He retired from the posi-

tion of Dean and Professor in 1958, and subsequently devoted himself to mycological research and publication. Altogether he published over 100 titles (10 of which were books); some pertained to general education. He was known internationally as well as nationally.

He was very versatile with an early interest in music and track as well as botany, and he greatly stimulated these programs at the University of Tennessee. His interests were regional: he was a charter member of the Association of Southeastern Biologists and assisted in the founding of The Highlands, N.C., Biological Station. He was a member of many scientific organizations.

He was a great teacher, an excellent mycological investigator, an able administrator and an educator of great vision. The loss will be felt far beyond the State of Tennessee and the profession of Botany.

About Institutions

The **Department of Biology, University of North Alabama**, received a contribution from Union Carbide Corporation which provided for the purchase of a Zeiss research microscope equipped for photomicrography.

The **Department of Biological Sciences, Eastern Kentucky University**, has a new joint Ph.D. program with the **School of Biological Sciences** at the **University of Kentucky**.

Campbellsville College and the **Kentucky Baptist Hospital School of Nursing** have entered into an agreement in which students of the KBHSN/CC affiliation will enroll at the College for their first year of training after which they will complete their program at the facilities of the School of Nursing in Louisville, Kentucky.

The **Department of Zoology and Physiology, Louisiana State University**, has acquired a new ultracentrifuge, a liquid Scintillation Counter and three environmental control rooms.

A Concept II type Ickes-Braun rigid-frame greenhouse has recently been added to the biology facilities at the **University of Mississippi**. It will be used primarily as a teaching laboratory.

The **Department of Biology, Jackson State University, Mississippi**, will move into a new five million dollar biology-chemistry building in January, 1978. The building will be equipped with modern biological instruments which will include an electron microscope, liquid scintillation counter, amino acid analyzer and many other research and teaching tools.

The **University of Tennessee at Chattanooga** has become affiliated with the **Gulf Coast Research Laboratory**, Ocean Springs, Mississippi, and the **Tech-Aqua Consortium** in Smithville, Tennessee.

The **University of Virginia** announces the following graduate courses in biology to be offered at the Mountain Lake Biological Station this summer.

First Term: June 11 through July 15

Principles of Ecology, *Dr. William Odum*, University of Virginia

Introduction to Evolution, *Dr. Elizabeth B. Conant*, University of Virginia

Pteridology, *Dr. Donald R. Farrar*, Iowa State University

Herpetology, *Dr. Harry G. M. Jopson*, Bridgewater College

Second Term: July 16 through August 19

Ecological Genetics, *Dr. Janis Antonovics*, Duke University

Taxonomy of Seed Plants, *Dr. Carl S. Keener*, Pennsylvania State University

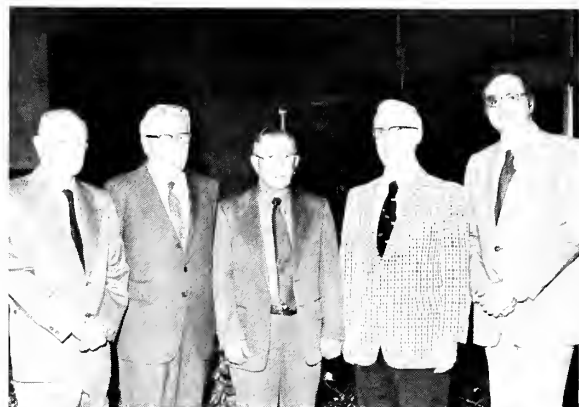
Invertebrate Zoology, *Dr. Clifford Johnson*, University of Florida

Mammalogy, *Dr. Charles O. Handley, Jr.*, United States National Museum

There are four Mountain Lake fellowships of \$200 each available. The fellowships may not be held concurrently with any other stipend from the Station. The recipients are chosen by the Research and Awards Committee of the Department of Biology. Applications for these awards should be sent to the Director, Mountain Lake Biological Station, University of Virginia, Gilmer Hall, Charlottesville, Virginia 22903.

A major renovation of Martin Science Building is underway at **Randolph-Macon Woman's College**. Completion date for the 1.5 million dollar project is set for September, 1978.

The **Department of Botany, North Carolina State University**, held a commemorative dinner on October 26, 1977, in honor of the four past Heads and new Head, spanning the 58-year history of the Department. Below, left to right: *Dr. B. W. Wells*, Ecologist (Head, 1919-1949); *Dr. D. B. Anderson*, Physiologist (1949-50); *Dr. H. T. Scofield*, Physiologist (1950-1964); *Dr. G. R. Noggle*, Physiologist (1964-1977); and *Dr. J. P. Miksche*, Cytologist (1977-Present).



SREL Symposium

Microcosms in Ecological Research

The Savannah River Ecology Laboratory, in cooperation with the University of Georgia's Institute of Ecology, U.S. Department of Energy, National Environmental Research Park Program, U.S. Environmental Protection Agency's Environmental Research Laboratory (Athens), and Electric Power Research Institute's Environmental Assessment Department, will host an ecological

symposium on the use of microcosms in ecological research **November 8-11, 1978**. The symposium format will include presentations by invited speakers, panel discussions and contributed papers.

For information contact: *Dr. John P. Giesy, Jr.; Savannah River Ecology Laboratory; Aiken, SC 29801. (803) 824-6331, Ext. 2472.*

International Symposium on Groundwater Biology

An International Symposium on Groundwater Biology (combining the Fourth International Colloquium on *Gammarus* and *Niphargus* and the Second International Symposium on Groundwater Ecology), co-sponsored by Old Dominion University and Virginia Polytechnic and State University, will be held **September 10-16, 1978**, at V.P.I. & S.U. in Blacksburg, VA.

The Symposium will consist of eight formal paper sessions, four informal discussion sessions, and a mid-conference field excursion to a selected karst area in southwestern Virginia.

Papers on the following subjects are solicited: 1) systematics, ecology, physiology, ethology, and genetics of primarily groundwater amphipod crustaceans; 2) other aquatic, subterranean

groups; 3) pollution, population and community ecology of groundwater ecosystems; 4) dispersal and zoogeography of groundwater organisms; and 5) biological ramifications of physical-chemical changes in groundwater habitats.

Four discussion sessions will be held on: 1) protection of endangered groundwater species and ecosystems; 2) concepts of gammaroidean amphipod taxonomy; 3) ecological classification of groundwater habitats and standardization of groundwater terminology; and 4) sampling techniques for groundwater organisms.

For further information contact: *Dr. John R. Holsinger; Department of Biological Sciences; Old Dominion University; Norfolk, VA 23508.*

PAYMENT OF ANNUAL DUES

Individuals who wish to join the Association for the first time while in attendance at the 1978 Annual Meeting may do so by reporting to the ASB Booth staffed by members of the Executive Committee. "Old" members must mail their dues directly to the Treasurer: *Dr. J. C. O'Kelley; Department of Biology; University of Alabama; University, AL 35486.* The Local Arrangements Committee **will not** accept payment of annual dues!

COVER PHOTOGRAPHS NEEDED

The cover of the ASB Bulletin is available for publication of your best pictures of biologically interesting subjects. Please submit glossy prints (about 5 × 7 is the most convenient size for handling, but any reasonable size will do) and brief descriptions to the Editor for consideration.

TIME AND PLACE OF FUTURE MEETINGS

1979	April 25-28	University of Tennessee, Chattanooga
1980		University of South Florida, Tampa
1981		University of Tennessee, Knoxville

Black Warrior River

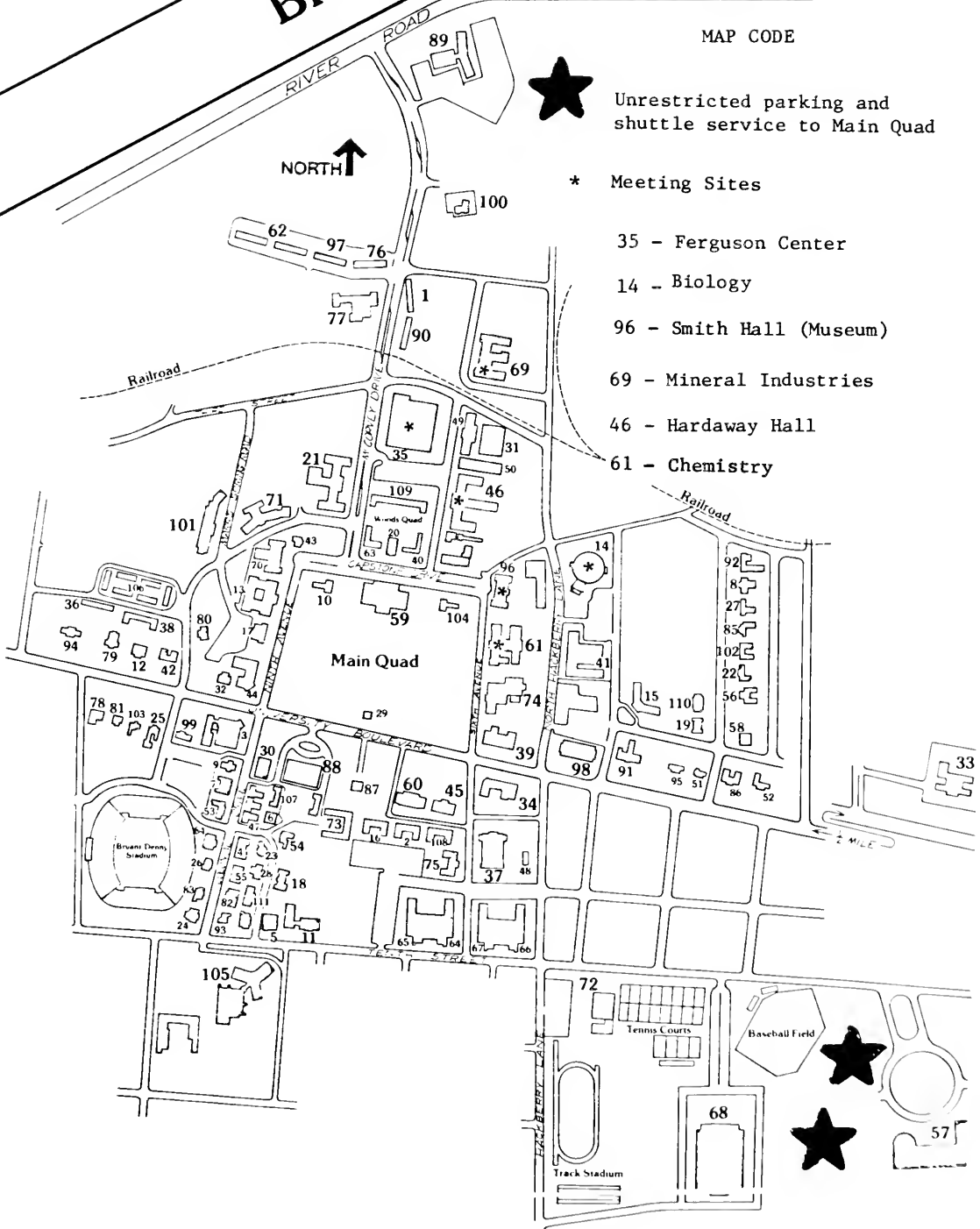
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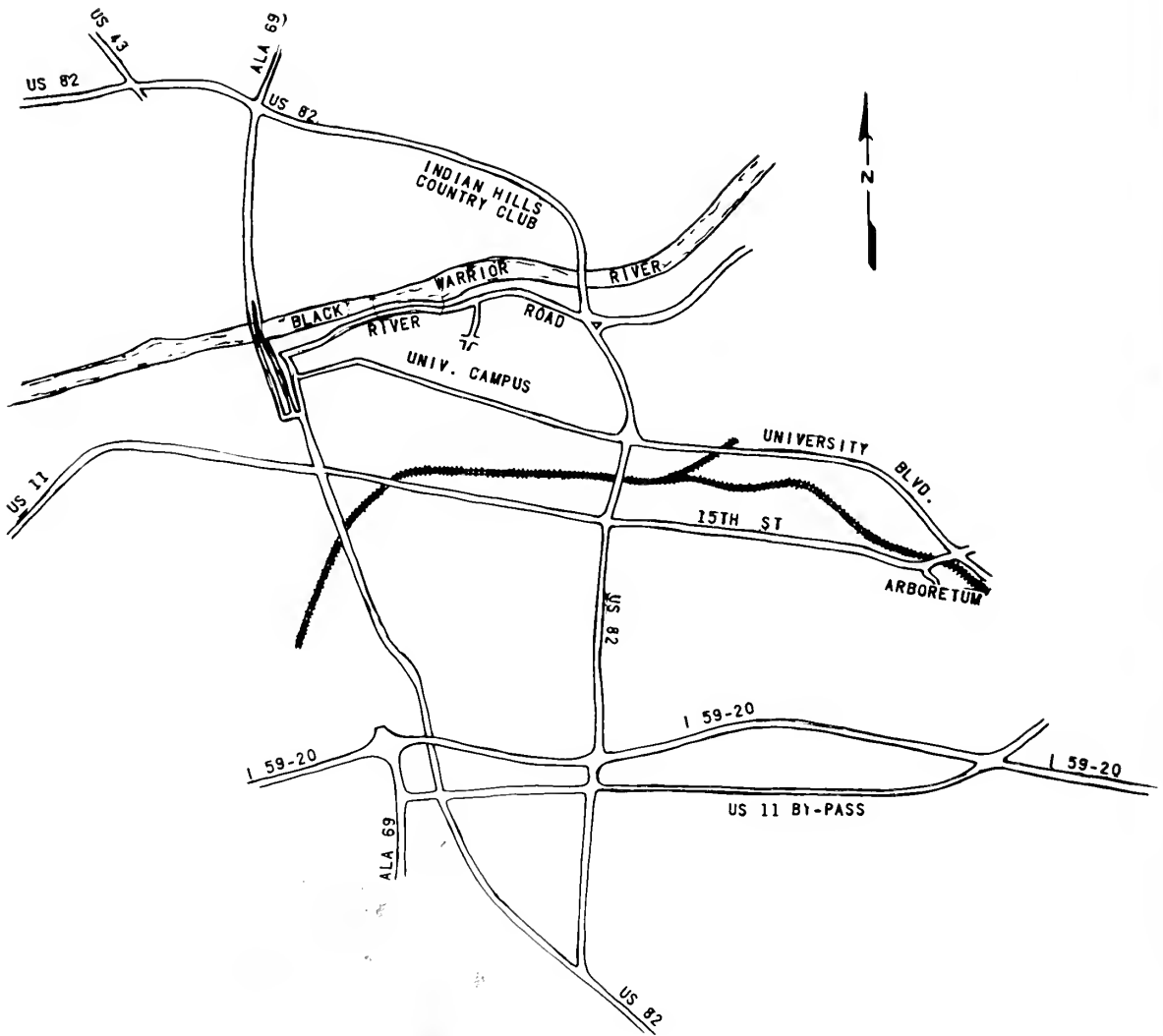


Unrestricted parking and shuttle service to Main Quad

* Meeting Sites

- 35 - Ferguson Center
- 14 - Biology
- 96 - Smith Hall (Museum)
- 69 - Mineral Industries
- 46 - Hardaway Hall
- 61 - Chemistry





CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.*

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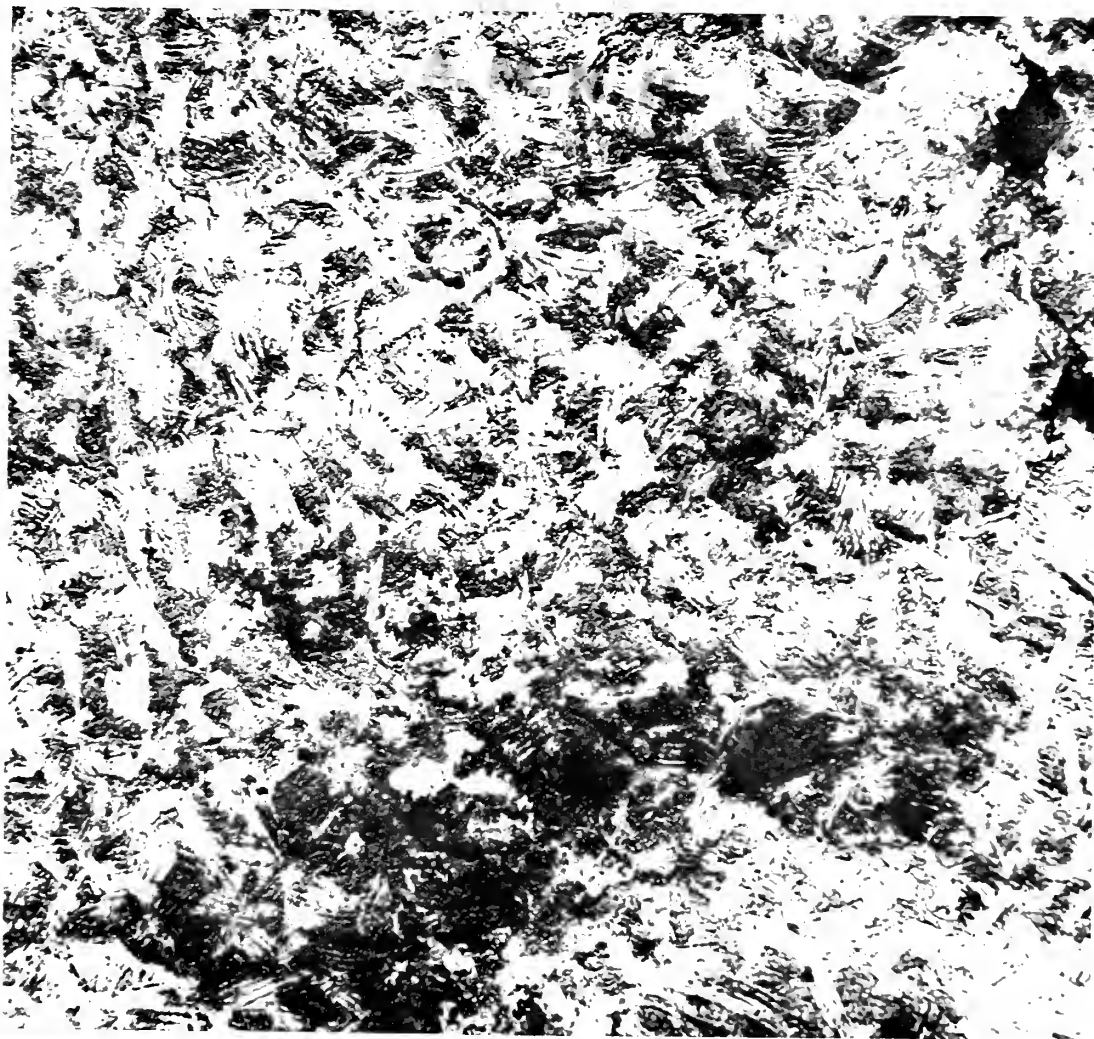
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BULLETIN

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July 1978



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GARY E. DILLARD
 EDITOR

JERRY M. BASKIN
 Associate Editor

JON FORTMAN, News Editor
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Rudolph Prins (1979), Western Kentucky University

Jon R. Fortman (1980), Mississippi University for Women

George M. Simmons, Jr. (1980), VPI & SU

Fr. John H. Mullahy†, Loyola University of the South

Linda M. Stroud (1981), NC State University

AAAS Representative, Section G —

Franklin F. Flint (1978-81)

AIBS Representative —

John M. Herr, Jr. (1978)

†Deceased



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PATRONS

Carolina Biological Supply Company; Burlington, NC
 Parco Scientific Company; Vienna, OH
 Scientific Products; Atlanta, GA

BUSINESS AFFILIATE

Olinkraft, Incorporated; West Monroe, LA

COVER

Intertidal calcareous pavement at Enewetak Atoll, Marshall Islands. The pavement is covered with a thin film of the blue-green alga, *Calothrix crustacea* Thuret and shows tooth marks of the herbivorous reef fish, *Acanthurus guttatus*. Courtesy of **Kenneth L. Webb**, Virginia Institute of Marine Science.

! HELP !

COVER PHOTOGRAPHS NEEDED

Our supply of suitable photographs for the cover of the *ASB Bulletin* has been exhausted. Please submit glossy prints (preferably 5 × 7) and brief descriptions to the Editor for consideration.

COPY DEADLINES

October Issue: August 15
January Issue: November 15
April Issue: January 1
July Issue: May 15

ASSOCIATION AFFAIRS

Flory Recipient of 1978 Research Award



The 1978 ASB Research Award, sponsored by Carolina Biological Supply Company, was won by **Dr. Walter S. Flory, Jr.**, Babcock Professor of Botany, Wake Forest University, for his paper entitled "Chromosome Evolution in the Amaryllidaceae."

Dr. Flory has been an ASB member for more than 30 years. He was a member of the first ASB Research Prize Committee and served as its chairman, 1949-50. He was the ASB Vice President, 1960-61, and ASB President, 1962-63. Besides being active in numerous scientific societies, he is a member of Sigma Xi, Phi Sigma and Phi Beta Kappa, and is a Fellow of AAAS, of the Virginia Academy of Science, of Fairchild Tropical Garden and of The Royal Horticultural Society of England.

When one looks at his work at Bridgewater

College, Harvard University, Texas A & M University, Virginia Polytechnic Institute, the University of Virginia and Wake Forest University, it is obvious why he has received so much recognition and so many awards. He has been included in Who's Who in America since 1948, in the Dictionary of International Biography since 1967, and in Who's Who in the World since 1974. He was Alumnus of the Year, Bridgewater College in 1956 and William Herbert Medalist, American Plant Life Society in 1978. Dr. Flory won the J. Shelton Horsley Research Award, Virginia Academy of Science in 1949, President and Visitors Research Prize, University of Virginia in 1950, Ivey F. Lewis Distinguished Service Award, Virginia Academy of Science in 1969, and Special Award of Merit, Highlands Biological Station in 1973.

Radford Recipient Of 1978 Meritorious Teaching Award



Dr. Albert E. Radford of the University of North Carolina at Chapel Hill was the recipient of the 1978 Meritorious Teaching Award at the 39th Annual Meeting at Tuscaloosa, Alabama. The Meritorious Teaching Award is an annual presentation supported by Scientific Products Company.

Dr. Radford received the B.S. degree from Furman University in 1939 and entered graduate school at the University of North Carolina where he served as a teaching assistant. His studies were interrupted from 1941 to 1946 while he served with the Corps of Engineers in WW II. He served in the North African and European theaters and rose in rank from private to captain. He returned to the University of North Carolina in 1946, served as Instructor in Botany, and received the Ph.D. in 1948. His entire distinguished career has been spent at the University of North Carolina at Chapel Hill where he became full professor in 1958.

Dr. Radford is an active member and officer of a number of organizations such as Sigma Xi, Elisha Mitchell Scientific Society, Southern Appalachian Botanical Club, Botanical Society of America, American Association for the Advancement of Science and Association of Southeastern Biologists. He has served as Trustee, Vice-President, President and Chairman of the Board of Directors of the Highlands Biological Station. He has served on the editorial board of *Brittonia*, editor of *Flora North America* and editor in chief of *Flora of Southeastern United States* and *Flora of the Carolinas*. He has authored and co-authored eight books, many of which are directly related to teaching plant systematics.

Dr. Radford has been very active in identifying and working for the preservation of natural areas in North Carolina and across the Southeast. Under his directorship the UNC herbarium has grown to be the largest in the South with almost 500,000 vascular specimens.

Dr. Radford has given unselfishly of his time and talents and has contributed in many ways to the teaching of Systematic Botany to both undergraduate and graduate students. In 1956 he was honored with the UNC Tanner Award for excellence in undergraduate teaching.

Under Dr. Radford's direction 13 students have completed the Ph.D. degree in Botany, 29 received the M.A. and 7 the M.S. His students currently serve in a variety of academic and research positions at colleges, universities and research facilities across the Southeast.

Dr. Radford's nomination was supported by numerous letters from former students, both undergraduate and graduate, and colleagues. Many indicated that because of Dr. Radford's infectious enthusiasm and energy, they were influenced to pursue advanced degrees and make Botany their life's work. Perhaps one supporter best expressed the admiration many feel for Dr. Radford when he wrote, "Many students have found in him a personal confidant with the greatest of integrity, empathy, strength, and conviction. He is constantly available to his students, past and present, despite his many projects and duties. He is truly a scholar and one who has dedicated his life to his students, discipline, institution and region."

— George G. Murphy

EMERITUS MEMBERSHIP

The following were elected to Emeritus Membership at the Thirty-ninth Annual Meeting in Tuscaloosa. The year in which each became a member of the Association is given in parentheses.

- A. W. Collier (1964)
- Wilbur H. Duncan (1939; Charter Member; Vice-President, 1966-67)
- Robert K. Godfrey (1955)
- Thelma Howell (1943)
- Martha J. Johnson (1948)
- Sam E. McFadden (1950)
- H. Malcolm Owen (1959)
- Lucille Walton (1961)
- Larry A. Whitford (1966)

A biologist who has been a member of the Association for ten or more years and has retired from professional duties is eligible for election to Emeritus Membership. If you are retiring or have retired, believe you are eligible, and would like to become an Emeritus Member, please notify the Treasurer, *Dr. J. C. O'Kelley; Department of Biology; University of Alabama; University, AL 35486.*

NECROLOGY

EVERETT L. BISHOP (1976); Member, 1974-76.

RUTH McCLUNG JONES (1976); Member, 1948-75; Emeritus.

YOUNG JOHN McGAHA (1976); Member, 1969-75.

ROBERT A. McINTYRE, JR. (1976); Member, 1959-76.

DAVID M. MORRIS, JR. (1975); Member, 1968-75.

FR. JOHN H. MULLAHY (1978); Member, 1951-78.

PATRICIA A. SARVELLA (1977); Member, 1960-77.

MORGAN E. SISK (1976); Member, 1968-76.

OFFICERS, EXECUTIVE COMMITTEE AND OFFICIAL REPRESENTATIVES ASSOCIATION OF SOUTHEASTERN BIOLOGISTS: 1978-79

PRESIDENT — Raymond O. Flagg, Carolina Biological Supply Company, Burlington, NC 27215

PRESIDENT ELECT — James W. Hardin, North Carolina State University, Raleigh, NC 27607

VICE PRESIDENT — Beryl C. Franklin, Northeast Louisiana State University, Monroe, LA 71209

RETIRING PRESIDENT — Madeline P. Burbanck, Emory University, Atlanta, GA 30322

SECRETARY — (1976-79) Jerry M. Baskin, University of Kentucky, Lexington, KY 40506

TREASURER — (1978-80) Joseph C. O'Kelley, University of Alabama, University, AL 35486

EDITOR, ASB BULLETIN — Gary E. Dillard, Western Kentucky University, Bowling Green, KY 42101

EDITOR, NEWS AND NOTES — Jon R. Fortman, Mississippi University for Women, Columbus, MS 39701

ARCHIVIST — Madeline P. Burbanck, Emory University, Atlanta, GA 30322

EXECUTIVE COMMITTEE MEMBERS-AT-LARGE — (1979) J. Frank McCormick, University of Tennessee, Knoxville, TN 37916

(1979) Rudolph Prins, Western Kentucky University, Bowling Green, KY 42101

(1980) Jon R. Fortman, Mississippi University for Women, Columbus, MS 39701

(1980) George M. Simmons, Jr., Virginia Polytechnic and State University, Blacksburg, VA 24061

(1981) Linda M. Stroud, North Carolina State University, Raleigh, NC 27607

AAAS REPRESENTATIVE (SECTION G) — (1979) Franklin F. Flint, Randolph-Macon Woman's College, Lynchburg, VA 24504

AIBS REPRESENTATIVE — (1978) John M. Herr, Jr., University of South Carolina, Columbia, SC 29208

LOCAL ARRANGEMENTS AND PROGRAM COMMITTEE — (1979) **Chairman:** Robert G. Franke, University of Tennessee, Chattanooga, TN 37401

AUDITING COMMITTEE — (1978) **Chairman:** Robert R. Haynes, University of Alabama, University, AL 35486; Harriet E. Smith, University of Alabama; Joseph F. Scheiring, University of Alabama

NOMINATING COMMITTEE — (1979) **Chairman:** John M. Herr, Jr., University of South Carolina, Columbia, SC 29208; Walter S. Flory, Jr., Wake Forest University, Winston-Salem, NC 27109; Leland Shanor, University of Florida, Gainesville, FL 32611

RESOLUTIONS COMMITTEE — (1979) **Chairman:** Madeline P. Burbanck, Emory University, Atlanta, GA 30322; Robert G. Franke, University of Tennessee, Chattanooga, TN 37401; Mary C. Dunn, Middle Tennessee State University, Murfreesboro, TN 37132

MERITORIOUS TEACHING AWARD COMMITTEE — (1979) **Chairman:** Richard C. Stalter, St. John's University, Jamaica, NY 11439; (1980) Margaret Gilbert, Florida Southern College, Lakeland, FL 33802; (1981) Rudolph Prins, Western Kentucky University, Bowling Green, KY 42101

RESEARCH AWARD COMMITTEE — (1979) **Chairman:** Bruce B. Smith, York College, York, PA 17405;

(1980) Charles E. Jenner, University of North Carolina, Chapel Hill, NC 27514; (1981) J. Kenneth Shull, Jr., Loyola University, New Orleans, LA 70118

TRAVEL AWARD COMMITTEE — (1979) **Chairman:** Harry E. Shealy, Jr., University of South Carolina, Aiken, SC 29801; (1980) John D. Reynolds, Virginia Commonwealth University, Richmond, VA 23220; (1981) Diane T. Wagner-Merner, University of South Florida, Tampa, FL 33620

PLACE OF MEETING COMMITTEE — (1979) **Chairman:** Gene S. VanHorn, University of Tennessee, Chattanooga, TN 37401; (1980) Ardis L. Cramer, 1431 Cornell Road, N.E., Atlanta, GA 30306; (1981) Linda M. Stroud, North Carolina State University, Raleigh, NC 27607.

CONSERVATION COMMITTEE — (1979) **Chairman:** John R. Bozeman, Georgia Department of Natural Resources, Box 1097, Brunswick, GA 31520; (1980) J. Whitfield Gibbons, Savannah River Ecology Laboratory, Aiken, SC 29801; (1979) J. Frank McCormick, University of Tennessee, Knoxville, TN 37916; (1981) Arthur L. Buikema, Jr., Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

PAST PRESIDENTS COUNCIL — (1979) **Chairman:** Madeline P. Burbanck, Emory University, Atlanta, GA 30322

PRIORITIES IN PUBLIC AFFAIRS COMMITTEE — (1979) **Chairman:** C. Willard Hart, Jr., Smithsonian Institution, Room 417 NHB, Washington, DC 20560; John R. Bozeman, Georgia Department of Natural Resources, Box 1097, Brunswick, GA 31520

MERITORIOUS SERVICE CERTIFICATES

In addition to the customary awards and announcements at the Friday night banquet, President Burbanck presented to each of the retiring Officers and Executive Committee members a certificate of appreciation for meritorious service to the Association of Southeastern Biologists. The preparation of these certificates was authorized by the Executive Committee, and their presentation is to be an annual event.

EXECUTIVE COMMITTEE ACTIONS

After hearing the report by John Herr, our representative to AIBS during the past three years, on his most recent meeting with the Governing Board of AIBS, a motion was made and passed that our Association change from Adherent to Affiliate Membership status in AIBS. This will mean a considerable saving of money while maintaining an affiliation with AIBS.

A report on the questionnaire which was distributed at the Friday morning Business Meeting concerning the possibility of meeting annually in late April or early May indicated that there were a considerable number of in-

stitutions with academic schedules which would interfere with attendance at this later date. The Executive Committee decided to continue to schedule the Annual Meeting during the second weekend in April subject to the restriction of not meeting on Easter weekend and taking into consideration the availability of facilities at host institutions.

CONSERVATION COMMITTEE REPORT, APRIL 1978

Issues related to the Endangered Species Act of 1973 dominated Committee activities.

Both the House and Senate have conducted Oversight Hearings preliminary to reauthorization of the Act. In the Senate hearings, Bill S.2899 was introduced on behalf of Senators Culver, Baker, Randolph, Wallop, Gravel and Hodges to amend Section 7 of the Act. At present, only Congress may exempt projects from requirements of the Act. The amendment would transfer this responsibility to an "Endangered Species Committee" comprised of The Secretary of Agriculture, The Secretary of the Army, The Chairman of the Council on Environmental Quality, The Administration of the Environmental Protection Agency, The Secretary of the Interior, The Secretary of the Smithsonian Institution and The Secretary of Transportation.

The Chairman of the ASB Conservation Committee has been authorized to testify on behalf of the ASB Executive Committee at Congressional Oversight Hearings to be held in May, 1978. The Chairman has met with staff of the Subcommittee on Resource Protection of the Senate Committee on Environment and Public Works and with national conservation organizations in order to prepare for the hearings. The Chairman also met with Dr. Zygmunt Plater who reviewed the recent status of the Act in court and Congress.

There have been only 4 lawsuits out of 4500 potential conflicts, indicating that the Act provides for a sound and workable process for resolving conflict. National conservation groups strongly support the Act and stress the importance of Section 7. State conservation agencies uniformly support the intent of the Act but do experience difficulties in coordinating efforts with federal agencies. Industry groups generally oppose Section 7 of the Act because it puts standards and restrictions on agency programs.

Because of the growing number of public works projects being challenged on the basis of the Endangered Species Act, it is anticipated that a variety of amendments will be introduced by the House and Senate to weaken the Act. Senate Bill 2899 may prove to be the most reasonable alternative. For example, others are considering an amendment to Section 7 which would transfer exemption decisions to the appropriate state Governor.

Our Association is one of 5 co-plaintiffs in a legal suit between the Tennessee Valley Authority and Hiram G. Hill, Jr., et al., Respondents. A brief prepared by Zygmunt J. B. Plater, W. P. Boone Dougherty and Donald S. Cohen was submitted to the Supreme Court of the United States in March, 1978, and the case was argued before that court by Dr. Plater on April 18, 1978. The Tennessee Valley Authority was represented by the Attorney General of the United States. The basis of the litigation is that TVA has constructed the Tellico Dam in violation of the Endangered Species Act. TVA contends that Congressional action to fund an ongoing pro-

ject is an "implied exemption" under Section 7 of the Act. ASB recognizes the Act as being critical to the preservation of biological species and supports compliance to the law by all parties. ASB stands in opposition to the interpretation by TVA as to what may be implied. In related action, Cecil Andrus, Secretary of the Interior, recently requested that TVA more thoroughly examine alternative uses of the Tellico Basin. One alternative use, "the Hanson Study," was recently reviewed in *BioScience*. By the time this report is published the issue may finally be resolved.

In January, 1978, the Associate Director of the Endangered Species Office solicited public participation in documenting the status of endangered species. On behalf of the Conservation Committee, John Bozeman and Whit Gibbons contacted ASB state correspondents in order to identify the status of endangered species in the Southeastern United States. Approximately 20 respondents provided information regarding over 60 species. This information is being forwarded to the Office of Endangered Species.

— John Bozeman
 J. Whitfield Gibbons
 J. Frank McCormick, Chairman

AN EDITORIAL PLEA

Some problems arose in handling abstracts for the 39th Annual Meeting. The most troublesome are summarized below. Please remember these points when you prepare your abstract(s) for subsequent meetings.

1. Double-space all copy. It is very difficult to mark single-spaced copy such that it is legible and easily understood by the printer.
2. When submitting the abstract to the Program Chairman of the Local Arrangements Committee, provide a typewritten original and a carbon copy. Do not submit Xerox copies! Xerox copy paper is very difficult to mark for the printer.
3. In the case of a multiple author abstract, please have the abstract checked by *all* authors. Mass confusion results when the "right hand does not know what the left hand is doing" (or has already done!). We have had cases where the same paper was submitted by separate individuals of the multiple authorship—often with a slightly different title.
4. Check your abstract to insure that it does not exceed 150 words. Some members, it would seem, are under the impression that the 150 word maximum applies only to the abstract title!
5. Proof-read your own abstract—*please*. Incorrect spellings, especially nomenclatural, of groups for which you profess knowledge are inexcusable.

ADVERTISING SPACE

Advertising space is now available in the *ASB Bulletin*: Minimum ½ page @ \$125.00 per issue; Full page @ \$200.00. Submit photo-ready ad copy to the Editor by deadline dates specified on the inside, front cover of the *Bulletin*.

TIME AND PLACE OF FUTURE MEETINGS

1979	April 25-28	University of Tennessee, Chattanooga
1980	April 23-26	University of South Florida, Tampa
1981		University of Tennessee, Knoxville
1982		Eastern Kentucky University, Richmond

EXHIBITORS THIRTY-NINTH ANNUAL MEETING

Carolina Biological Supply Company (**Patron**)
 Parco Scientific Company (**Patron**)
 Scientific Products (**Patron**)
 Academy of Natural Sciences, Philadelphia
 Addison-Wesley Publishing Company
 American Optical Corporation
 Bausch and Lomb, Incorporated
 Coulter Electronics, Incorporated
 Forestry Suppliers, Incorporated
 Frank Carryl Company
 General Supply Corporation
 Fisher Scientific Company
 Hunter Publishing Company
 John Wiley and Sons, Incorporated
 Martin Instrument Company
 Olympus Corporation of America
 Preiser Scientific, Incorporated
 Southern Biological Supply Company
 Turtox/Cambosco
 W. W. Norton and Company, Incorporated
 Wards Natural Science
 Worth Publishers, Incorporated

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University
Florida — Vacant
Georgia — Fred K. Parrish, Georgia State University
Illinois — George T. Weaver, Southern Illinois University
Kentucky — Joe E. Winstead, Western Kentucky University
Louisiana — Harry J. Bennett, Louisiana State University

Maryland — Don Windler, Towson State University
Mississippi — James T. Murrell, Mississippi University for Women
North Carolina — Vacant
South Carolina — G. Thomas Riggan, Jr., Newberry College
Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *News Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Dr. Carol-Ann Manen has joined the Department of Biology, University of Alabama, Tuscaloosa, as an assistant professor. **Dr. Manen** was previously a Fellow in the Department of Biochemistry at the Roche Institute of Molecular Biology. Her research interests center on the regulation of RNA polymerase I activity in target tissues during growth stimulation. **Dr. Steven C. Harris** has also joined the Department in a Post-Doctoral position. **Dr. Harris** received his Ph.D. in Aquatic Entomology from North Dakota State University. He will be working with **Dr. Joseph Scheiring** on a newly funded grant from the Geological Survey of Alabama. **Drs. Robert Haynes** and **Joseph Scheiring** have received a \$70,500 grant from the Geological Survey of Alabama to undertake "A Distributional Analysis of the Benthic Macroinvertebrates, Plankton and Macrophytes of the Alabama River."

Dr. John W. Hardy resigned as Chairman of the Department of Natural Sciences, University of Florida, to return to research and teaching in ornithology and bioacoustics. The new chairman is **Dr. Graig D. Shaak** an invertebrate paleontologist on the Natural Sciences curatorial staff. **Drs. Bruce J. MacFadden** and **Walter Auffenberg**, University of Florida, each received seed money grants from the Division of Sponsored Research, University of Florida. **Dr. MacFadden** received \$5,000 for his proposed paleomagnetic investigations of Florida Cenozoic limestones. **Dr. Auffenberg** received \$3,650 for his investigation of ecological energetics of the American alligator.

Dr. Wayne L. Milstead has joined the staff of the U.S. Fish and Wildlife Service Region 4 office in Atlanta, Georgia, as a Staff Specialist-Botanist in the Endangered Species Program. He is involved in gathering additional information on plant species in the Southeast for final listing as endangered or threatened species at the federal level.

Promotions were recently announced by **President James Strobel** at Mississippi University for Women: **Dr. Jon Fortman** from Associate Professor to Professor of Biology and **Dr. James Murrell** from Assistant Professor to Associate Professor of Biology.

Dr. George Hoffman will be returning to Meredith College this coming fall. He has been on a year's leave of absence at the National Institute of Environmental Health Sciences.

Clemson University announces the appointment of three new faculty members to the Department of Zoology. **Dr. James M. Colacino** (physiologist) and **Dr. Edward E. Ruppert** (invertebrate zoologist) were appointed at the Assistant Professor level. **Dr. Robert J. Taylor** (population ecologist) was appointed at the Associate Professor level.

Dr. Beverly Anne Weeks, Department of Biology, University of South Carolina, has received \$65,000 from the National Cancer Institute to fund a research project on "The Effects of Age and Nutrition on Tumor Immunity."

Dr. Burton J. Bogitsh, Professor of Biology, Vanderbilt University, has been appointed Chairman of the Department of General Biology for a three-year term, effective the beginning of the 1978-79 academic year.

Dr. Leslie Real has been appointed Assistant Professor of Zoology at North Carolina State University. **Dr. Real** received his Ph.D. at the University of Michigan and is currently a postdoctoral fellow at the Rosenstill School of Marine Biology at the University of Miami.

About Institutions

A new Beta Beta Beta Chapter, Mu Omega, has recently been established at the **University of Alabama-Huntsville**.

Georgia College has received its ninth National Science Foundation grant for Undergraduate Research Participation. The grant was for \$11,500 and will be directed by **Dr. Dan Caldwell**.

Tulane University has developed an Environmental Studies Program whereby a student can major in either a natural science or a social science and take basic relevant courses in the other discipline; thus the student acquires the expertise of a regular major subject and fundamental understanding of related issues.

The **Department of Biology** at the **University of Southwestern Louisiana** will again offer its summer program in Estuarine Biology. Students will spend 4 days a week for 7 weeks at the Fearman Bayou Field Station accessible only by boat or plane. A variety of estuarine and marine habitats are easily accessible from the field station. Enrollment is limited and will be distributed on a first come first serve basis. For additional information write: *Dr. Courtney T. Hackney*, Summer Program in Aquatic Biology, Department of Biology, Box 4-2451, University of Southwestern Louisiana, Lafayette, Louisiana 70504.

The **Department of Zoology** at **North Carolina State University** has recently acquired a lodge on Yates Pond, a 20-acre pond near the campus. This lodge will be renovated and used in the department's wildlife and fisheries program.

CHANGE OF ADDRESS

It is your responsibility to notify the ASB when you have a change of address. We can only send your mail when we know where you are, and the Post Office charges the ASB first-class postage on returned mail.

Please send your new address to: *Ms. Dorothy Hubbard*, Circulation Manager, The Academy of Natural Sciences, 19th and the Parkway, Philadelphia, PA 19103.

Please PRINT new address below:

Name:

New Address:

City: State: Zip code:

CAREERS IN THE LIFE SCIENCES

. . . A Special Issue of *The American Biology Teacher*

Copies, at \$3.50 each, may be ordered from: **National Association of Biology Teachers; 11250 Roger Bacon Drive; Reston, VA 22090.**

JEMSS BACK ISSUES

The Herbarium of the University of North Carolina, Chapel Hill, has a number of back volumes and issues of the **Journal of the Elisha Mitchell Scientific Society**. Write *Herbarium; Coker Hall 010-A; UNC-Chapel Hill; Chapel Hill, N.C. 27514* for list.

IT'S NOT TOO SOON!

The Association's 50th Anniversary will be celebrated in conjunction with our 48th Annual Meeting in 1987. You are encouraged to correspond with the President regarding ideas you might have to celebrate the occasion.



SREB INVITES APPLICATIONS FOR SMALL GRANTS

The Southern Regional Education Board (SREB) operates a small grants program (\$150-\$500) enabling faculty and doctoral students in the natural sciences in institutions in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia and West Virginia to obtain support for expenses incurred while traveling to use uncommon equipment and facilities not available on their own campus. Facilities which may be used are listed in the *Catalog of Uncommon Facilities in Southern Universities*, a publication of SREB.

For details and application procedures contact: **Dr. E. C. Godbold; Director of Administration; Southern Regional Education Board; 130 Sixth Street, N.W.; Atlanta, GA 30313.**

KENTUCKY ACADEMY OF SCIENCE FOUNDATION FOR BOTANICAL RESEARCH IN KENTUCKY

The KAS Foundation for Botanical Research is now receiving applications for grants to be awarded for 1978-79. It is anticipated that \$500 will be available to support student research. **Deadline** for receipt of applications by the Chairman of the Foundation is **October 1, 1978.**

Grants are open to applicants enrolled in a college or university program within the Commonwealth or applicants may be students enrolled in institutions of higher learning located outside the political boundaries of Kentucky if the individual's research program involves a study that would be conducted primarily within the State. Grant applications must involve research projects within the generally accepted boundaries of the field of botany. As a general outline this encompasses: Plant Taxonomy or Systematic Botany, Plant Ecology, Plant Genetics, Plant Anatomy, Plant Morphology, Plant Cytology, Phycology, Mycology, Plant Physiology and Paleobotany.

Applications should include a brief description of the proposed research, references to appropriate literature and an outline of anticipated costs. Research projects are expected to be completed within a two year period from initiation of funding and the applicant will be expected to present a summary of his/her results before an appropriate sectional meeting of the Kentucky Academy of Science.

Completed applications or inquiries should be sent to: **Dr. Joe E. Winstead; Department of Biology; Western Kentucky University; Bowling Green, KY 42101.**

REVISED EDITION

NATIONAL LIST OF SCIENTIFIC PLANT NAMES

The Department of Botany, Smithsonian Institution, was recently asked by the Soil Conservation Service of the U.S. Department of Agriculture to produce an updated, revised and corrected edition of the *National List of Scientific Plant Names* originally issued by the Service in 1971. The Department of Botany has agreed to undertake the revision of this check-list.

The need for a standard, efficiently produced and more widely available check-list of North American vascular plants has long been felt by all. The opportunity now exists for filling this vacuum with a publication in a reasonable amount of time. In the published revision, full acknowledgment will be given to the individuals making contributions of data.

Please address your correspondence regarding the check-list to: **D. C. Wasshausen, Chairman; Department of Botany; National Museum of Natural History; Smithsonian Institution; Washington, D.C. 20560.**





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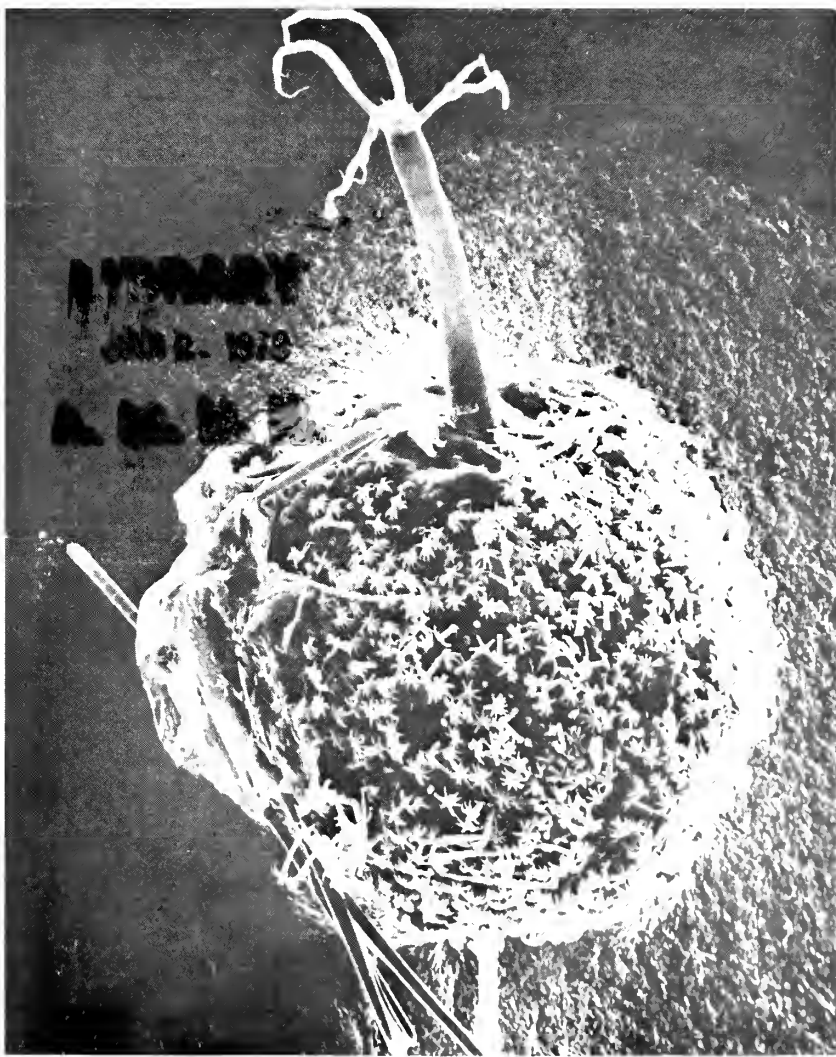
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The ASB

BULLETIN

Volume 25, Number 4

October 1978



Heteromeyenia tubisperma (Potts)

*The Official Quarterly Publication of
The Association of Southeastern Biologists*

The ASB BULLETIN is the official quarterly publication of the Association of Southeastern Biologists, Inc., and is published at Philadelphia, Pennsylvania in January, April, July and October. Letters and other contributions, as well as all communications about editorial matters should be addressed to Dr. Gary E. Dillard, Editor, Department of Biology, Western Kentucky University, Bowling Green, Ky. 42101. News items should be sent to the News Editor, Dr. Jon Fortman, Department of Biological Sciences, Mississippi University for Women, Columbus, Ms. 39701. Inquiries about missing numbers and other circulation matters should be addressed to Ms. Dorothy Hubbard, Circulation Manager, The Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pa. 19103. Subscription orders from institutions should be sent to the Business Manager, Dr. J. C. O'Kelley, Department of Biology, University of Alabama, University, Al. 35486. Subscription rate for non-members of the ASB: \$10.00 per year. Printing and typography by the Fulton Press, Inc., Lancaster, Pa.

Second-class postage paid at Philadelphia, Pennsylvania.

GARY E. DILLARD
EDITOR

JERRY M. BASKIN
Associate Editor

JON FORTMAN, News Editor
J. C. O'KELLEY, Business Manager

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- Retiring President** — Madeline P. Burbank, Emory University, Atlanta, Ga. 30333
- President Elect** — James W. Hardin, NC State University, Raleigh, N.C. 27607
- Vice-President** — Beryl C. Franklin, Northeast Louisiana State University, Monroe, La. 71201
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- Treasurer** — J. C. O'Kelley, University of Alabama, University, Al. 35486
- Archivist** — Madeline P. Burbank
- Executive Committee** —
 - J. Frank McCormick (1979), University of Tennessee
 - Rudolph Prins (1979), Western Kentucky University
 - Jon R. Fortman (1980), Mississippi University for Women
 - George M. Simmons, Jr. (1980), VPI & SU
 - Fr. John H. Mullahy†, Loyola University of the South
 - Linda M. Stroud (1981), East Carolina University
- AAAS Representative, Section G** — Franklin F. Flint (1978-81)
- AIBS Representative** — John M. Herr, Jr. (1978)

†Deceased



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COVER

Scanning electron microscope photograph of a gemmule of the freshwater sponge, *Heteromeyenia tubisperma* (Potts, 1881). Courtesy of Frederick W. Harrison, Western Carolina University.

PATRONS

- Carolina Biological Supply Company; Burlington, NC
- Parco Scientific Company; Vienna, OH
- Scientific Products; Atlanta, GA

BUSINESS AFFILIATE

Olinkraft, Incorporated; West Monroe, LA

COPY DEADLINES

- January Issue: November 15*
- April Issue: January 1*
- July Issue: May 15*
- October Issue: August 15*

ASSOCIATION AFFAIRS

FORTIETH ANNUAL MEETING AT THE UNIVERSITY OF TENNESSEE CHATTANOOGA, TENNESSEE

25-28 April, 1979

In preparing for the 1979 Annual Meeting, please note the following deadlines. Members can facilitate arrangements for the meeting by sending all requested material as far in advance of the deadlines as possible. Because time available for preparation of the program and publication of abstracts is already at a minimum, it is absolutely necessary for the Program Committee and Editor to adhere strictly to the deadlines in order for the programs and April Bulletin to be ready in time for the meeting. **LATE ABSTRACTS AND OTHER MATERIALS CANNOT BE ACCEPTED.** Please remind your secretary and yourself that all material intended for the printer must be neatly typed, double-spaced throughout (this means title, author(s), institutional affiliation(s), text, footnotes, *everything*). Poorly prepared material will be returned to the sender!

DEADLINES

November 15 — Receipt of material to appear in the January Bulletin.

December 1 — Receipt of titles and abstracts of papers to be presented at the Chattanooga Meeting (See Call for Papers for detailed instructions).

December 15 — Suggestions for nominations for ASB officers and executive committee members (See Call for Papers for detailed instructions).

January 1 — Receipt of material to appear in the April Bulletin (other than abstracts).

January 15 — Nominations for the Meritorious Award for Teaching (see below).

February 1 — Applications for Travel Awards to Graduate Students (see below).

February 1 — Papers to be considered for the Association Research Prize (see below).

teaching at the April, 1979, Annual Meeting. The Meritorious Award for Teaching is sponsored by **Scientific Products**, Chamblee, Georgia. The regulations governing the award are as follows:

The recipient must be a member of ASB in good standing. He or she should have taught biology in a southern institution for at least ten years and must be currently teaching. He or she must not be a dean or have regular administrative duties beyond the departmental level. Among evidences of the qualifications of the candidate are the progress of the candidate as indicated by recognition in his or her institution (important assignments and other contributions specifically related to effective teaching) and the number and quality of students for whom he or she provided the primary inspiration to continue in biology, especially those who later received advanced degrees.

Members are urged to nominate outstanding teachers for this award. Nominations are kept on file from year to year; those who do not receive the award when they are first nominated are reconsidered by the Committee in subsequent

MERITORIOUS TEACHING AWARD NOMINATIONS

For the twenty-eighth time, an ASB member will be recognized for especially meritorious

years. Nominations and supporting documentation should be sent to *Dr. Richard Stalter; St. John's University; Jamaica, NY 11439* no later than January 15, 1979.

MARGARET GILBERT
RUDOLPH PRINS
RICHARD STALTER, *Chairman*

TRAVEL AWARDS FOR GRADUATE STUDENTS

Since 1957, funds have been available for partial compensation of travel expenses of graduate students attending the Annual Meeting. Preference is given to those presenting papers and having greater distances to journey.

As prescribed by Association Bylaws, the rules for application follow:

1. Give a conservative, itemized estimate of travel expenses.
2. Give information as to whether or not a paper is being presented by the applicant.
3. In a paragraph, give a brief history of your education to date, indicate how many years you have been — and plan to be — in graduate school, your major field or fields of interest, publications which have appeared or are in preparation, and any other pertinent professional details.
4. Give your source(s) of support while in graduate school, e.g., GI Bill, NSF, NIH, Teaching Assistantship, etc.
5. Have your major professor or departmental chairman provide a letter supporting your application.
6. Applications and supporting materials, **in triplicate**, should be received by *Dr. Harry E. Shealy, Jr., University of South Carolina, Aiken, SC 29801* by February 1, 1979. Applicants will be notified of the decision of the Committee as soon as possible.

JOHN D. REYNOLDS
DIANE WAGNER-MERNER
HARRY E. SHEALY, JR., *Chairman*

ASSOCIATION RESEARCH PRIZE

If you intend to present a paper at the Chattanooga meeting, you are invited to submit your manuscript in competition for the Association of Southeastern Biologists Research Award. The Award, a handsome medallion, is sponsored by

the **Carolina Biological Supply Company**, Burlington, North Carolina.

Rules of the competition are as follows:

1. The Research Award is given annually for an especially meritorious paper actually presented by the author(s) at the Annual Meeting. **If the paper is not presented, it will be disqualified.**
2. Only members are eligible to submit papers in competition for the Award. This applies to **all** names on the paper.
3. Papers submitted in competition may be in press but must not have been published prior to the previous Annual Meeting.
4. Papers are judged by eminent scientists selected by the Committee from institutions outside the Southeast. Every effort is made by the Committee to keep the authors of submitted papers anonymous. Criteria for the Award are left to the discretion of the judges who may withhold the Award if no paper is deemed to have sufficient merit.
5. Papers must be submitted **in triplicate** and in their entirety no later than February 1, 1979, to *Dr. Bruce B. Smith, Department of Biology, York College, York, PA 17405*.

Announcement of the winner of the Research Award will be made at the Annual Meeting. The original copy of the award-winning paper will be sent to the sponsor of the prize.

CHARLES E. JENNER
J. KENNETH SHULL, JR.
BRUCE B. SMITH, *Chairman*

NOMINATIONS

The Nominating Committee would welcome suggestions from the membership in selecting nominees for offices and executive committee positions. The following positions will be filled at the Chattanooga Annual Meeting: **President-Elect, Vice-President, Secretary** and two seats on the **Executive Committee**. The Call for Papers will include a form for this purpose to be sent to *Dr. John M. Herr, Jr.; Department of Biology; University of South Carolina, Columbia, SC 29208* by December 15, 1978.

WALTER S. FLORY, JR.
LELAND SHANOR
JOHN M. HERR, JR., *Chairman*

FR. JOHN H. MULLAHY

1914 – 1978

Father John Henry Mullahy, S.J., died suddenly on the night of May 16, 1978. Father Mullahy was well known to the members of the Association of South-eastern Biologists, having served on the Executive Committee from 1969-1970, and having been re-elected to the Executive Committee at the 1978 ASB meeting in Tuscaloosa.

Father Mullahy was born in Baltimore, Md., on June 26, 1914, to Elizabeth Diehl and John Henry Mullahy. He grew up in Harrisburg, Pa., and upon graduation from high school entered the New Orleans Province of the Society of Jesus in 1932. His Jesuit training was taken at St. Charles College in Grand Coteau, La., and completed at St. Mary's College in Kansas in 1946 where he obtained the Licentiate in Theology. Father Mullahy was ordained a priest in the Society of Jesus on June 17, 1945.

Besides his Jesuit education, Father Mullahy earned a B.A. degree in 1937 in English and Philosophy from St. Louis University. He became teaching regent at Spring Hill College in Mobile, Al., where he taught philosophy, debating and drama, and was in charge of the band. While at Spring Hill, Father P. H. Yancey encouraged Father Mullahy to study biology, chemistry and math, and in 1940 he entered Fordham University where he obtained a Master's degree in Biology in 1941.

Father Mullahy rejoined the faculty of Spring Hill College in 1946 where he taught biology and philosophy. He entered Vanderbilt University the following year and received his Ph.D. in phycology in 1951. His doctoral research was directed by Dr. Harold C. Bold. The following year Father Mullahy was a Fulbright Fellow at Manchester University in England and was a guest investigator for the British Association for the Advancement of Science at the Stazione Zoologica in Naples, Italy, in the summer of 1952.

In the fall of 1952 Father Mullahy was appointed Associate Professor of Biology at Loyola University in New Orleans. After serving as Visiting Professor of Phycology at the University of Washington at Friday Harbor in 1953, he returned to Loyola where he became Chairman of the Department of Biological Sciences in 1954. He was appointed Professor of Cytology in 1955.

During his career at Loyola, Father Mullahy served as director of graduate studies in biology (1956-1978), chairman of the Pre-Medical Studies Committee (1955-1978), member of the Board of Directors of Loyola

(1966-1978), Chairman of the Board (1968-1970), Vice-Chairman of the Board (1970-1978) and Treasurer of the University (1970-1978).

Father Mullahy was very active in professional societies. Among his many activities, he was a member of The British Phycology Society, International Society of Plant Morphology, The American Association of Jesuit Scientists, The American Phycological Society, The American Society of Microbiology, The New York Academy of Science, The Louisiana Academy of Science, The Torrey Botanical Society, and Sigma Xi, to mention a few. In addition, he served as an officer in the New Orleans Chapter of the Muscular Dystrophy Association (Vice President), the New Orleans Chapter of the American Botanical Society (President), the local chapter of the American Society of Oceanography (Vice-President), the New Orleans Academy of Science (President), and Beta Beta Beta (Vice-President for the Southeastern Region). It was this last office on which he worked the hardest and held the longest because this dealt with students. He was active in starting many Beta Beta Beta chapters in the Southeast.

Except for God and His church, Father Mullahy's first love was his students. He probably spent more time advising, counseling, and just talking to his students than on anything else that he did. He constantly encouraged them to strive to do their very best in their academic work and often helped them learn that they were capable of doing more than they had imagined. Father Mullahy also provided strong moral and spiritual leadership to his students. His deep interest in the welfare and achievements of his students characterized his entire career at Loyola. He was indomitable in promoting the highest standards of scholarship throughout the University, particularly in the department he chaired with such strong dedication and distinction. Because of the high standards to which he adhered, his students have a truly phenomenal record on various national examinations and have been very well received in the finest medical, dental and graduate schools in the country.

Father Mullahy died while driving to the Loyola University commencement exercises where he was to deliver the benediction. He had planned to ask that the graduates never forget that they had been educated not only for themselves, but for their fellow men and the greater honor and glory of God.

E. L. BEARD

J. KENNETH SHULL, JR.

News of Biology in the Southeast

STATE CORRESPONDENTS

Alabama — James Wilkes, Troy State University
Florida — Vacant
Georgia — Fred K. Parrish, Georgia State University
Illinois — George T. Weaver, Southern Illinois University
Kentucky — Joe E. Winstead, Western Kentucky University
Louisiana — Harry J. Bennett, Louisiana State University

Maryland — Don Windler, Towson State University
Mississippi — James T. Murrell, Mississippi University for Women
North Carolina — Vacant
South Carolina — G. Thomas Riggan, Jr., Newberry College
Tennessee — John R. Freeman, University of Tennessee at Chattanooga

Virginia — Jean Pugh, Christopher Newport College
West Virginia — Roy B. Clarkson, West Virginia University

JON R. FORTMAN — *News Editor*
Department of Biological Sciences
Mississippi University for Women
Columbus, Mississippi 39701

About People

Auburn University, Department of Botany and Microbiology. The following grants have been awarded to members of the Department: **Dr. D. E. Davis**, "Effects of Herbicides on Submerged Seed Plants", 2-year grant by the Water Resources Research Institute; **Drs. C. M. Peterson and J. D. Weete**, "Water Conservation in Cotton by Drought-Induced Leaf Surface Wax Synthesis", 2-year grant by the Water Resources Research Institute. **Dr. D. E. Davis**, long recognized as an outstanding teacher in the School of Agriculture, was awarded the 1978 Outstanding Teacher Award of the Weed Science Society. A graduate teaching assistant, **Joey McEnerney**, won first place award at the 1978 annual meeting of the Southern Weed Science Society in New Orleans for the paper, "Seed Protectant Effects on Metachlor Absorption and Translocation". **Dr. Elizabeth J. Cutler**, botanist and reader at the University of Manchester, England, presented the 16th annual Benjamin Minge Duggar Lecture in April, 1978, under the sponsorship of the Botany and Microbiology Department. **Dr. Cutler** is an internationally recognized plant anatomist and morphologist. **Professor Gerald R. Wilt** was selected as a Mortar Board Favorite Teacher for the 1978 winter quarter. **Professor Wilt** is also an active participant on faculty evaluations for the Southern Regional Education Board. **Dr. Robert Kral**, Professor of Botany at Vanderbilt University, is a Visiting Professor of Botany during the 1978 summer quarter for instruction in systematic botany.

University of Alabama-Birmingham, Department of Biology. Two new faculty have been added to the staff. They are **Dr. Robert Angus**, formerly at the University of Connecticut, and **Dr. Jack W. Hudson**, former Professor of Zoology and Curator of Mammals at Cornell University. **Dr. Angus** will teach genetics in the fall, while **Dr. Hudson** will take over the Chairmanship of the Biology Department in October.

North Georgia College, Department of Biology. **Dr.**

Mac A. Callaham, Head of the Department, has received a \$160,000 grant from the Appalachian Regional Commission for student stipends and pre-professional program development in allied health, dentistry and medicine. **Dr. Dorothy L. Brock**, Associate Professor, has received a \$13,200 grant from the National Science Foundation for a local course improvement project to involve revision and expansion of the Introductory Biology laboratory curriculum.

Louisiana State University, Department of Zoology and Physiology. ASB members were saddened by the death of **Dr. George H. Lowery, Jr.**, Boyd Professor of Zoology and Physiology and Director, Museum of Natural Sciences. **Dr. Lowery** was an internationally known ornithologist. The loss of this excellent teacher, investigator and administrator will be felt throughout our profession. New appointments to the Department include: **Dr. James V. Remsen, Jr.**, Assistant Professor and **Dr. Valentine Lance**, Assistant Professor.

Louisiana State University, Department of Botany. **Dr. Barry H. Good** has accepted a position as Assistant Professor in the Department of Biological Sciences at Loyola University. **Dr. Good** completed his dissertation under the direction of **Dr. Russell L. Chapman**. **Dr. Shirley C. Tucker** has received a grant from the National Science Foundation for a project entitled, "Ontogenetic Features in Piperales and Aristolochiales". **Dr. Lowell Urbatsch** has received an NSF grant for "Systematics of the Genus *Calea*". **Dr. Shirley Tucker** was recently elected Vice-President of the Botanical Society of America for the coming year. She has served as Program Director of the organization of 2500 botanists for the past three years. **Dr. Urbatsch** received the Ralph Alston award for the outstanding paper of the year in phytochemistry. The award is presented by the Botanical Society of America. **Dr. Urbatsch**, with **Dr. Nikolaus Fischer**, Department of Chemistry, presented a paper on the chemistry of certain Compositae at the 1978 Plant Sciences Conference at Virginia Polytechnic Institute and State University. **Dr. Russell L. Chapman** received

an Amoco Foundation Award for Undergraduate Teaching administered through the L.S.U. Foundation. He was one of two faculty recipients on the Baton Rouge campus.

Louisiana Tech University, Department of Zoology. **Dr. John M. Wakeman**, from the University of Texas, has been appointed as Assistant Professor. **Dr. Wakeman** will teach cell biology and animal physiology. His research interests center on the ecological effects on metabolism of aquatic organisms.

Gulf Coast Research Laboratory, Ocean Springs, Mississippi. **Dr. David W. Cook**, Assistant Director for administration and academic affairs has assumed the office of President of the Mississippi Academy of Sciences. He succeeds **Dr. B. J. Grantham** of the University of Southern Mississippi. In a recent ballot, MAS members chose **Dr. W. Wayne Walley**, Professor of Biology at Belhaven College, President-Elect who will succeed **Dr. Cook**. **Drs. David Cook** and **Edwin Cake** will be associate investigators in a viral evaluation of prohibited oyster growing waters in Mississippi. The principal investigator for the 1978 Sea Grant project is **Dr. R. D. Ellender Jr.**, Assistant Professor of Microbiology, University of Southern Mississippi. **Dr. Gordon Gunter**, Director Emeritus and a senior zoologist, is the principal investigator of a \$56,517 project to provide plankton and hydrographic data from two Ocean Thermal Energy Conversion sites in the northern Gulf of Mexico to the University of California Lawrence Berkeley Laboratory. **John Steen**, a doctoral graduate student at the Gulf Coast Research Laboratory, is the chief biologist on the project. **Dr. Harding Michel**, University of Miami, will be a consultant. **Dr. Edwin W. Cake** has been awarded \$36,547 by the Mississippi-Alabama Sea Grant Consortium for an engineering assessment of a proposed oyster depuration facility. This funding is for the second year of a three-year study. Other principal investigators include: **Drs. David Cook, Marvin T. Bond** and **D. C. Williams**.

University of North Carolina at Charlotte, Department of Biology. **Dr. Roger H. Trumbore** has been appointed Chairman of the Department. **Dr. Trumbore** came to UNCC from Empire State College, State University of New York, where he served as Special Assistant to the President.

North Carolina State University, Department of Zoology. One addition to the department is **Dr. Leslie A. Real**, Assistant Professor. The following faculty have received grants: **Dr. J. Mal Whitsett**, National Science Foundation; **Dr. John G. Vandenbergh**, PHS-National Institute of Mental Health Grant; **Dr. O. T. Sanders**, N.C. Wildlife Resources Commission; **Dr. P. D. Doerr**, N.C. Wildlife Resources Commission; **Dr. W. W. Hassler**, Department of Natural Resources and Community Development of the State of North Carolina and Weyerhaeuser Company.

Appalachian State University, Department of Biology. Retiring after 31 years of service in the Department is **Dr. F. Ray Derrick**. **Dr. Robert Wayne VanDevender** from the University of Michigan will replace **Dr. Derrick**.

Winthrop College, Department of Biology. **Keith L. Bildstein** will join the biology faculty as an Instructor. **Mr. Bildstein** is working toward his Ph.D. at Ohio State University at the present time. He comes to Winthrop College from the College of William and Mary. His fields of interest are animal behavior and ornithology.

University of Tennessee, Department of Botany. **Leslie G. Hickok** has been appointed an Assistant Professor effective January, 1979. **Dr. Hickok** received his Ph.D. from the University of Massachusetts and is a cytogeneticist with research interests in the genetics and cytogenetics of pteridophytes. He will be coming to the University of Tennessee, Knoxville, from Mississippi State University. **Dr. Patricia L. Walne** has been awarded the 1978 Darbaker Prize from the Botanical Society of America for meritorious work in the study of microscopical algae. **Dr. Edward E. C. Clebsch** was elected Chairman of the Ecological Section of the Botanical Society of America for 1978-79. Several members of the Department participated in the first Smoky Mountain Field School, conducted in the Great Smoky Mountains National Park with joint sponsorship of UTK and the National Park Service. The school will be repeated during the summer of 1979. Participating faculty from the Department were **Drs. E. E. C. Clebsch, A. J. Sharp, M. Bierner, B. E. Wofford** and **A. S. Heilman**.

University of Richmond, Department of Biology. **Dr. Thomas R. Platt** from the University of Alberta has been appointed to replace **Dr. Nolan E. Rice** who retired at the end of the 1977-78 school year. **Dr. Platt** will teach courses in parasitology and invertebrate zoology.

Virginia Polytechnic Institute and State University, Department of Biology. New members in the department are: **Dr. Jim Conroy** from the Upstate Medium Center, New York, immunology; **Dr. Bruce Turner** from UCLA, ichthyology; **Dr. Bob Kramp** from the University of Tennessee, radiation biology; and **Dr. Brent Opell** from Harvard, invertebrate zoology. Two members of the Department have retired. They are **Dr. Perry C. Holt**, invertebrate zoology and evolution and **Dr. Robert D. Ross**, vertebrate natural history and ichthyology. Grants in the Department are as follows: **Dr. Curtis Adkisson**, NIH, "Development of Call Notes in Pine Grosbeaks"; **Dr. Arthur L. Buikema**, NSF, American Petroleum Inst., and Department of State, "International Symposium on Groundwater Biology", "Effect of 1977 Refinery Effluent Guideline on Estuarine Organisms" and "A Training Manual for Assessing Biological Complexity and Healthiness"; **Dr. Judith**

Croxdale, NSF, "Leaf Morphogenesis: Structural and Functional Differences in a Heterophyllous Aquatic Plant"; **Drs. John Cairns, Ken Dickson, Albert Hendricks** and **Donald Linzey**, Appalachian Power Company, "Environmental Analyses of Pumped Storage Sites"; **Dr. Jackson Webster** and **Garland B. Pardue**, USDA/Forest Service, "Factors Influencing Trout Production in a Second Order Stream"; **Dr. David A. West**, NSF, "Genetics and Ecology of Threshold Trait; Pupal Color Dimorphism in Swallowtail Butterflies".

Washington and Lee University, Department of Biology. **Dr. Thomas G. Nye** has been appointed Head of the Department. **Dr. Nye** replaces **Dr. James H. Starling** who will continue at Washington and Lee as coordinator of the Pre-Medical program. Other appointments include **Dr. Jay B. Labov** who will replace **Dr. C. P. Hickman** during the 1978-79 academic year.

George Mason University, Department of Biology. Two full time additions to the Department are **Dr. Paulette Royt**, Assistant Professor, microbiology-virology (Ph.D. University of Maryland) and **Dr. Luther P. Brown**, Assistant Professor, ethology (Ph.D. Ohio State University). Grants to members of the Department include: **J. R. Wall**, Virginia Institute of Marine Science, "Genetic Studies of Scallops and Clams"; **Ruth Kaplan**, VIMS, "Studies on the Structure and Biological Properties of the Horseshoe Crab Agglutinin"; **A. S. Tombes**, EPA, "Study of *Giardia* with Phase and Scanning Electron Microscopy"; **Allen Sherald**, George Mason University Foundation, "Genetics of Sclerotization and Coloration in *Drosophila*"; **Melissa Stanley**, George Mason University Foundation, "Carbohydrate Utilization in Fall Army Worm Cell Lines"; **Judith Skog**, George Mason University Foundation, "Collection of Extant and Extinct Ferns in Peru".

College of William and Mary, Department of Biology. **Dr. Maxeen Biben** has joined the Department as Acting Assistant Professor. She is the replacement for **Dr. C. Prichard Terman**, who will be on research leave to study population regulating mechanisms in *Peromyscus*.

Rollins College, Department of Biology. The Department announces the appointment of **Dr. Persis C. Coleman** as Assistant Professor and **Dr. David Matthews** as Visiting Assistant Professor. **Dr. Coleman** comes from post-doctoral training at Stanford University and **Dr. Matthews** from post-doctoral training at Cornell University.

Elon College, Department of Biology. **Dr. Thomas E. Powell, Jr.**, founder and chief executive officer of *Carolina Biological Supply Company* in Burlington, N.C., recently made a gift of \$250,000 to the Department. **Dr. Powell** received his Ph.D. degree from Duke University. The fund will be used to establish the **T. E. Powell, Jr. Professorship of Biology**. The position is expected to be filled for the 1979-80 academic year

and solicitations for nominations will be held in the near future.

University of Florida, Department of Botany. **Dr. George Bowes** has been promoted to Associate Professor. **Dr. Walter S. Judd**, a recent graduate of Harvard University, has joined the Department as Assistant Professor. **Dr. Judd's** interests are in the systematic botany of flowering plants. **Dr. James W. Kimbrough** has been appointed Graduate Coordinator for the Department of Botany. **Dr. Kimbrough** became President-Elect of the Mycological Society of America at the annual meeting of the Society at Athens, Georgia. **Dr. David S. Anthony** was presented a Certificate of Appreciation by **Governor Reuben Askew** "in appreciation for significant contributions to the betterment of this State and its people." For over two years **Dr. Anthony** has served as a Director of the Florida Sulfur Oxides Study, part of the time as Chairman. **Dr. Paul R. Fantz**, Adjunct Professor of Botany during the 1977-78 year, has joined the research staff of The Fairchild Tropical Garden in Miami, Florida.

University of Alabama in Huntsville, Department of Biology. **Dr. M. Eloise Rowland**, recently retired faculty member, has been presented with a resolution of commendation by the Board of Trustees of the University of Alabama System. **Dr. Rowland** was a UAH faculty member for ten years and her total collegiate and university experience spans more than twenty-two years. She received her B.S. degree from Mississippi State College for Women (now Mississippi University for Women) and her Ph.D. in microbiology/parasitology from the University of Tennessee School of Biological Sciences.

West Virginia University, Department of Biology. **Robert L. Birch** retired after 29 years in the Department. **Lila Abrahamson** resigned her position of Associate Professor to accept a position in California. **John DeCosta**, Chairman of the Department, is on a year's leave of absence working in Lund, Sweden. **Martin Schein** will be Acting Chairman. **Willis Hertig**, Associate Professor, will take a leave of absence to serve as Deputy Director of the West Virginia Department of Natural Resources.

Western Kentucky University, Department of Biology. **Dr. Jeff H. Jenkins** will continue to serve as Acting Head of the Department during 1978-79 as the search for a new Head has been re-opened. **Dr. Gary E. Dillard** was co-recipient of the University's 1978 Award for Distinguished Contributions in Research.

About Institutions

Auburn University. An interdepartmental curriculum in Plant Protection has been finalized and will be offered to undergraduate students for the first time this fall quarter. It is a joint program developed by faculty

within the Departments of Agronomy and Soils, Botany and Microbiology and Zoology-Entomology. This curriculum is designed for those undergraduate students interested in qualifying for positions available in the protection of crops from diseases, insects, weeds, rodents and other pests.

Department of Natural Sciences, Florida State Museum, University of Florida. Applications are being taken for the position of Chairman-Curator by the Search Committee to administer a research-oriented Department of 12 curators in systematic biology, ecology, paleontology and zooarcheology. This will be a 12-month position beginning July 1, 1979, with application deadline on November 1, 1978. Three references and a curriculum vitae should be sent to: Search Committee, Department of Natural Sciences, Florida State Museum, University of Florida, Gainesville, 32611.

Louisiana State University. It is anticipated that the Department of Botany will add a plant physiologist with an interest in mineral nutrition to the staff. Advertising and interviewing for the position would be completed during the fall semester and the appointment would begin with the spring 1979 semester. The new position together with two recent appointments in the Department of Plant Pathology and Crop Physiology will further strengthen the program in plant physiology at LSU. The Life Sciences Electron Microscopy Committee has received an allocation of funds from a National Institutes of Health Biomedical Grant for the purchase of a cold stage triode sputter coater for the preparation of specimens for scanning electron microscopy.

Old Dominion University. Seaport Systems Management program has just completed its first year of operations at Old Dominion University. This program is sponsored by NSF-RIAS for a three-year period of funding. It includes graduate course work, funded research and pertinent seminars related to various aspects of port operations. It represents a coordinated, interdisciplinary activity involving the Departments of Biological Sciences, Civil Engineering, Urban Studies, and the Institute of Oceanography. Ground breaking ceremonies were held June 15th for a 6.1 million dollar Life Science Building.

Virginia Polytechnic Institute and State University. The Department of Biology is continuing to develop an undergraduate and graduate program in the area of Health Physics. The program routinely attracts approximately 20 students that annually participate in the program. **Dr. Bob Kramp** will be responsible for its continued growth and development.

George Mason University. The Department of Biology now offers a master's degree specialization in Cell and Molecular Biology.

Gulf Coast Research Laboratory, Ocean Springs, Mississippi. A research grant in the amount of \$14,293

has been awarded to GCRL for support of a project entitled, "A Survey and Assessment of Reef Shell Resources in Mississippi Sound." **William J. Demoran** is the principal investigator. A grant for \$15,000 has also been received by the Laboratory from the National Oceanographic and Atmospheric Administration's Sea Grant program to prepare a hydrological/meteorological atlas of Mississippi Sound. **Charles K. Eleuterius** is the principal investigator. Construction will begin within a month on a toxicology building on the main campus of the Gulf Coast Research Laboratory. **Dr. Harold D. Howse, Laboratory Director**, states that the new facility will house the most modern toxicology laboratories in Mississippi.

University of Alabama in Huntsville. A charter group of Beta Beta Beta (Mu Omega Chapter) was recently established with 13 active, 9 graduate, 6 faculty and 1 honorary members. **Dr. Harold Wilson** is serving as Counselor and **Susan Gilbert**, President. A major project for the chapter, according to **Ms. Gilbert**, will be testing biological activity of a plant growth substance which the Chemistry Club is synthesizing. **Dr. Paul Yokley** from the University of North Alabama was the installing officer.

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SREB INVITES APPLICATIONS FOR SMALL GRANTS

The Southern Regional Education Board (SREB) operates a small grants program (\$150-\$500) enabling faculty and doctoral students in the natural sciences in institutions in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia and West Virginia to obtain support for expenses incurred while traveling to use uncommon equipment and facilities not available on their own campus. Facilities which may be used are listed in the *Catalog of Uncommon Facilities in Southern Universities*, a publication of SREB.

For details and application procedures contact: **Dr. E. C. Godbold; Director of Administration; Southern Regional Education Board; 130 Sixth Street, N.W.; Atlanta, GA 30313.**

KENTUCKY ACADEMY OF SCIENCE FOUNDATION FOR BOTANICAL RESEARCH IN KENTUCKY

The KAS Foundation for Botanical Research is now receiving applications for grants to be awarded for 1978-79. It is anticipated that \$500 will be available to support student research. **Deadline** for receipt of applications by the Chairman of the Foundation is **October 1, 1978.**

Grants are open to applicants enrolled in a college or university program within the Commonwealth or applicants may be students enrolled in institutions of higher learning located outside the political boundaries of Kentucky if the individual's research program involves a study that would be conducted primarily within the State. Grant applications must involve research projects within the generally accepted boundaries of the field of botany. As a general outline this encompasses: Plant Taxonomy or Systematic Botany, Plant Ecology, Plant Genetics, Plant Anatomy, Plant Morphology, Plant Cytology, Phycology, Mycology, Plant Physiology and Paleobotany.

Applications should include a brief description of the proposed research, references to appropriate literature and an outline of anticipated costs. Research projects are expected to be completed within a two year period from initiation of funding and the applicant will be expected to present a summary of his/her results before an appropriate sectional meeting of the Kentucky Academy of Science.

Completed applications or inquiries should be sent to: **Dr. Joe E. Winstead; Department of Biology; Western Kentucky University; Bowling Green, KY 42101.**

REVISED EDITION NATIONAL LIST OF SCIENTIFIC PLANT NAMES

The Department of Botany, Smithsonian Institution, was recently asked by the Soil Conservation Service of the U.S. Department of Agriculture to produce an updated, revised and corrected edition of the *National List of Scientific Plant Names* originally issued by the Service in 1971. The Department of Botany has agreed to undertake the revision of this check-list.

The need for a standard, efficiently produced and more widely available check-list of North American vascular plants has long been felt by all. The opportunity now exists for filling this vacuum with a publication in a reasonable amount of time. In the published revision, full acknowledgment will be given to the individuals making contributions of data.

Please address your correspondence regarding the check-list to: **D. C. Wasshausen, Chairman; Department of Botany; National Museum of Natural History; Smithsonian Institution; Washington, D.C. 20560.**



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