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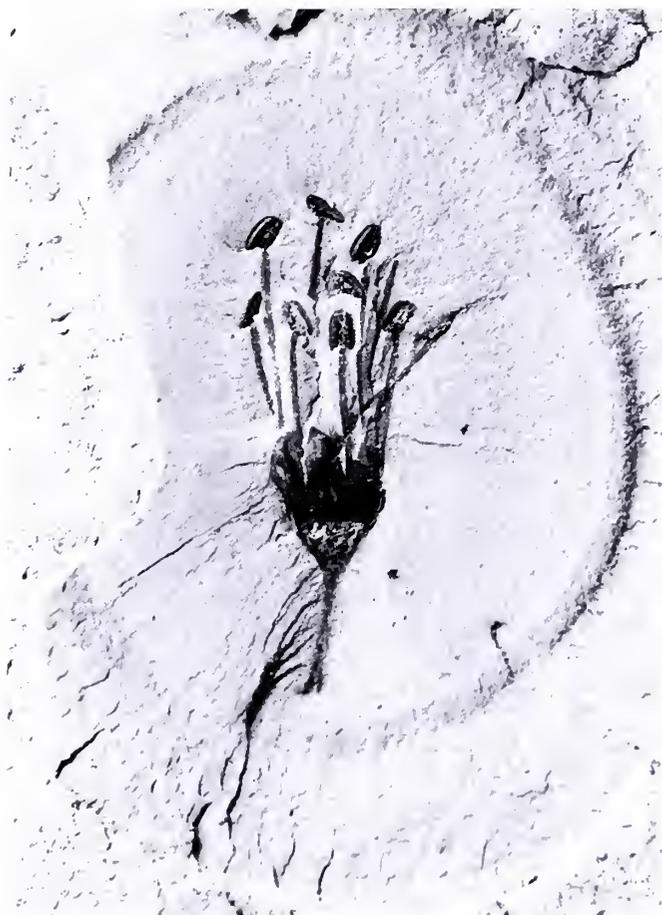


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ASB BULLETIN

January 1993



Protomimosoidea buchananensis (Leguminosae)
Middle Eocene fossil flower, Holly Springs, MS (see p. 18)

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

ASB BULLETIN
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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1993 April 14-17 Old Dominion University, Virginia Beach, VA

1994 April University of Central Florida, Orlando, FL

1995 April 19-21 University of Tennessee, Knoxville, TN

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54th ANNUAL MEETING in VIRGINIA BEACH, VIRGINIA

Old Dominion University and the Department of Biological Sciences welcome the 54th annual meeting of the Association of Southeastern Biologists to Virginia Beach, Virginia, 14-17 April, 1993. All activities except the Thursday evening social and field trips will be held at the historic Cavalier Hotel on the oceanfront in Virginia Beach. The Thursday night social will be at the Virginia Marine Science Museum.

SOCIETIES MEETING WITH ASB IN VIRGINIA BEACH

**American Society of Ichthyologists and Herpetologists, Southeastern Division
Beta Beta Beta
Botanical Society of America, Southeastern Section
Ecological Society of America, Southeastern Chapter
Society of Wetland Scientists, South Atlantic Chapter
Southeastern Fishes Council
Southeastern Society of Parasitologists
Southern Appalachian Botanical Club**

Virginia Beach is located on the southeast coast of Virginia and is part of the Tidewater region. The city is bordered on the east by the Atlantic Ocean and on the north by the Chesapeake Bay. The area is rich in history as evidenced by the sites of the earliest English landings and settlements in North America (Cape Henry, Jamestown, and Williamsburg). Virginia Beach is surrounded by excellent examples of coastal plain ecosystems (salt marshes, forested wetlands, barrier islands, and beaches); many of which are in protected areas. Weather in Virginia Beach in April is very unpredictable but chances are good that it will be pleasant. The ocean water will be cold. Daytime air temperatures should be in the 70's.

The Cavalier Hotel is located on the ocean beach at the northern edge of the commercial tourist section of Virginia Beach. The resort consists of two hotels. The original Cavalier on the Hill, built in 1927, and the Cavalier on the Ocean, which opened in 1973. The hotel has excellent lodging and dining facilities, meeting rooms, tennis courts, pools, fitness center, and ample free parking.

Old Dominion University is a state University located on a 146 acre campus in Norfolk, Virginia. The school was founded in 1930 as a branch of the College of William and Mary. There are more than 16,000 students enrolled in 80 bachelor's, 49 master's, and 14 doctoral programs.

The Department of Biological Sciences has a full-time faculty of 26, with additional adjunct members from Eastern Virginia Medical School and various agencies and other universities. It is housed in the Mills Godwin Life Sciences Building. The department has an M.S. program and offers Ph.D.'s in Ecological Sciences and Biomedical Sciences. Special facilities include an electron microscope complex, environmental pollution laboratories, an herbarium, greenhouse, and animal care facility.

POINTS OF INTEREST IN THE VIRGINIA BEACH AREA

SEASHORE STATE PARK. 2500 Shore Drive. Contains almost 3,000 acres and 27 miles of nature trails through cypress and live oak. Guided walks and biking. The park fronts on the Chesapeake Bay.

BACKBAY NATIONAL WILDLIFE REFUGE. 4005 Sandpiper Road. This 5000 acre refuge of beach, woodland and marsh in southern Virginia Beach provides habitat for migratory waterfowl.

VIRGINIA MARINE SCIENCE MUSEUM. 717 General Booth Boulevard. The most popular museum in Virginia, with more than 100,000 gallons of aquaria, 60 hands-on exhibits, and a one-fifth mile outdoor boardwalk. Explores Virginia marine life, from coastal plain river to deep ocean. Admission charge. Site of Thursday night's social (admission included in cost of social ticket).

OLD CAPE HENRY LIGHTHOUSE. Fort Story. This is the oldest government-built lighthouse in America, dating to 1791.

ADAM THOROUGHGOOD HOUSE. 1636 Parish Road. A 17th century modified hall and parlor house, reminiscent of English cottage architecture. Historic herb and flower gardens.

FRANCIS LAND HOUSE. 3131 Virginia Beach Blvd. An 18th century plantation. Period architecture, furnishings and gardens.

THE CHRYSLER MUSEUM. Norfolk. One of the country's top 20 art museums; most famous for its 8,000-piece glass collection.

NORFOLK BOTANICAL GARDEN. Norfolk. 175 acres of gardens with year-round floral displays. The azaleas are particularly noteworthy in the spring. Admission charge.

WATERSIDE. Norfolk. A festival marketplace on the Elizabeth River harbor with shops and dining.

VIRGINIA AIR and SPACE CENTER. Hampton. Newly opened exhibit with 12 full-size air and spacecraft and an I-max theater.

COLONIAL WILLIAMSBURG. Williamsburg. Restored colonial capital of Virginia. Craftsmen in 18th century attire practice industries of the era. Admission charge for some exhibits.

BUSCH GARDENS' THE OLD COUNTRY. Williamsburg. Seventeenth-century villages recreate life in old England, Scotland, Germany, and Italy. Roller coasters, rides and other entertainment. Admission charge.

ENTERTAINMENT IN THE VIRGINIA BEACH AREA

A great variety of entertainment is readily available in the area. The Beach has numerous night clubs with different musical sounds. Productions by the Virginia Symphony, the Virginia Stage Company, and the Virginia Opera Association are frequently scheduled. Many different types of acts and performers are booked into the

Virginia Beach Pavilion, Norfolk Scope, and Chrysler Hall. The Tidewater Tides baseball team, a minor league affiliate of the New York Mets, has its home field in Norfolk.

THURSDAY NIGHT BUFFET SUPPER

The Thursday night social will be held from 6:30 to 10:00 p.m. on 15 April at the Virginia Marine Science Museum (profiled earlier under points of interest). ASB will have the entire museum to itself. All exhibits will be open and interpretive staff from the museum will be present. Transportation to and from the museum will be provided by the city trolleys. Dinner will be a seafood buffet and entertainment will be provided.

TRAVEL TO VIRGINIA BEACH

Automobile: When approaching from the west, the easiest routes are Interstate 64, U.S. 460 or U.S. 58. From the north and south, convenient routes are Interstates 85 or 95 (connecting with U.S. 58), U.S. 13 and U.S. 17. These routes intersect with I-64 which circles Hampton Roads and connects with the Virginia Beach - Norfolk Expressway, Route 44. The Expressway (a toll road) ends at the Visitor Information Center and leads visitors directly to the oceanfront resort area. The Cavalier is at the northern end of the commercial strip on the oceanfront (turn left on Atlantic or Pacific Avenues).

Air Travel: Virginia Beach is served by Norfolk International Airport which offers more than 200 flights daily through 7 major airlines. USAir has been designated as the official carrier for those attending the Association of Southeastern Biologists Meeting, 14-17 April, 1993. A special convention fare is available offering a 40% discount off the standard round trip coach fare within the Continental United States and 5% off any promotional fare.

SPECIAL AIRFARE INSTRUCTIONS

To obtain the discount, you must call Shoreline International Travel at 1-800-969-5200, Monday through Friday, 8:00 a.m. - 5:00 p.m. eastern time. Refer to the ASB meeting and identify yourself as a participant.

Airport Transportation: Norfolk International Airport is a 20-minute drive from the oceanfront. Car rentals are available at the airport through several national car rental agencies. The regular individual fare via Norfolk Airport Shuttle to the Cavalier is \$15.50 (one-way). If groups of 5 or more arriving around the same time can be identified by Shoreline Travel, a fare of \$6.50 each can be arranged.

ACCOMMODATIONS

A block of 200 rooms is available at the Cavalier Hotel at special convention rates. Please plan to stay at the Cavalier and be at the center of the meeting activities. ASB has had to guarantee sufficient rooms to offset the cost of the meeting facilities. The hotel has ample free parking across the street, but there is a nominal charge for parking in the front lot near the lobby. Reservations must be made directly with the hotel by 14 March, 1993. After that date, requests will be handled on a space available basis. All reservation requests must be secured by a first nights deposit in the form of a check, money order or major credit card.

The special convention rates are extended for three days prior to and following the meeting. The special rates are as follows: single or double, \$75 per night per room; triple or quad, \$85 per night per room. To insure that you receive the special room rates be sure to indicate that you are an ASB meeting participant.

The Cavalier Hotels
42nd St. and Oceanfront
Virginia Beach, VA 23451

Toll Free Reservations Call:
1-800-446-8199

In Virginia Call:
1-800-582-8324 or 1-804-425-8555

Note: You must specify that you are an ASB registrant when you make your reservation.

Free information on the many other motels and hotels in the area can be obtained by calling 1-800- VA BEACH.

PRE-REGISTRATION AND REGISTRATION

A pre-registration form is provided with this copy of the *Bulletin*. **THE DEADLINE FOR RECEIVING PRE-REGISTRATION MATERIALS IS 30 MARCH 1993.** Your pre-registration will allow us to plan facility needs and services for the meeting. Pre-registration packets and late registration will be at the Cavalier Hotel on Wednesday from 12:00 noon until 10:00 p.m., on Thursday from 8:00 a.m. until 5:00 p.m. and on Friday from 8:00 a.m. until 12:00 noon.

PRE-REGISTRATION IS NECESSARY TO ENSURE THE MOST EFFECTIVE PLANNING FOR FIELD TRIPS, SPECIAL MEALS, AND SOCIAL EVENTS. Late tickets for social events and special meals may not be available at the meeting.

Pre-registration fees are fully refundable **PROVIDED** we receive notification of cancellation by **5:00 p.m. on 30 March 1993.**

Please bring your April, 1993 *ASB Bulletin* containing the detailed program and abstracts to the meeting. Copies will be sold at the registration desk for \$3.50.

GENERAL SCHEDULE

ALL EVENTS AT THE CAVALIER HOTEL EXCEPT WHERE NOTED

WEDNESDAY, 14 APRIL

Registration	12 Noon-10:00 PM
ASB Executive Committee Meeting	3:00-7:00 PM
Council Meeting, SE Society of Parasitologists	5:00-6:00 PM
Parasitology Symposium	7:00-9:00 PM
Council Meeting, SABC	7:30-10:30 PM
ASB Social w/Cash Bar	7:30-10:00 PM
Continuation of ASB Executive Committee Meeting (if necessary)	8:30-10:30 PM

THURSDAY, 15 APRIL

Past Presidents' Breakfast	7:00-8:00 AM
Registration	8:00 AM-5:00 PM
Placement Service	8:00 AM-5:00 PM
General Plenary Session:	8:30-9:45 AM
<p>Welcome by Dr. James Koch, President, Old Dominion University Announcements by Local Committee Speaker - Dr. John Cairns, Jr., Virginia Tech, "Maintaining Per Capita Ecosystem Services While Human Population Grows to Ten Billion: A Major Global Challenge for Biologists"</p>	
Exhibits	9:45 AM-5:00 PM
Paper and Poster Sessions	10:00 AM-5:00 PM
Symposium:	
Barrens Vegetation and Restoration Ecology in the Eastern United States	10:00 AM-5:15 PM
Luncheon: Society of Wetland Scientists	12:15-1:45 PM

Luncheon: Beta Beta Beta	12:15-1:45 PM
Beta Beta Beta Field Trip	2:00-6:00 PM
Business Meeting: Southeastern Division, American Society of Ichthyologists and Herpetologists	4:00-5:00 PM
Business Meeting: Southeastern Fishes Council	5:00-6:00 PM
Buffet Supper at Virginia Marine Science Museum	6:30-10:00 PM

FRIDAY, 16 APRIL

Breakfast and Business Meeting: Southern Appalachian Botanical Club and Southeastern Section, Botanical Society of America	7:00-8:30 AM
Placement Service	8:00 AM-5:00 PM
Registration	8:00 AM-12 NOON
Exhibits	8:00 AM-12 NOON
Paper and Poster Sessions	8:00 AM-5:00 PM
Teaching Update Workshop: Modern Instrumentation for Teaching Plant Ecophysiology (presented by Dr. Howard Neufeld, Appalachian State University)	9:00-10:30 AM
Business Meeting: Beta Beta Beta	10:30-11:30 AM
ASB Business Meeting and Election of Officers	11:30 AM-12:30 PM
Luncheon Meeting: Southeastern Chapter of Ecological Society of America	12:30-2:00 PM
Luncheon Business Meeting: Southeastern Society of Parasitologists	12:30-2:00 PM
Beta Beta Beta Paper Sessions	2:00-5:00 PM
Social Hour (Cash Bar)	6:00-7:30 PM
ASB Banquet	7:30-10:00 PM

SATURDAY, 17 APRIL

ASB Executive Committee Meeting	7:00-9:00 AM
Field Trips: Departure from the Cavalier Hotel	7:30 AM to 9:00 AM

A special workshop on current issues related to underrepresented groups in biology has been proposed for the meeting. Look for details in the program issue of the Bulletin.

FIELD TRIPS

Transportation and lunch (except for Beta Beta Beta) are provided for all field trips. Departures will be from the main lobby of the Cavalier Hotel. Please note the departure times.

1. MADISON CAVE

Saturday, 17 April, 8:00 AM - 7:00 PM

Madison Cave, located near Waynesboro in western Virginia, is one of the oldest known caves in Virginia. It was first mapped by Thomas Jefferson, and George Washington's signature is carved on the wall. Once mined for saltpeter, this cave preserve is now closed to the public. Deep ground water lakes provide habitat for unique endemic species, including an isopod designated as threatened by the Federal government. Bring headlamp or flashlight. Led by Dr. John Holsinger of ODU. Limit 10. Cost: \$19.50.

2. THE GREAT DISMAL SWAMP (BIRDING EMPHASIS)

Saturday, 17 April, 7:30 AM - 1:00 PM

The Great Dismal Swamp is a vast peat formation that spans the Virginia-North Carolina border. This National Wildlife Refuge, originally surveyed by George Washington, consists of eleven distinct plant communities surrounding Lake Drummond. Birdwatchers will enjoy observing some of the 179 bird species that have been reported here. The Great Dismal Swamp, a book on the area's geology and natural history, will be available for \$10. Led by Dr. Robert Rose of ODU. Limit 20. Cost: \$9.50.

3. HOG ISLAND

Saturday, 17 April, 9:00 AM - 6:00 PM

Hog Island, adjacent to Virginia's Eastern Shore, is a barrier island in the Virginia Coast Reserve, which is maintained by the Nature Conservancy. The University of Virginia has established its LTER program here, with a research focus on wetland landscape transitions. Frank Day has installed minirhizotrons on the island to examine root dynamics. Prepare to wade in high water. Led by Dr. Linda Blum of the University of Virginia. Limit 23. Cost: \$12.00.

4. BLACKWATER ECOLOGICAL PRESERVE

Saturday, 17 April, 9:00 AM - 1:00 PM

Also known as the Zuni Pine Barrens, the Blackwater Ecological Preserve comprises the northernmost stand of reproducing longleaf pine forest in the US. Managed jointly by ODU, Union Camp, the Nature Conservancy and the Virginia

Division of Forestry, the 130 ha Preserve is burned regularly to maintain diversity. Many rare plants occur here, including recently rediscovered species first recorded by Fernald. Led by Al Plocher of ODU. Limit 20. Cost: \$13.50.

5. HISTORIC WILLIAMSBURG
Thursday, 15 April, 8:30 AM - 3:00 PM

Participants will tour shops and factories recreated from colonial times. Dramatizations by performers in period costumes bring the past to life. Cost includes admission ticket and lunch at a charming local restaurant. Limit 32. Cost: \$43.00 (adults), \$29.00 (children six to twelve years), and free for children under six years.

6. BETA BETA BETA TRIP TO VIRGINIA AIR AND SPACE CENTER/
HAMPTON ROADS HISTORY CENTER

Thursday, 15 April, 2:00 - 6:00 PM

Exhibits concerning history, adventure and space. Samuel P. Langley's Great Aerodome, Apollo 12 Command Capsule, and ten air and space craft. Led by David Anderson of ODU. Cost: \$9.00.

NOTICE OF AWARDS FOR 1993

"TRAVEL" SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB

DEADLINE: 1 February 1993

Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be members of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

- (a) Give information as to whether you submitted a title and abstract for a paper or poster.
- (b) Give a conservative, itemized estimate of meeting expenses excluding transportation.
- (c) In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications that have appeared or are in preparation, degree sought, name of major professor, and any other pertinent professional details.
- (d) Give your source(s) of support while in graduate school; e.g. NSF, NIH, USDA, Teaching Asst., Research Asst., Fellowship, etc.
- (e) Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.
- (f) Send application, with supporting letter, all in triplicate, to : Dr. Harold G. Marshall, Dept. of Biological Sciences, Old Dominion University, Norfolk, VA 23529-0266, (804) 683-3595.
- (g) Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

MERITORIOUS TEACHING AWARD NOMINATION

DEADLINE: 1 February 1993

Each year the ASB recognizes one of its members for especially meritorious teaching. This award of \$1000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the July *ASB Bulletin*.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a Southeastern institution for at least ten years, and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his or her institution (important assignments and other contributions specifically related to effective teaching, and teaching awards) 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, using the form in the *ASB Bulletin* 37: 127, 1990, and include supporting documentation (biographical sketch or CV, supporting letters, photograph of candidate, etc.). Send all of this, once compiled, to: Dr. Mac A. Callaham, Biology Department, North Georgia College, Dahlonega, GA 30597, (404) 864-1953.

RESEARCH AWARDS

ASB RESEARCH AWARD (\$500) and ASB STUDENT RESEARCH AWARD (\$500) Rules are as follows:

- (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting. In order to qualify for presenting the paper, the author(s) must submit an abstract by the 1 December deadline. Papers submitted for the competition must be received in triplicate and in their entirety by 1 February and must be journal-ready manuscripts worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission.
- (b) The senior author must be an ASB member in good standing. The student award is given to the senior author if he/she is a graduate or undergraduate student at the time of presentation.
- (c) Papers may be in press but not published prior to the previous annual meeting.
- (d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses or objectives, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Research Award Committee, the award may be withheld or it may be split in case of a tie.
- (e) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names, and affiliations of all

authors, abstract, and biographical information will be published with an announcement in the July *ASB Bulletin*. The appropriate box should be checked on the ASB title form. Send to: Research Award - Dr. Edward E. C. Clebsch, Department of Botany, University of Tennessee, Knoxville, TN 37996, (615) 974-6209. Student Research Award - Dr. Donald R. Young, Biology Department, Virginia Commonwealth University, Richmond, VA 23284, (804) 367-1562.

ASB STUDENT RESEARCH AWARD IN AQUATIC BIOLOGY (\$100)-The purpose of the award is to encourage excellence in research in aquatic biology by undergraduate and graduate students. The award is sponsored by Wildlife Supply Company (Wildco). Rules are as follows:

- (a) Students who are members of ASB and whose research is sponsored by a faculty member or biology professional who is also an ASB member are eligible.
- (b) The paper must be based on research designed and completed by the student.
- (c) The paper must be presented orally by the student as senior author in a regular paper session at the annual meeting. The student must submit an abstract in compliance with the 1 December deadline in the call for papers. By 1 February the student must submit three typed or printed copies of the manuscript, a brief biographical sketch, and a letter from the faculty/professional sponsor affirming student status and their sponsorship to the chair of the ASB Student Research Awards Committee.
- (d) The manuscript must conform to the style and general content of peer-reviewed journals in an area of aquatic biology.
- (e) Oral presentations will be verified by the Student Awards Committee and the manuscripts will be evaluated in accordance with the following criteria: significance of the research to the field, validity of hypotheses tested, innovativeness and appropriateness of methods, validity of conclusions, clarity of presentation of results, and quality of writing style.
- (f) It is intended that aquatic biology be broadly interpreted; for example the research could involve an entomological project on an aquatic insect.
- (g) An award will not be given if in the judgement of the Committee there is no meritorious paper.
- (h) The winner will be announced at the annual banquet.

The appropriate box should be checked on the ASB title form. Send manuscripts and other required materials to: Dr. Donald R. Young, Biology Department, Virginia Commonwealth University, Richmond, VA 23284, (804) 367-1562.

EUGENE P. ODUM AWARD - \$250 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points: (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) Previous winners are not eligible to win the award a second time.
- (g) Submit title and abstract to program chairman by **1 December**. A second copy must be sent to the award coordinator by the same date. The appropriate box should be checked on the ASB title form. Send to: Dr. Andy Ash, Department of Biology, Pembroke State University, Pembroke, NC 28372, (919) 521-4214, ext. 418.

NORTH CAROLINA BOTANICAL GARDEN AWARD - \$100 given by the North Carolina Botanical Garden (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is awarded for a paper presented at the annual ASB meetings that best advances our understanding of the biology and conservation of southeastern plants and thus contributes to the mission of the North Carolina Botanical Garden. Of special interest to the Garden are the rare plant species of the Southeast: why they are rare; how they interact with plants, animals, and their environment; and what can be done to ensure their survival. As noted below, the paper may deal with a broad area including systematics, ecology, and conservation.

The presentation will be evaluated by a panel of judges at the time of presentation on the following points: (a) significance of ideas; (b) quality of methodology; and (c) clarity of presentation. The prize will be presented at the annual ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award. They may be students, faculty or others.
- (b) The paper must deal with the systematics, ecology, evolution, species biology (including population biology, pollination, dispersal, establishment, and maintenance), propagation, or conservation of vascular plants that are native in the southeastern United States.
- (c) The paper must be presented in a regular Plant Systematics or Plant Ecology contributed paper session; papers presented in poster sessions or in symposia are not eligible.
- (d) The title and abstract of the paper must be submitted to the Award Coordinator at the time of submission to ASB; this may be a copy of the same abstract submitted to ASB by **1 December**. The appropriate box should be checked on the ASB Title Form. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. Peter White, Dept. Biology, University of North Carolina, Chapel Hill, NC 27599.

THE SOUTHEASTERN DIVISION OF THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS BEST STUDENT PAPER AWARD AND TRAVEL GRANTS - Prizes of \$100 will be awarded each for the best student papers in ichthyology and herpetology presented in connection with the Division's annual meeting. In addition, a limited number (1-3) of travel grants (\$50 each) are available to assist undergraduate and graduate students in attending meetings when they present papers. Students interested in being considered for student paper awards and travel grants should contact Dr. C. Kenneth Dodd, Jr., National Ecology Research Center, U.S. Fish and Wildlife Service, 412 N.E. 16th Avenue, Room 250, Gainesville, FL 32601, (904) 372-2571. Consideration for travel grants requires a short paragraph justifying the need for the award.

GUIDELINES FOR POSTER SESSIONS

Poster sessions have been incorporated as a regular means of scientific presentation at the annual ASB meetings. This type of presentation provides a more informal environment that encourages a direct interchange of ideas and discussion between presenter and audience.

Adherence to the following guidelines will help ensure the effectiveness of poster sessions. Posters will be organized by subject matter and number sequentially in accord with abstract listings in the *ASB Bulletin*. All posters will be on display for a half day, although authors or co-authors are required to be with their posters only during a specified session. Thumb tacks, tape, backing paper, scissors, and other special display material **will not** be provided and should be supplied by each presenter.

Posters should be carefully planned to maximize clarity and simplicity in conveying information. Poster boards four feet in height and eight feet in width will be available for each paper. Arrange for a heading including title, author(s) name, and author(s) institution(s) to be placed at the top in letters no less than three cm high. The body of the poster should be self-explanatory and should include figures, tables, graphs, maps, or photographs displayed in a well organized and coherent sequence from top to bottom. Do not crowd the display. All materials, including text legends and captions on figures or tables, should be legible from a distance of about two meters. Each illustration should be captioned. A limited degree of text can be included, but care should be taken not to overwhelm the audience. Authors may choose to post a large typeset copy of the abstract at the top of the poster and include a clear listing of specific conclusions at the bottom.

LOCAL ARRANGEMENTS COMMITTEE

CHAIR (REGISTRATION AND ACCOMMODATIONS):	Frank P. Day
PROGRAM :	Harold G. Marshall
AUDIOVISUALS :	Alan H. Savitzky
EXHIBITS :	Robert K. Rose
FIELD TRIPS and TRANSPORTATION :	Deborah A. Waller
SOCIAL ACTIVITIES :	Ray S. Birdsong
HOST INSTITUTION :	Old Dominion University Dept. of Biological Sciences Daniel Dauer, Chair Norfolk, VA 23529-0266 (804) 683-3595
MEETING HEADQUARTERS:	The Cavalier Hotels 42 th St. and Oceanfront Virginia Beach, VA 23451 (804) 425-8555

ASB ANNUAL MEETING 14-17 APRIL 1993
PRE-REGISTRATION FORM

(Type or print; one form per registrant; duplicate as needed)

Name _____

Social Security Number (Office Use Only) _____

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Institution _____

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Name Tag Information (if different from above)

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Institution _____

Pre-registration deadline is 30 March 1993

Affiliation (Check where appropriate):

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If you desire vegetarian meals, please check _____

Registration:

Regular:	\$35.00	\$	_____
Student:	\$14.00	\$	_____

(Late registration: Regular \$45.00; Student \$18.00)

Thursday Night Supper-Marine Science Museum

Regular:	\$25.00	x _____	Tickets	\$	_____
Student:	\$20.00	x _____	Tickets	\$	_____

ASB Banquet (Friday)

Regular:	\$27.00	x _____	Tickets	\$	_____
Student:	\$22.00	x _____	Tickets	\$	_____

Name: _____

Breakfasts

ASB Past Presidents:	\$11.00 x _____	Tickets \$ _____
SABC/SE-BSA:	\$10.50 x _____	Tickets \$ _____
Executive Committee:	\$11.00 x _____	Tickets \$ _____

Luncheons

Beta Beta Beta:	\$10.00 x _____	Tickets \$ _____
Wetland Scientists:	\$16.00 x _____	Tickets \$ _____
ESA/SE Chapter:	\$16.00 x _____	Tickets \$ _____
Parasitologists:	\$16.00 x _____	Tickets \$ _____

Field Trips

No. 1:	\$19.50 x _____	Tickets \$ _____
No. 2:	\$ 9.50 x _____	Tickets \$ _____
No. 3:	\$12.00 x _____	Tickets \$ _____
No. 4:	\$13.50 x _____	Tickets \$ _____
No. 5: Adult	\$43.00 x _____	Tickets \$ _____
Child	\$29.00 x _____	Tickets \$ _____
No. 6 (Beta Beta Beta):	\$ 9.00 x _____	Tickets \$ _____

TOTAL AMOUNT ENCLOSED \$ _____

Make checks payable to Old Dominion University

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ASB MEETING
 Non-Credit Operations
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 Norfolk, VA 23529-1060

Note: To become a member of ASB, please complete the application form in the back of this issue and send to the ASB Treasurer with the appropriate dues.

ANNOUNCEMENTS

CHANGES IN THE CONSTITUTION:

Education Committee: This committee will consist of six members with two appointed by the President each year to overlapping three-year terms. The two senior members will co-chair the committee, or through common agreement or coin flip, one may assume the responsibility of the Chair. The committee is charged with the responsibility of aiding the Association in its efforts to foster the teaching of biology at all levels in the educational system. This includes, but is not limited to, promoting biological and environmental aspects of scientific literacy, facilitating the input of research scientists into primary and secondary education, aiding and encouraging the teaching of biological science to non-majors at the post secondary level, and the nurturing of future professional biologists. Working in conjunction with the Executive Committee, it will be the responsibility of the committee to select focused activities which will further these goals within the time and resource restraints of the Association. These projects may include the organization of symposia for annual meetings and representation of Association interests at national science education conferences and in education coalitions or alliances approved the Executive Committee. ASB members serving as these representatives will be appointed by the President, upon consultation with the Education Committee Chairman.

Patron dues: The Executive Committee recommends that patron dues be \$500 annually rather than the present \$300 annual patron dues.

The Association of Systematics Collections will hold its 1993 Annual Meeting on 7-9 May 1993, in Pittsburgh, PA at the Carnegie Museum of Natural History. The theme is "Public Relations for Systematic Collections and Research." The featured event will be a workshop on building local community support for collections and collections-based research, including suggestions for working with trustees and friends' groups. There will also be an in-depth discussion of the draft documents of "Systematics Agenda 2,000" (the effort to determine research needs and priorities in systematics), with a session on implementation strategies. A business meeting and discussion of NSF programs will be held on 7 May. A riverboat cruise will be the stage for the annual banquet and award ceremony on 8 May. There will be opportunities to visit the Carnegie collections and the Hunt Institute for Botanical Documentation. for program and hotel information, contact: ASC, 730 11th St NW, 2nd Fl., Washington, DC 20001; (202) 347-2850.

According to Dr. J.M. Herr, Jr., president, the name of the Southern Appalachian Botanical Club has been changed to Southern Appalachian Botanical Society.

REQUEST FOR CONSERVATION ISSUES

The Conservation Committee would like to know the issues that ASB Members feel the committee should address over the short- and long-term. In recent years, this committee has generated resolutions on wetlands, biodiversity, and National Wildlife Refuge congressional legislation. We are not bound to only provide draft resolutions. There is a variety of actions our association could involve itself. Thus, we would also like your input on how this committee and our Association may facilitate the ecologically wise use or preservation of regional, national, and global resources. Please let us know your greatest conservation related-concerns and how you feel this committee may best serve our Association.

The Association represents a large number of the biologists in the Southeastern United States, which could serve as a resource to various other organizations and agencies. In addition to your input on conservation issues, the committee would like to know of individuals who would be willing to serve as speakers or consultants, or as members of state-oriented conservation subcommittees.

Please send your thoughts, ideas, or comments to: Cliff R. Hupp, Chair, ASB Conservation Committee, U.S. Geological Survey, 3850 Holcomb Bridge Road, Suite 160, Norcross, GA 30092; (404) 409-7709; FAX 404-409-7725.

Wetlands Ecology A rigorous, college-level, introductory field/lecture course offering three(3) hours of undergraduate or graduate credit. This 13-day summer course, now in its eighth year, is offered to students who have a background in biology or related field or who have the instructor's consent. Past participants say this course has enhanced their understanding in regulatory work, private consulting, graduate school studies or careers.

Major course features include identification of wetland vascular plants, wetland soils and hydrology, overview of the nation's wetland ecosystems, wetland field techniques and introductory wetland delineation. Students use a team approach in the solution of wetland field problems. Enrollment is limited to 16.

For further information about the 1993 class scheduled July 25–August 6, write The Division of Public Service, University of North Carolina at Wilmington, 601 South College Road, Wilmington NC 28403-3297, or call (919)395-3193. Brochures will be mailed in February, 1993.

ANNOUNCING
MOUNTAIN LAKE BIOLOGICAL STATION
SUMMER FIELD COURSES 1993

The Mountain Lake Biological Station offers a summer program of study and research in environmental and evolutionary biology. Situated at an elevation of 4,000 feet in the Allegheny Mountains of southwestern Virginia, the station draws faculty and students from across the nation. Students may pursue the master's degree in biology by summer study, a program that is particularly suitable for teachers in secondary education. Opportunities for independent study and research assistantships are available to undergraduates both terms.

FIRST TERM
June 13 - July 17

Course Title	Instructor	Home Institution
Vascular Plant Taxonomy	Spencer Tomb Assoc.Prof. of Biology	Kansas State University
The Biology of Mammals	Jack Cranford Assoc.Prof. of Zoology	VPI&SU
Molecular Techniques for Population Genetics & Evolutionary Biology June 13 - July 2	Daniel Burke Assist.Prof. of Biology AND Michael Timko Assoc.Prof. of Biology	University of Virginia University of Virginia
Workshop in Allozyme Techniques July 4 - 17	Charles Werth Assist.Prof of Biology	Texas Tech University

SECOND TERM
July 18 - August 21

Conservation Biology	Peter Kareiva Prof. of Zoology	University of Washington
Natural History of the Southern Appalachians	Philip Shelton Prof. of Biology	Clinch Valley College
The Biology of Mosses	Ann Stoneburner Assist. Res. Botanist AND Robert Wyatt Prof. of Botany	University of Georgia University of Georgia

SCHOLARSHIPS AVAILABLE: Service awards for students covering room and board costs. Scholarships which provide financial assistance. Post-Doctoral Research Awards (10 weeks).

FURTHER INFORMATION: Director, Mountain Lake Biological Station
 Gilmer Hall, University of Virginia
 Charlottesville, VA 22903-2477

REVIEW

Herendeen, Patrick S., and Dilcher, David L. (eds.). 1992. Advances in Legume Systematics, Part 4. The Fossil Record. The Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, England. £24.00 softcover. 336 pp.

This fourth and latest addition to the Royal Botanic Garden's series *Advances in Legume Systematics* is an important contribution to the literatures of paleobotany and legume biology. The editors' stated goals for this volume are to: "i) facilitate detailed systematic studies of fossil legumes, ii) bring together in one place as much fossil legume material as possible so that it is more widely available to the palaeobotanical and neobotanical communities, iii) provide a forum for discussion of legume palaeobiology, and iv) integrate palaeobotanical data with current ideas of legume systematics and biology that are based upon living plants." This well-organized volume is an admirable attempt at achieving these goals, and upholds the high standards of scholarship set by previous volumes in the series.

The sixteen papers in the book are divided among three major sections. The first section, *Studies of Specific Fossil Taxa*, brings together five papers which revise or describe fossil fruits and flowers from eastern and western Europe (C. Buzek; P. S. Herendeen; P. S. Herendeen and P. R. Crane), the Caribbean (Dilcher et al.), and the southeastern United States (W. L. Crepet and P. S. Herendeen). Those whose interests include organisms preserved in amber are sure to find Dilcher et al.'s report of fossil *Acacia* flowers from the Dominican Republic engaging. The sixth and last paper of the section provides a synopsis of the occurrences of fossil mimosoid legume woods worldwide (J. P. Gros). The second section, *Regional Summaries of Fossil Legumes*, includes seven comprehensive discussions of legume fossils from southeastern North America (P. S. Herendeen), the Caribbean (A. Graham), eastern Europe and Eurasia (L. Hably; A. K. Shakryl), China (S.-X. Guo and Z.-K. Zhou), India (N. Awasthi), and New Zealand (M. Pole). All of the papers in this group deal with macrofossils (wood, leaves, flowers, fruits) except for Alan Graham's review of Caribbean legume remains, which also treats microfossils (pollen). The final section includes three papers that examine large sets of data in order to explore *Evolutionary Patterns and Mechanisms*. Concepts and conclusions of these reports are broadly applicable to discussions of evolution in plant and animal groups outside of the Leguminosae, and thus are more relevant on a general level than papers of the preceding sections. Daniel Axelrod discusses in great detail how repeated climatic fluctuations and changes in edaphic conditions have driven the evolution and speciation of legumes and have influenced geographic distribution patterns observed among the living representatives of the family. The author's conclusions are supported by a great deal of evidence from a wide variety of independent sources, including studies of plate tectonics, global sea level fluctuations, oxygen isotope stratigraphy, the paleobiology of marine and continental floras and faunas, and paleoclimatology. This paper concludes with a discussion of the origin and nature of various types of plant communities (tropical rainforest, deciduous hardwood forest, caatinga, savannah, etc.) in which fossil and extant legumes assume an important role. Elisabeth Wheeler and Pieter Baas present an analysis of fossil leguminous woods that elucidates trends in xylem evolution and the responses of woody legumes to environmental changes through geologic time. In the last paper of the volume, Herendeen et al. chart the rise of Leguminosae from the Upper Cretaceous onwards and demonstrate that by the Middle Eocene (roughly 45 million years ago), all major lineages of the three subfamilies except tribe Cercideae had diversified. They make the important observation that the fossil record does not substantiate current conclusions about the most archaic members of the family based solely on living taxa. This observation points to the need to incorporate well-documented fossil data into systematic and phylogenetic studies of not only this large and diverse family, but of other taxonomic groups for which reliable fossil data is available as well. As the authors point out, fossil taxa frequently exhibit character states or mosaics of characters not encountered in living taxa, and so may contribute to understanding patterns of overall diversity, changes in characters and character distributions through time, and the relative timing of major events in the evolution of lineages.

The book is a perfect-bound paperback with an attractive cover photo and spine. The 11 signatures are individually sewn so the book is sturdy and will endure frequent use. The paper is of superb quality and the many excellent black and white photos and line drawings are exceptionally reproduced. The typeface is very readable, and the individual contributions are clearly written and accessible. The

editors have thoughtfully included a geological time scale that includes epoch and stage names so readers will have no difficulty ascertaining the ages of the fossils discussed or how many millions of years before present they lived. There are, regrettably, numerous typographical errors, but these are mostly confined to the bibliographies and do not affect the flow of the papers presented.

While this volume is mostly geared to researchers concerned with the systematics and paleobiology of the legume family, there is much to recommend this volume to those whose interests embrace topics in other disciplines, including palynology, ecological wood anatomy, paleoclimatology, speciation, extinctions, and biogeography. The southeastern biologist will find three interesting papers which treat aspects of the diverse assemblage of legume fossils described from Lower Eocene to Oligocene sediments of the Mississippi Embayment. Like any good book, the present volume raises many questions and suggests areas in which continued or new research is needed. At £24.00 this book is not overly expensive, and would be a good addition to the bookshelves of researchers in a variety of fields. It certainly deserves a place in the university or natural history museum library.

VICTOR B. CALL, *Department of Natural Sciences, Florida Museum of Natural History, Gainesville, FL 32611-2035.*

Notice

41st Annual Meeting—North American Benthological Society Calgary, Alberta, Canada, May 25–28, 1993

The 41st Annual Meeting of the North American Benthological Society (NABS) will be held in Calgary, Alberta, Canada. The theme of the conference and plenary session will be “*Biomonitoring of Ecosystem Health: An Ecological Research Agenda*”. The scientific program will consist of special invited and contributed sessions, posters and workshops addressing not only this theme, but will also cover other general topics related to the study of benthic organisms and environments. Abstracts are due 4 January 1993. For information contact: NABS Scientific Program, c/o Janice L. Akre, Science Liaison Division, National Hydrology Research Institute, 11 Innovation Boulevard, Saskatoon, SK, Canada S7N 3H5.

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Math and Science
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

ALABAMA

The University of Alabama in Huntsville, Department of Biological Sciences. Dr. Debra Moriarity was recently awarded a NIH grant for natural products research. Dr. Adriel D. Johnson was a NASA Summer Fellow, working on cytoskeletal system components at Marshall Space Flight Center. Dr. Richard F. Modlin returned from sabbatical at Lund University in Sweden, where he was a Fulbright Fellow. Dr. Ronald B. Young and Dr. William R. Garstka each won UAH Foundation awards for excellence in research and teaching, respectively. These awards were based upon nominations and review of supporting credentials of faculty members from all academic departments and research centers on campus. Only four individuals were recognized for their superior achievement in each of the two categories which carried a \$2,500 prize. Dr. Suzanne Ross (Ph.D., University of Alabama in Birmingham) joined the faculty this past fall. Her area of expertise is microbiology and immunology with research interests in mycoplasmas.

University of North Alabama, Department of Biology. Dr. Amy E. Crews-Oyen (Ph.D., Veterinary Science, University of Wisconsin–Madison) has been appointed Assistant Professor of Biology. Her research interests include the effect of *Schistosoma mansoni* infection on reproductive function in its intermediate host, *Biomphalaria glabrata*. Dr. Crews-Oyen recently held a postdoctoral position at Emory University. Dr. William Montgomery, parasitologist, has retired from the department after 30 years of service. Dr. Paul Kittle was appointed Head of the Department. Mr. Raymond Hix has received a position in the Oak Ridge National Laboratory's Science and Engineering Research Semester Undergraduate Program. He will pursue interests in wetland biology with the ORNL Environmental Science Division. Dr. Terry Richardson and UNA have entered into contract with the University of Alabama to participate in their NSF/EPSCoR project entitled, "Land/Water Interfaces: The Effects of Organic Matter on Biogeochemical Cycles and Production." The project at UNA will focus on the production, biomass, and distribution of benthic invertebrates and will employ two undergraduate students.

FLORIDA

Florida Southern College, Department of Citrus and Horticulture. John Griffis has completed his Ph.D. at the University of Florida. He spent part of the summer consulting with a tissue culture laboratory in Ireland.

University of Florida, Department of Botany. Beate Rueter and Anthony Miller are the first recipients of Winona Jordan Undergraduate Scholarships. This endowment for undergraduate scholarships in Botany and for graduate student fellowships for research in orchid biology is being established through the Vaughn-Jordan Foundation of West Palm Beach, Florida. Jeffrey Gerwing received the J. C. Dickinson IV Award in Tropical Agriculture for his research on agro-ecosystems in Costa Rica. A major new research program in the department is the study of the large scale die-back of *Sabal palmetto* along the gulf coast of Florida. Jack Putz, Kimberlyn Williams and a number of students are making great strides in their attempts to understand what is going on. Linda Perry has received a grant for her contribution to the program. Melanie Moon won first place in the student poster competition at the International Symposium on the Biology of Aquatic Plants at Daytona in July 1992.

GEORGIA

West Georgia College, Department of Biology. Dr. William P. Maples retired after 34 years of service. Dr. Marijo Kent is a new Assistant Professor, having received her Ph.D. from University of Minnesota.

St. Paul in Veterinary Physiology/Genetics. She did postdoctoral work at the Center for Reproductive Biology at Collierville, Tennessee. Her teaching expertise is in the areas of Molecular Biology, Reproductive Physiology, Embryology and Anatomy. *Dr. Leos Kral* (Ph.D., Michigan State University, Genetics) is also a new Assistant Professor. His postdoctoral work was done at Wayne State University School of Medicine in Biochemistry. His teaching expertise is Genetics and Molecular Biology. *Dr. James Mathis* joined the department as an Assistant Professor, and will be teaching Microbiology, Genetics, Biochemistry and Plant Physiology. He received his Ph.D. in Microbiology from North Carolina State University, and was a postdoctoral/research plant physiologist/biochemist.

Armstrong State College, Department of Biology. *Dr. Brett Larson* (Ph.D., University of Oregon—Cell Biology) and *Dr. Roger Tilley* (Ph.D., Baylor University College of Medicine—Microbiology) are new members of the department. Other new appointments include *Dr. Gail Wynn* (Ph.D., Louisiana State University—Entomology), *Dr. Ritin Khan* (Ph.D., George Washington University—Aquatic Ecology), and *Ms. Suzanne Kempke* (M.S., University of Illinois—Zoology). *Dr. Al Pingel* has retired after many years of service to the College.

KENTUCKY

Eastern Kentucky University, Department of Biological Sciences. *Dr. Ross Clark* has been named professor and Chair of the department. Ross has most recently been associated with the Morton Arboretum, near Chicago. His principal interests lie in the areas of plant systematics and ecology. *Dr. Pat Callie* (Ph.D., University of Michigan) has joined the department as an Assistant Professor. *Dr. Callie* held a postdoctoral appointment at the University of Michigan. He will teach courses in Genetics and Molecular Biology. *Mr. Tim Kimmel* is completing his Ph.D. degree at Penn State and has been named Visiting Assistant Professor for the 1992–93 year. He will be replacing *Drs. John P. Harley* and *Charles Elliott*, who are on sabbatical leaves.

LOUISIANA

Northeast Louisiana University, Monroe, Department of Biology. Four new faculty have joined the department. *Dr. Benny L. Blaylock* (Ph.D., University of Arkansas for Medical Sciences) held positions as a postdoctoral Fellow and as a staff Fellow at the National Institute of Environmental Health Sciences, where his primary research interests were the immunotoxicology of environmental chemicals, toxins and pharmacologically active agents on the skin immune system. *Dr. Thomas W. Sasek* (Ph.D., Duke University) is primarily interested in plant physiological ecology. He has studied kudzu in its native Asian habitats with an 18-month Fulbright fellowship at Kobe University in Japan. *Dr. Robert M. Sullivan* (Ph.D., University of New Mexico) comes from the New Mexico Museum of Natural History where he served as Curator of Zoology and Biochemical Systematics. His research interests include population genetics and biogeography of relict populations of coniferous forest and mesic woodland animals, particularly in the Southwest and Great Basin. *Charles M. Allen* (Ph.D., University of Southwestern Louisiana) is an Associate Professor of Biology, and has recently published the second edition of the book, *Grasses of Louisiana*, 1992. He also has two grants from the U.S. Forest Service and a Cooperative Agreement with Southern Forest Experiment Station for research in the Cunningham Brake Natural Research Area in Natchitoches Parish. His research interests are in plant ecology and taxonomy with emphasis on grasses.

University of Southwestern Louisiana, Department of Biology. *Dr. Lewis Deaton* traveled to England in August to participate in a symposium: Cell Volume Regulation: Mechanism and Control. *Dr. Joe Staton* has accepted a postdoctoral fellowship with the Smithsonian Marine Station at Link Port in Ft. Pierce, Florida to work on the genetics of Spinunuculans. *Arlene Billock* has joined the support staff as coordinator of research for *Dr. Robert Twilley's* lab. She received her M.S. degree in terrestrial plant Ecology. *Dr. Matt Dakin*, Professor of Entomology has retired and will be residing in Auburn, Alabama. *Dr. Paul Klerks* has joined the staff as a Quantitative Toxicologist. He received his Ph.D. from Stony Brook, SUNY.

Tulane University, Department of Ecology, Evolution, and Organismal Biology. *Dr. Thomas Sherry* is currently on research leave, temporarily being replaced by *Dr. Kenneth Rosenberg*. The department has 12 new incoming graduate students.

MISSISSIPPI

University of Mississippi, Department of Biology. Dr. Stephen Threlkeld, a limnologist, has joined the department of Professor of Biology. His previous appointment was at Fordham University. Dr. Clifford Ochs is also a new department member in limnology. His Ph.D. is from Cornell and his work was in bacterioplankton. He is an Assistant Professor of Biology. Finally, Dr. Stephen D'Surney joined the department as an Assistant Professor. He is a fish geneticist and molecular biologist, and was recently at Oak Ridge.

Mississippi University for Women, Division of Science and Math. Dr. Lani Lyman-Henley joined the division as an Assistant Professor. Her Ph.D. is from the University of Tennessee in Animal Behavior. She will teach General Biology, Ecology, and Human Anatomy. Dr. Harry Sherman retired as Division Head, and is replaced by Dr. Bill Parker. Dr. Parker has taught in the Division since 1974, and presently serves as Managing Editor for the *Journal of Herpetology*, in addition to his divisional head duties.

Gulf Coast Research Laboratory, Ocean Springs. The Laboratory has been awarded \$180,000 from the U.S.P.A. for the final year of study which uses *medaka*, a small fish species, to measure the impact of the carcinogen (DEN) at low exposure levels. GCRL's Project Marine Discovery program is going "on the road," thanks to a grant from the Mississippi-Alabama Sea Grant Consortium. This is an outreach program designed for kindergarten through high school. Dr. Sharon H. Walker, administrator of GCRL's J. L. Scott Marine Education Center and Aquarium in Biloxi, is the new President of the National Marine Educators Association.

NORTH CAROLINA

Highlands Biological Station, Highlands. Courses for the summer of 1993 include: Amphibian Cytogenetics (7-18 June), Conservation Biology—Theory and Practice (21 June-2 July), Freshwater Fishes (5-16 July), Taxonomy and Natural History of Southern Appalachian Mayflies, Stoneflies, and Caddisflies (19-30 July). For further information contact Highlands Biological Station, P.O. Box 580, Highlands, NC 28741. Telephone 704-526-2602.

Meredith College, Department of Biology and Health Sciences. Janice Coffey Swab has returned from a two-year Fulbright teaching grant in Africa and has accepted a teaching position as Visiting Professor of Biology.

North Carolina State University, Department of Zoology. The new Head of the department is Dr. Harold Heatwole, a native of Virginia, who comes to us after 25 years in Australia. He specializes in marine snakes, but is very versatile with an additional doctorate in Botany. Dr. John Vandenberg has relinquished the Headship to concentrate on teaching and research. Dr. Ron Hodson was installed as President of the U.S. Chapter of the World Aquaculture Society. Dr. Jeffrey Hinshaw has been promoted to Associate Professor. Dr. Jeffrey Walters has been promoted to Professor and Dr. Gordon Thayer to Adjunct Professor. NCSU has received a Hughes Grant of \$1,000,000 for five years of curriculum development and undergraduate internships. Dr. Tom Losordo has been elected as secretary to the World Aquaculture Society. The department continues to serve over 1,100 undergraduates and approximately 85 graduate students.

Campbell University, Department of Biology. Three new faculty joined the department in August 1992. Dr. Debora Weaver (Ph.D., University of Maryland) came from a teaching appointment at the University of Dar es Salaam in Tanzania. Dr. Weaver teaches courses in Basic Biology, Microbiology, Anatomy & Physiology and Cell Biology. Her research involves cytoskeletal proteins of nerve cells. Dr. Mark Hammond (Ph.D., University of South Carolina) came from a postdoctoral position at the Los Alamos National Laboratory where he was working on the development of a new high-speed DNA sequencing technique. He teaches Microbiology, Genetics, and Molecular Biology. He will also be administering a NSF grant to upgrade the department's molecular biology program. His research is in translational control and DNA replication. Dr. Raymond Grizzle (Ph.D., Rutgers University) came from a teaching position at Livingston University in Alabama. He will be coordinating the basic biology program and developing new courses in environmental science. Dr. Grizzle has research programs on the effects of pollutants on faunal benthos of coastal waters, and the ecology of suspension-feeding bivalve mollusks.

East Carolina University, Department of Biology. Dr. Carlton Heckrotte, a herpetologist, has retired. His research interest was bio-rhythms in snakes. Dr. Edmund J. Stellweg ran two Biotechnology Workshops this past summer. Dr. William G. Ambrose, Jr. and his research associate Mr. Paul Renaud

have returned from NE Greenland, where they were involved in marine research. Four new faculty have joined the department: *Dr. Willem M. Roosenburg*, lecturer with expertise in Population Biology and Evolutionary Ecology of Vertebrates; *Dr. Bruce W. Grant* with interests in Physiological Ecology; *Mrs. Lynda S. Singhas* to teach Anatomy and Physiology, and *Dr. Jonathan I. Morris*, a molecular biologist, was hired as a Research Assistant Professor. *Clifford Knight*, Professor of Biology, has contracted with Wadsworth Publishing Co., to write an entomology textbook with *Dr. John Meyer* (co-author) from North Carolina State University.

SOUTH CAROLINA

Wofford College, Department of Biology. *Dr. Robert Moss* (Ph.D., Harvard University) has joined the department from Yeshiva University. Dr. Moss replaces *Professor William B. Hubbard*, who retired this year. *Dr. George Shiflet* is the new department Chairman, replacing *Dr. Ray Leonard*, who will retire in 1993.

Winthrop University, Department of Biology. *Dr. Janice Chism* is a new member of the department. Her Ph.D. is from the University of California, Berkeley. Her research deals with the reproductive behavior and ecology of the Patas Monkey and other primates. She will teach Investigative Biology, Human Anatomy and Physiology, and Physical Anthropology.

Anderson College, Division of Natural Sciences and Mathematics. *Dr. Thomas Kozel* has been appointed Head of the Division. The college moved from two- to four-year status and will be developing B.S. degrees in the areas of Science and Mathematics. Dr. Kozel came from Savannah State College, where he had taught and done research for ten years.

TENNESSEE

The University of Tennessee, Knoxville, Department of Botany. *Dr. A. J. Sharp*, Professor Emeritus of Botany, was inducted as a Fellow of the Linnean Society on 28 May 1992 in London, England.

Memphis State University, Department of Biology. *Dr. Jim Payne*, Professor and Chairman, participated in a two-week workshop on constructed wetlands for wastewater treatment held at Colorado State University. During the NSF sponsored workshop, each attendee developed an individual research project. Dr. Payne was one of three recipients selected for last year's Arts and Sciences Meritorious Faculty Award. *Dr. Robert J. Cooper* joined the faculty as an Assistant Professor. His Ph.D. was earned in Wildlife Biology from West Virginia University. He comes to Memphis State from Humboldt State University. He has initiated research projects to investigate neotropical migratory bird habitat use and population ecology in bottomland hardwood forests of the Mississippi Alluvial Plain. The Meeman Biological Station and adjacent Meeman Shelby Forrest State Park serve as a primary study area for this research. *Dr. Charles Biggers* was honored as "Professor of the Year," by Mortar Board, for his dedication to students as well as his commitment to the Biology department and the University.

WASHINGTON, D.C.

Howard University, Department of Botany. The departments of Botany and Zoology have been merged into a Department of Biology. The new Chairperson is *Dr. C. Eric Thomas*, formerly Associate Professor, College of Dentistry, Ohio State University. *Dr. Geraldine Twitty* was recently elected to the Board of Directors of the AIBS. *Lafayette Frederick* was a recipient of the AAAS Mentor Award at the annual meeting of the AAAS in Chicago. The Mentor Award includes a plaque and \$5,000. Dr. Frederick shared this award with *Professor Anthony Andreoli*, a biochemist from California State College, Los Angeles. *Dr. Mary McKenna* conducted the third Rocky Mountain Biology Field Course for departmental students. The field course, sponsored by the U.S. Forest Service, was held in Wyoming in the Snowy Mt. Range area.

WEST VIRGINIA

West Virginia University, Biology Department. *Drs. Keith Garbutt* and *James B. McGraw* received a grant for "Tolerance of wetland species to AMD and long-term viability of wetland plant communities as AMD treatment systems." Philip Keeting has a grant to study "Steroid hormone effects on human osteoblastic cell interleukin 1 production." Other grants to Dr. Keeting include \$349,779 for "Early response patterns in differentiating osteoblasts." The USDA Forest Service has awarded a grant to

James B. McGraw to study "Interaction of natural levels of environment stress and defoliation on oak survival, photosynthesis and growth."

MUSEUMS AND BOTANICAL GARDENS

ALABAMA

Alabama Museum of Natural History, Tuscaloosa. On 28–31 July 1992, Alabama set an example for the Southeast and the nation with its first annual "EnviroMeet Southeast," at the Paul Bryant Conference Center in Tuscaloosa. The four-day symposium was made up of topflight educators, scientists, consultants, engineers, and business people. On 5–10 October 1992 the Moundville "Native American" Festival 1992 was held at Moundville, Alabama. Moundville belonged to a civilization which declined about 50 years before the arrival of Christopher Columbus.

GEORGIA

The Columbus Museum. More than 40 original fragments of building ornament designed by architect *Louis H. Sullivan* was displayed at the Museum during the Fall of 1992. The exhibition by entitled: *Louis H. Sullivan: Unison with Nature*. From 28 February to 25 April 1993, an exhibition, *Lasting Impressions, Drawings by Thomas Hart Benton* will be on display. With pack on his back and sketchbook in hand, Benton traveled throughout his career, into the mountains and down the rivers: through the South, West, and Midwest. His travels took him into the hamlets of Appalachia and the boom-towns of East Texas. He drew farmers, city dwellers, homesteads, and steel mills.

MISSISSIPPI

The Crosby Arboretum, Picayune. In September, the Arboretum sponsored an "Identification and Delineation of Jurisdictional Wetland's Workshop," held at the John C. Stennis Space Center. Director, *Ed Blake* was awarded one of the Governor's Awards for the Arts. The Board of Trustees of the American Society of Landscape Architects, representing all 50 states, visited the Arboretum for talks and tours by *Ed Blake, Bob Brzuszek, Chris Wells* and *Robert Poore*. They adopted a wetlands policy statement for the Society. The policy will guide the ASLA members for the next five years. Officers for 1992–93 are: *Howell Crosby*, Secretary, *Christian Brown*, Treasurer, *Jo Love Little*, Vice-President, and *Anne S. Bradburn*, President.

NORTH CAROLINA

The University of North Carolina at Charlotte Botanical Gardens is pleased to announce that its founder, Biology Professor Emeritus *Dr. Herbert Hechenbleikner* received a 1992 Governor's Award for Excellence for his role in establishing the academic gardens facilities. The Gardens consist of three units: The Van Landingham Glen, a planting of thousands of hybrid rhododendrons and some 1,000 species of native plants of the Carolinas (including more than a dozen endangered or threatened species), founded in 1966; The Susie Harwood Garden, a collection of ornamentals from around the world; and the McMillan Greenhouse, established in 1972, containing orchids, unusual tropical plants and a rain forest simulation. We believe the Gardens contain one of the most diverse assortments of plants of any educational institution in the South, and they are used regularly in botany and ecology courses and workshops. The living collections complement the resources of the computerized UNCC Herbarium. For information, brochures, trail guides or specific plant lists, contact the director, *Dr. Lawrence Mellichamp*, Biology Dept., UNC Charlotte, Charlotte, NC 28223.

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CONTENTS

THE ASB BULLETIN

VOLUME 40, NUMBER 1, JANUARY 1993

News of 54th Annual Meeting—Virginia Beach, Va.	1
Announcements	16
Review	19
News of Biology in the Southeast	21

Cover photo: Fossil Protomimosoidea furnished by Dr. Victor Call, Florida Museum Natural History, Univ. Florida, Gainesville, Fl.

See Pages 9–12 for important dates concerning various awards.

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Host of the 54th Annual Meeting, Virginia Beach, VA

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1993 April 14-17 Old Dominion University, Virginia Beach, VA

1994 April 13-16 University of Central Florida, Orlando, FL

1995 April 19-21 University of Tennessee, Knoxville, TN

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PEBBLE NEST CONSTRUCTION AND SPAWNING
BEHAVIORS IN *SEMOTILUS THOREAUIANUS*
(PISCES: CYPRINIDAE)

Eugene G. Maurakis, Mark H. Sabaj, and William S. Woolcott

Biology Department, University of Richmond
Richmond, VA 23173

ABSTRACT

A male *Semotilus thoreauianus* constructed a pit-ridge pebble nest where he spawned with individual females at the pit-ridge interface. Nest-building was continuous with the excavation of pebbles from the rear of the pit and their subsequent deposition on its upstream rim. A successful spawn occurred as the female appressed her vent and caudal peduncle to the pit-ridge interface and pitched her head upward into the water column. As the female retroflexed, the male constricted his body laterally around hers, forming the spawning clasp, a maneuver that serves to anchor the female and force gametes from each partner. These behaviors were consistent with those of other *Semotilus* species. Reduced water currents in the spawning pit facilitated the vertical descent of gametes.

INTRODUCTION

Johnston and Ramsey (1990), in a redescription of *Semotilus thoreauianus*, Dixie chub, did not present an account of its reproductive behaviors, but suggested that the species constructed nests similar to those of *Semotilus atromaculatus*, creek chub. With information from direct field observations and reviews of videotapes made of *S. thoreauianus* in a piedmont stream in Alabama, nest construction and spawning in *S. thoreauianus* are described and compared to the breeding behavior of *S. atromaculatus*.

MATERIALS AND METHODS

A nest of *S. thoreauianus* was studied in an unnamed tributary of Sougahatchee Creek (Tallapoosa River system, Mobile Bay drainage), U.S. Rt. 280, Lee County, Alabama, 11.2 air km NW of Auburn, 10 April 1992. Water temperature was 18.3 C.

Descriptions of nest construction and reproductive behaviors are based on field observations, and videotapes recorded above the surface of the water with a CCD video camera equipped with a polarizing filter to minimize reflected light. A zoom macrolens allowed the field of vision to be manually adjusted and focused for close-up and wide-angle views. Two hours of videotapes, replayed frame-by-frame (30 frames/sec) to identify behaviors of *S. thoreauianus*, were compared with taped behaviors over nests of *S. atromaculatus* filmed in E. Branch Genito Creek (James River drainage), Goochland County, Virginia, Co. Rt. 641, about 6 km N of St. Rt. 6, 17 April 1989 and 17 April 1992. The nest-building male *S. thoreauianus* and other specimens of the species, collected with a backpack DC electroshocker and preserved in 10% formalin, were deposited in the fish collection at University of Richmond.

The following methods are the same as those used in Maurakis et al. (1990) for descriptions of nests of other *Semotilus* spp. Nest parameters (ridge height, length, and width; and pit depth, length, and width) and stream depth and width

were measured with a meter stick. The velocity of water current was measured 1 cm above the nest and substrate with a Marsh-McBirney current meter at six sites: 0.5 m upstream of the upstream margin of the nest's ridge, 0.5 m downstream of the downstream margin of the nest's pit, in the spawning pit, and three locations on the 0.83 m long ridge (downstream and upstream margins, and midpoint).

One-liter samples of nest and substrate material were collected in a 1-liter plastic beaker. Pebble samples from the nest were collected from the upstream, middle, and downstream portions of the ridge of the nest. Substrate samples, restricted to areas adjacent to those collected from the ridge, were taken at a depth equal to or less than the maximum depth (6 cm) of the pit. Nest and substrate materials, stored in tagged plastic bags and returned to the laboratory, were air-dried and sifted through five custom-built wire sieves. Mesh sizes were determined by commercially available prefabricated screen sizes of 23.0, 11.3, 6.0, 2.5, and 0.8 mm. Material (<0.8 mm) that sifted through the smallest size mesh was collected in a pan. The weight of materials in each sieve size and pan was used to calculate the percentage of material per mesh and pan size. Percentages of size classes (based on weights) were used in electivity indices (Ivlev 1961) to calculate the relative proportion of each pebble size class in the ridge to the corresponding size class in the substrate.

RESULTS AND DISCUSSION

Meristic, morphometric, and color characters of our specimens conformed to those described for *S. thoreauianus* by Johnston and Ramsey (1990) except as follows. Males had an orange band (rather than a clear one) at the base of the dorsal fin and all fins (except dorsal) of males had orange rather than yellow membranes.

Nest Characteristics—The nest of *S. thoreauianus*, like those we observed of *S. atromaculatus*, was composed primarily of 23.0, 11.3, and 6.0 mm pebbles. The relative ranks of proportions of nest to substrate material were comparable in the two species (Maurakis et al. 1990) (Table 1). Ridge and pit dimensions of the nest of *S. thoreauianus* were similar to those in nests of *S. atromaculatus*, except for pit width which was greater (Table 1). Water velocities over the nest of *S. thoreauianus* ranged from a low of 0.04 m/sec in the spawning pit to 0.32 m/sec at 0.5 m downstream of the pit.

Nest-building Behavior—A tuberculate male *S. thoreauianus* constructed a pit-ridge pebble nest at the upstream part of a riffle that was indistinguishable from a *S. atromaculatus* nest. With his jaws he excavated pebbles from the downstream end of the pit, deposited them over eggs in the upstream end of the pit, then returned to the rear of the pit. Nest-building produced a ridge of deposited material that increased in length, continually displacing the pit downstream as reported for *S. atromaculatus* by Woolcott and Maurakis (1988).

Spawning Behavior—The spawning clasp and its location (*i.e.* on the upstream slope of the pit where it meets the ridge) for *S. thoreauianus* are like those described for *S. atromaculatus* (Reighard 1910; Maurakis and Woolcott 1989; Maurakis et al. 1990), *Semotilus corporalis* (Maurakis and Woolcott 1992), and *Semotilus lumbee* and *Semotilus* sp. (Woolcott and Maurakis 1988). The male's clasp serves to anchor the female to the substrate and simultaneously, through its pressure,

Table 1. Stream and nest characteristics of *Semotilus thoreauianus* and *Semotilus atromaculatus*.

Characteristic	<i>thoreauianus</i>	<i>atromaculatus</i> *
		\bar{x} (range)
No. of nests	1	14
Stream depth (cm)	5	15.5 (8.9–30.5)
Stream width (m)	1	2.7 (1.0–9.0)
Nest dimensions (cm)		
Ridge width	25.7	21.6 (7.6–45.7)
height	2.7	4.2 (1.0–11.4)
length	83.0	68.6 (9.0–210.0)
Pit width	33.0	16.2 (7.0–30.5)
depth	6.0	6.7 (3.5–17.8)
length	50.0	21.3 (7.6–45.7)
Water current (m/sec)		
Upstream of ridge	0.17	0.05 (0.03–0.18)
Ridge	0.15	0.08 (0.07–0.25)
Pit	0.04	0.02 (0.00–0.06)
Downstream of pit	0.32	0.13 (0.04–0.26)
Pebble size class (mm)		
		Electivity Index
23.0	0.86	0.50
11.3	0.82	0.20
6.0	0.40	0.10
2.5	0.02	0.0
0.8	–0.38	–0.30
<0.8	–0.66	–0.90

* Data from Maurakis et al. (1990).

force gametes from each of the partners. Concurrent with the spawning clasp, the discharge of the demersal eggs and a stream of milt that sinks when released, have been observed on videotape during a frame-by-frame analysis of spawning in *S. atromaculatus*. The low water velocities in the spawning pits of nests of all *Semotilus* species facilitate the vertical descent of the demersal eggs and milt (Maurakis et al. 1990). Simulation studies, using dyes and beads (similar in size and weight to eggs of *S. atromaculatus*), verified that materials, when released where the clasp occurs, immediately sink into the spawning pit. Beads and dyes, in contrast, released into the water at sites adjacent to the pit drifted downstream. The upward thrust (=retroflexure) of a female *S. atromaculatus* at the beginning of the spawning clasp was not a tactile response to the presence of the male, but rather self-initiated, conforming to the topography of pit-ridge interface. This was verified on videotape for *S. thoreauianus* as well where two unaccompanied females retroflexed at the pit-ridge interface on either side of a female that was retroflexing aside a male just prior to the clasp. The increased power of observation provided by video cameras coupled with frame-by-frame analysis of videotapes furnished a mechanism to differentiate between the retroflexure (initiated by the female) and the male's spawning clasp and its functions (anchoring and pressure). Previously, these two spatially and temporally different maneuvers were ascribed by some investigators (e.g. Reighard 1910; Woolcott and Maurakis 1988) to the single action of the male's spawning clasp.

Spawning and nest construction activities of *S. thoreauianus* were interrupted

only when the male reacted to females and small tuberculate males by chasing them from the nest site. Parallel swims, common between males of other *Semotilus* species, were not observed in *S. thoreauianus*. This does not preclude their occurrence, however, as tuberculate males of comparable size to the nest-building male did not appear near the nest. There were no nest associates (cyprinid species that spawn over a nest but do not contribute to its construction).

ACKNOWLEDGMENTS

We thanks Drs. H. Boschung and R. Mayden, University of Alabama, Tuscaloosa, for providing localities where *S. thoreauianus*, and not *S. atromaculatus*, occur, and for the loan of Alabama county maps. We appreciate constructive comments by Dr. L. Page, Illinois Natural History Survey, that improved the final manuscript. Funding in part was provided by University of Richmond Faculty Research grants and the Richard Gwathmey and Carolyn T. Gwathmey Memorial Trust.

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Program of the
54th ANNUAL MEETING of the
ASSOCIATION OF SOUTHEASTERN
BIOLOGISTS

Hosted by
OLD DOMINION UNIVERSITY

at

The Cavalier Hotel

Virginia Beach, Virginia

SOCIETIES MEETING WITH ASB IN VIRGINIA BEACH

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Southeastern Division

Beta Beta Beta

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Southeastern Fishes Council

Southeastern Society of Parasitologists

Southern Appalachian Botanical Society

MEETING HEADQUARTERS
THE CAVALIER HOTEL

GENERAL INFORMATION

Registration - Registration for the 54th annual meeting of the Association of Southeastern Biologists, and purchase of tickets for the banquet, Thursday social, breakfasts, luncheons, and field trips have been arranged through the office of Non-Credit Operations, Old Dominion University. For information on these and other activities, please call the local arrangements chair, Frank Day, at (804) 683-3595. Pre-registrants may pick up their registration packet with tickets and other information at the ASB Registration Desk in the Lobby area of the Cavalier Hotel. The desk will be open from 12:00 to 10:00 p.m. on Wednesday, 14 April, from 8:00 a.m. to 5:00 p.m. on Thursday, 15 April, and from 8:00 a.m. to 12:00 noon on Friday, 16 April. Late registration will be possible at these times; however, tickets for special events will be limited and may not be available. See the January 1993 issue of the ASB Bulletin for pre-registration information. Please bring this copy of the ASB Bulletin to the meeting, as no free copies will be available. Extra copies may be purchased at the ASB Information desk for \$3.50.

Ground Transportation - When approaching from the west, the easiest routes are Interstate 64, U.S. 460 or U.S. 58. From the north and south, convenient routes are Interstates 85 and 95 (connecting with U.S. 58), U.S. 13 and U.S. 17. These routes intersect with I-64 which circles Hampton Roads and connects with the Virginia Beach - Norfolk Expressway, Route 44. The Expressway (a toll road) ends at the Visitor Information Center and leads visitors directly to the oceanfront resort area. The Cavalier is at the northern end of the commercial strip on the oceanfront (turn left on Atlantic or Pacific Avenues). See the map of major routes into Virginia Beach in this issue of the Bulletin.

Airport Transportation - Norfolk International Airport is a 20-minute drive from the oceanfront. Car rentals are available at the airport through several national car rental agencies. The regular individual fare via Norfolk Airport Shuttle to the Cavalier is \$15.50 (one-way). If groups of 5 or more arriving around the same time have been identified by Shoreline Travel, a fare of \$6.50 each will be arranged.

Parking - The Cavalier Hotel has ample free parking across the street from the new Cavalier. There is a nominal charge for parking in the front lot near the lobby.

Job Placement Message Board - A job placement message board will be made available near the ASB information desk in the Beach Club Foyer.

Dining Facilities - Meals are available in the Cavalier Hotel. Virginia Beach has many fine restaurants, ranging from fast food to formal. There are many eating spots along the commercial strip on Atlantic Avenue. Your registration packet will have a list of many of the restaurants in Virginia Beach.

Social Activities and Special Events - Check your registration packet for tickets to the events for which you have pre-registered. Consult the program schedule for time and place of the various events, meetings, and meals. A limited number of tickets for these may be available at the registration desk for those who did not pre-register.

Thursday Evening buffet at the Virginia Marine Science Museum - The Thursday night social will include a buffet supper at the Virginia Marine Science Museum. ASB will have the entire museum to itself. All exhibits will be open and interpretive staff from the museum will be present. Dinner will be a seafood buffet, and entertainment will be provided by Sea Aira. We must give the caterers an accurate count of persons expected in advance so there will be enough food. We strongly recommend purchasing tickets in advance. Transportation will be provided by city trolleys. Trolleys will depart the Cavalier at 6:00 and 6:30 p.m., and return from the Museum at 9:00 and 9:30 p.m. Those wishing to drive themselves, may do so. It is a short, easy drive, and there is ample free parking at the Museum. Directions may be obtained at the ASB registration desk.

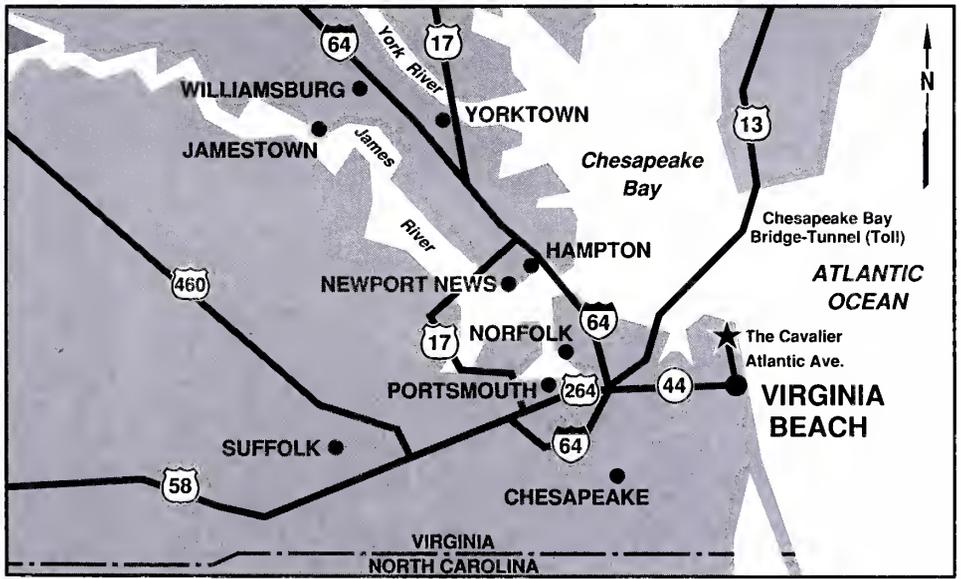
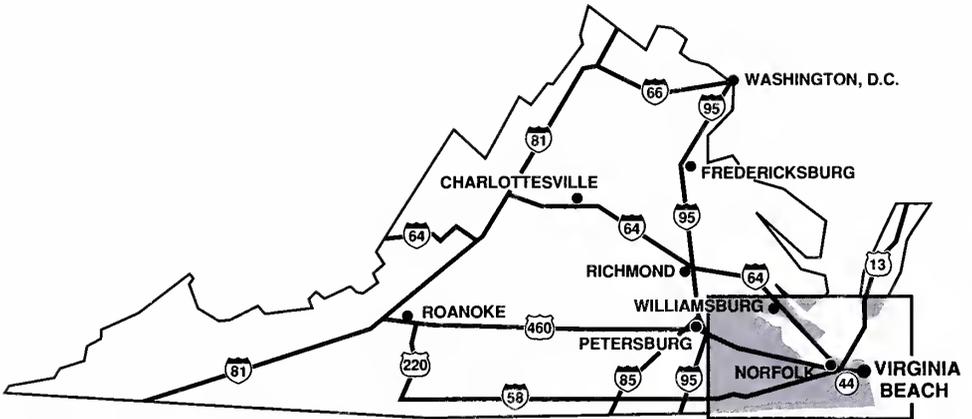
The Museum social is sponsored by the College of Sciences, Old Dominion University (Dr. Paul Homsher, Dean), The Office of Academic Affairs, Old Dominion University (Dr. John Eck, Associate Vice President of Research and Graduate Studies), and ASB.

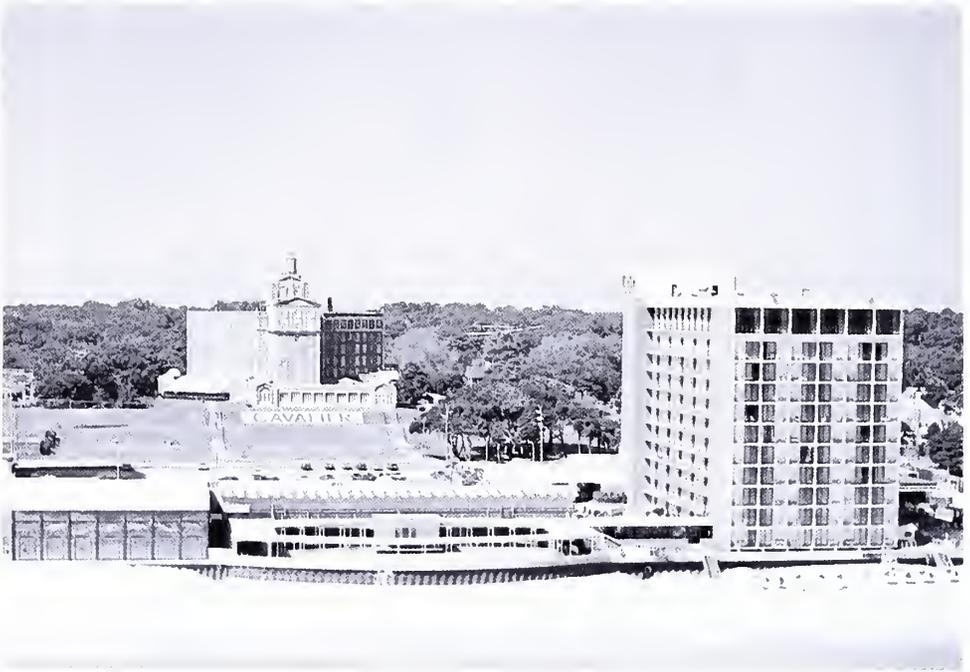
Friday Evening Banquet - The banquet will be held in the Cavalier Hotel (Beach Club A).

Field Trips - All field trips will depart from the Cavalier and you must pre-register. See details on each trip in the January 1993 issue of the ASB Bulletin.

Useful Telephone Numbers - (Area Code 804)

Frank Day (Local Arrangements and Registration)	683-3595
Harold Marshall (Program)	683-3595
Cavalier Hotel (Reservations) (outside Virginia)	800-446-8199
(in Virginia)	800-582-8324
Shoreline Travel (Air Transportation)	800-969-5200





The Cavalier Hotel



Old Dominion Building,
Old Dominion University



Virginia Marine Science Center



SPEAKER FOR THE 1993 PLENARY SESSION

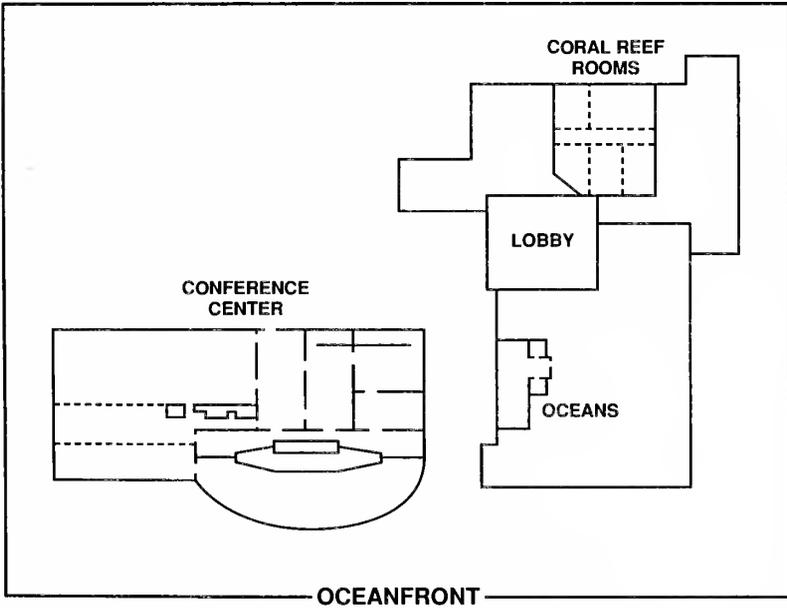
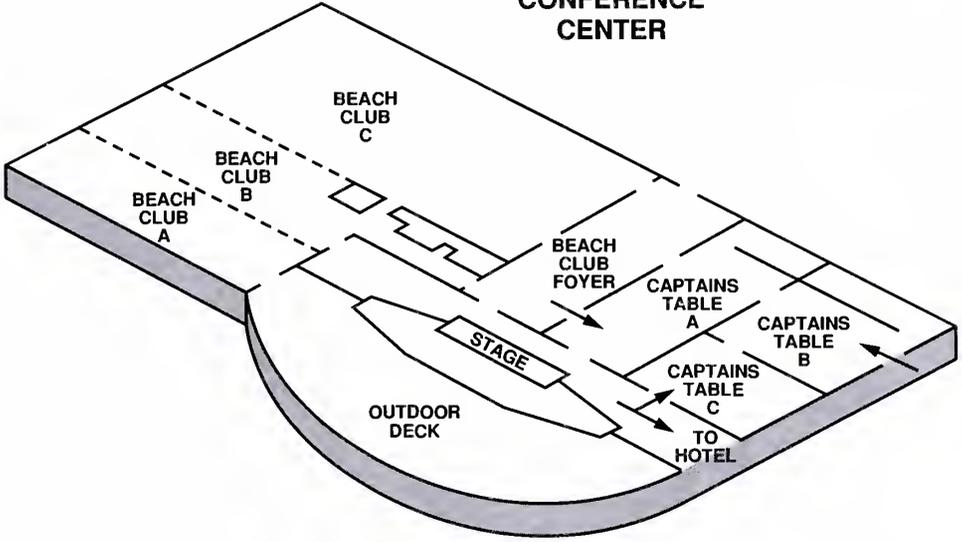
DR. JOHN CAIRNS, JR.

Dr. John Cairns, Jr., is University Distinguished Professor of Environmental Biology and Director of the University Center for Environmental and Hazardous Materials Studies at Virginia Polytechnic Institute and State University, Blacksburg. He received his Ph.D. and M.S. from the University of Pennsylvania and an A.B. from Swarthmore College and completed a postdoctoral course in isotope methodology at Hahnemann Medical College, Philadelphia. He was Curator of Limnology at the Academy of Natural Sciences of Philadelphia for 18 years and has taught at various universities and field stations. Dr. Cairns is widely recognized as an outstanding teacher and is one of the world's leading authorities on the assessment and restoration of aquatic ecosystems.

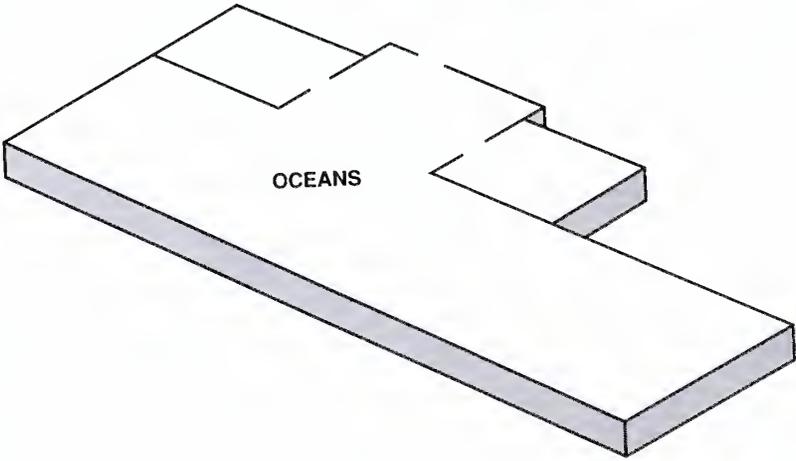
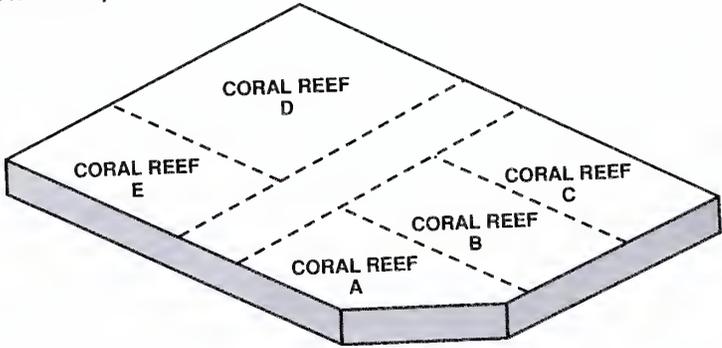
Among his awards are Fellow, American Association for the Advancement of Science in 1969; the Presidential Commendation in 1971; the Charles B. Dudley Award in 1978 for excellence in publications from the American Society for Testing and Materials; Superior Achievement Award, U.S. Environmental Protection Agency in 1980; the Founder's Award of the Society for Environmental Toxicology and Chemistry in 1981; the Icko Iben Award from the American Water Resources Association in 1984; the B. Y. Morrison Medal in 1984; Fellow, American Academy of Arts and Sciences in 1988; the United National Environmental Programme Medal in 1988; the American Fisheries Society Award of Excellence in 1989; the 1991 Life Achievement Award in Science by the Commonwealth of Virginia and the Science Museum of Virginia; and Member, National Academy of Sciences, 1991. Dr. Cairns has been a consultant and researcher

for the government and private industries, and has served on numerous scientific committees. His most recent books are *Functional Testing of Aquatic Biota for Estimating Hazards of Chemicals* (ASTM, 1989), *On Global Warming* (1989), *Integrated Environmental Management* (Lewis Publishers, 1991), and *Restoring Aquatic Ecosystems: Science, Technology, and Public Policy* (Cairns, committee chair for National Research Council, National Academy Press, 1991). His 1,085 publications include 51 books, with two currently in press. The title of Dr. Cairn's address at the plenary session is "Maintaining Per Capita Ecosystem Services While the Human Population Grows to Ten Billion: A Major Challenge for Biologists."

CONFERENCE CENTER



**THE CAVALIER
(New Hotel)**



Program Summary

All events at the Cavalier Hotel except where noted. See map of hotel floorplan in this issue of the Bulletin.

WEDNESDAY, 14 APRIL 1993

12:00 P.M.-10:00 P.M.	REGISTRATION, <u>Hotel Lobby</u>
3:00 P.M.- 7:00 P.M.	ASB Executive Committee Meeting, <u>Summit Room</u> (top floor)
5:00 P.M.- 6:00 P.M.	Council Meeting, SE Society of Parasitologists, <u>Captain's Table C</u>
7:00 P.M.- 9:00 P.M.	Parasitology Presidents Symposium: Species Concepts Revisited, <u>Coral Reef D</u>
7:30 P.M.-10:30 P.M.	Council Meeting, Southern Appalachian Botanical Society, <u>Captain's Table C</u>
7:30 P.M.-10:00 P.M.	ASB Social with Cash Bar, <u>Atrium</u> (near the lobby)
8:30 P.M.-10:30 P.M.	Continuation of ASB Executive Committee Meeting (if necessary), <u>Summit Room</u>

THURSDAY, 15 APRIL 1993

7:00 A.M.- 8:00 A.M.	Past President's Breakfast, <u>North Orions</u> (top floor)
7:00 A.M.- 5:00 P.M.	Slide Preview, room posted at ASB information desk
7:00 A.M.- 8:30 A.M.	Poster Session Set-up, <u>Beach Club A</u>
8:00 A.M.- 5:00 P.M.	LATE REGISTRATION, <u>Hotel Lobby</u>
8:00 A.M.- 5:00 P.M.	Placement Service, <u>Beach Club Foyer</u>
8:30 A.M.- 9:45 A.M.	Plenary Session, <u>Beach Club B</u>
9:45 A.M.- 5:00 P.M.	Exhibits, <u>Beach Club A</u>

POSTER AND MORNING PAPER SESSIONS

10:00 A.M.- 5:00 P.M.	Poster Session, <u>Beach Club A</u>
4:00 P.M.- 5:00 P.M.	Presenters with Posters
10:00 A.M.-12:00 P.M.	Symposium: Barrens Vegetation and Restoration Ecology in the Eastern U.S., <u>Beach Club B</u>
10:00 A.M.-12:00 P.M.	Plant Ecology, Session 1, <u>Captains Table A</u>
10:00 A.M.-12:45 P.M.	Cell and Molecular Biology, <u>Captains Table B</u>
10:00 A.M.-11:00 A.M.	Parasitology Keynote Address, <u>Coral Reef D</u>
11:00 A.M.-12:30 P.M.	Symposium: Zoonotic Diseases, <u>Coral Reef D</u>
10:00 A.M.-12:00 P.M.	Plant Systematics, Session 1, <u>Coral Reef E</u>
10:00 A.M.-12:00 P.M.	Invertebrate Zoology, <u>Oceans</u>
10:00 A.M.-12:30 P.M.	Genetics and Animal Physiology, <u>Captains Table C</u>

BUSINESS AND LUNCHEON MEETINGS

- 12:15 P.M.- 1:45 P.M. **Luncheon:** Society of Wetland Scientists, North Orions (top floor)
- 12:15 P.M.- 1:45 P.M. **Luncheon:** Beta Beta Beta, Summit Room (top floor)

SPECIAL EVENTS

- 8:30 A.M.- 3:00 P.M. **Trip to Historic Williamsburg** for accompanying persons and other interested participants, Bus departs from the Cavalier.
- 2:00 P.M.- 6:00 P.M. **Beta Beta Beta Field Trip to the Virginia Air and Space Center**, Bus departs from the Cavalier

AFTERNOON PAPER SESSIONS

- 1:30 P.M.- 4:30 P.M. **Symposium:** Barrens Vegetation and Restoration Ecology in the Eastern U.S., Beach Club B
- 1:30 P.M.- 5:15 P.M. Plant Ecology, Session 2, Captains Table A
- 1:30 P.M.- 4:00 P.M. **Special Workshop for Teachers:** Laser Disk Technology and Microcomputers, Captains Table C
- 1:30 P.M.- 5:30 P.M. Aquatic Ecology, Captains Table B
- 1:30 P.M.- 5:00 P.M. Parasitology, Session 1, Coral Reef D
- 1:30 P.M.- 5:15 P.M. Plant Systematics, Session 2, Coral Reef E
- 1:30 P.M.- 4:00 P.M. Ichthyology and Herpetology, Session 1, Oceans

BUSINESS MEETINGS

- 4:00 P.M.- 5:00 P.M. SE Division, American Society of Ichthyologists and Herpetologists, Oceans
- 5:00 P.M.- 6:00 P.M. SE Fishes Council, Oceans

SPECIAL EVENT

- 6:00 P.M.- 9:30 P.M. **Buffet Supper and Entertainment at the Virginia Marine Science Museum.** Sponsored by College of Sciences and Office of Academic Affairs, Old Dominion University and ASB. Trolleys depart at 6:00 P.M. and 6:30 P.M. from the Cavalier.

FRIDAY, 16 APRIL 1993

- 7:00 A.M.- 8:30 A.M. **Breakfast and Business Meeting:** Southern Appalachian Botanical Society and SE Section, Botanical Society of America, Orions (top floor)
- 7:00 A.M.- 4:00 P.M. Slide Preview, room posted at ASB information desk
- 8:00 A.M.- 5:00 P.M. Placement Service, Beach Club Foyer
- 8:00 A.M.-12:00 P.M. **LATE REGISTRATION**, Hotel Lobby
- 8:00 A.M.-12:00 P.M. Exhibits, Beach Club A

MORNING PAPER SESSIONS

- 9:00 A.M.-10:30 A.M. **Special Workshop:** The Minority Thrust: Today-Tomorrow, Beach Club B
- 8:00 A.M.-11:30 A.M. Plant Ecology, Session 3, Captains Table A
- 9:00 A.M.-10:30 A.M. **Teaching Update Workshop:** Modern Instrumentation for Teaching Plant Ecophysiology, Coral Reef C
- 8:00 A.M.-11:45 A.M. Parasitology, Session 2, Coral Reef D
- 8:00 A.M.-11:30 A.M. Ichthyology and Herpetology, Session2, Coral Reef E
- 8:00 A.M.-11:15 A.M. Plant Physiology and Plant Ecology, Coral Reef B
- 9:00 A.M.-12:00 P.M. Beta Beta Beta Scrapbook, Captain's Table C

BUSINESS AND LUNCHEON MEETINGS

- 10:30 A.M.-11:30 A.M. **Business Meeting:** Beta Beta Beta, Captain's Table B
- 11:30 A.M.-12:30 P.M. **Business Meeting:** ASB, Beach Club B
- 12:30 P.M.- 2:00 P.M. **Luncheon Meeting:** SE Chapter, Ecological Society of America, Summit Room (top floor)
- 12:30 P.M.- 2:00 P.M. **Luncheon Business Meeting:** SE Society of Parasitologists, North Orions (top floor)

AFTERNOON PAPER SESSIONS

- 2:00 P.M.- 5:30 P.M. Chesapeake Bay Ecology, Coral Reef C
- 2:00 P.M.- 3:15 P.M. Teaching Biology, Coral Reef D
- 2:00 P.M.- 5:30 P.M. Plant Ecology, Session 4, Coral Reef E
- 2:00 P.M.- 5:30 P.M. Animal Ecology, Coral Reef B
- 3:30 P.M.- 4:45 P.M. Plant Ecology, Session 5, Coral Reef D
- 1:00 P.M.- 4:00 P.M. Beta Beta Beta, District 1, Captains Table A
- 1:00 P.M.- 4:00 P.M. Beta Beta Beta, District 2, location to be announced

SPECIAL EVENTS

- 6:00 P.M.- 7:30 P.M. **ASB Mixer** (Cash Bar), Beach Club Deck (Beach Club B if the weather is bad)
- 7:30 P.M.-10:00 P.M. **ASB Banquet**, Beach Club A

SATURDAY, 17 APRIL 1993

- 7:00 A.M.- 9:00 A.M. **ASB Executive Committee Breakfast Meeting**,
Summit Room (top floor)
- 7:30 A.M.- 9:00 A.M. **Field Trips:** Departure from the Cavalier Hotel.
See January 1993 issue of ASB Bulletin for
details and exact times for each trip.

Michael J. Baranski - Dr. Baranski is Professor of Biology at Catawba College, Salisbury, NC. He received his B.S. in biology from West Liberty State College, West Virginia (1968) and Ph.D. from North Carolina State University in Botany (1974). He served as Biology Department Chair from 1986-89 and currently serves as Chair of the Faculty Senate and Director of Ecological Preserve. His visiting faculty appointments include North Carolina State University, Rocky Mountain Biological Laboratories; Duke University, North Carolina Department of Public Instruction, Science Institute for Middle School Teachers, and University of North Carolina at Charlotte. He has been a member of ASB since 1969. His ASB service includes Vice-President (1990/91, Executive Committee (1986-89), Conservation Committee, Place of Meeting Committee, Publications Committee, and Enrichment Fund Board of Trustees (1991). Service in other organizations includes Southern Appalachian Botanical Club (President, 1990-1992; Secretary Treasurer, 1981-90; Chairs of Nominating and Long-range Planning Committees, Botanical Society of America-Southeastern Section (Secretary-Treasurer, 1977-80; Nominating Committees); Southeastern Chapter of Ecological Society of America (Odum Award Judge and Odum Award Committee); North Carolina Academy of Science (Board of Directors, and Director of Collegiate Academy, and North Carolina Science Olympiad (Director, 1985-87). He has served on many state-level advisory committees and panels. At Catawba College, he has taught a wide range of courses in biology, botany, genetics, ecology, and conservation and sponsored many undergraduate research projects. His interests are in vegetation ecology, floristics, dendrology, wetlands natural heritage work, and environmental education. Active in the community and in local and regional conservation issues and organizations, he strongly believes that biologists must play an important role in environmental advocacy.

Diane R. Nelson - Dr. Nelson is Professor of Biological Sciences, East Tennessee State University, Johnson City, Tennessee. She earned her B.S. in Secondary Education (Natural Science) and her M.S. and Ph.D. in Zoology from the University of Tennessee - Knoxville, where she received an NSF Research Assistantship and a NASA Traineeship. Her research interests are in the systematics and ecology of the Tardigrada (water bears), utilizing scanning and transmission electron microscopy for morphological studies. She teaches courses in general biology (for non-science majors), invertebrate zoology, and marine biology. Since 1982, she has been studying/teaching marine biology in the summer at the Bermuda Biological Station for Research, and she is a member of the BBSR Corporation. Dr. Nelson organized the 3rd International Symposium on the Tardigrada, 1980, at East Tennessee State University and the 5th Symposium on the Tardigrada in conjunction with the Eighth International Meiofauna Conference (EIMCO) at the University of Maryland, August 1992. She is a member of the American Institute of Biological Sciences, the American Microscopical Society (nominee for Program Officer 1992-1995), the American Society of Zoologists, Sigma Xi, the Biological Society of Washington, and the International Association of Meiobenthologists. She was Secretary of the Tennessee Academy of Science for 14 years and also served the Academy as a member of the Executive Committee, Visiting Scientist, and Zoology Section Chair. In addition, she is a Fellow of the Academy. Active as a member of the Association of Southeastern Biologists for approximately 20 years, Dr. Nelson has served as Vice-President (1991-1992), Executive Committee member (1987-1990), Invertebrate Zoology Section Chair, member of the Conservation Committee, and member and chair of the Research Awards Committee.

VICE-PRESIDENT

James S. Fralish - Dr. Fralish is an Associate Professor of Forest Ecology at Southern Illinois University, Carbondale. He received B.S. and M.S. degrees in forestry from Michigan State University and a Ph.D. in plant ecology and soil from the Botany Department at the University of Wisconsin, Madison. A member of ASB since 1973, he received the Faculty Research Award in 1986 and 1990. was on the Executive Committee from 1986-1989, and updated the 1993 ASB Membership Directory. Current research includes studies on forest communities at Land Between the Lakes, KY and TN, rate of sugar maple encroachment into oak stands and its effect on herb diversity, reconstruction of presettlement forest landscape patterns, and fire ecology. He presently is a consultant with the Center for Field Biology, Austin Peay State University, Clarksville, and has served as vegetation science editor for *The American Midland Naturalist*. Research publications have appeared in *Ecological Applications*, *The American Midland Naturalist*, *Canadian Journal of Forest Research*, *Journal of Forestry* and *Illinois Academy of Science*.

Jerry C. Ritchie - Dr. Ritchie is an ecologist at the National Hydrology Laboratory of the Agriculture Research Service (ARS) of the United States Department of Agriculture (USDA) at Beltsville, MD. He received his B.A. degree in Biology from Pfeiffer College, Misenheimer, NC, a M.S. degree in Botany from the University of Tennessee, and a Ph.D. in Botany from the University of Georgia. After an 18 month post doctoral appointment at the University of Georgia, he spent 10 years at the National Sedimentation Laboratory in Oxford, MS before transferring to Beltsville, MD. His research interest are in nutrient and radionuclide cycling in natural and agroecosystems and on the use of remote sensing techniques for monitoring changes on the landscape. He has published over 100 journal papers on these topics. In 1992 he received the Agriculture and the Environment Award from USDA-ARS for his research efforts. Dr. Ritchie is active in the Ecological Society of America, the American Society of Limnology and Oceanography, and the Agronomy Society of America. He is a past-chairman of the Metropolitan Washington Chapter of the Ecological Society of America and is on the Executive Committee of the Board of Directors of the Renewable Natural Resources Foundation. He has been active in ASB since 1966 by presenting papers, chairing sessions, and organizing symposia. He is currently serving as ASB representative to AAAS.

TREASURER

Robert R. Haynes - Dr. Robert Haynes is a Professor of Biological Sciences at the University of Alabama, Tuscaloosa, Alabama. He earned his B.S. in Botany from Louisiana Polytechnic Institute (Louisiana Tech University), his M.S. in Biology from the University of Southwestern Louisiana, and his Ph.D. in Botany from the Ohio State University. Haynes taught two years at Louisiana State University in Shreveport before moving to Alabama. His research interests are in the systematics of aquatic vascular plants. Techniques utilized for his systematics studies include morphology, phytogeography, ecology, cytology, phytochemistry, and, more recently, chloroplast DNA sequences. Haynes has been an active member of ASB since 1977 and has served the Society in several capacities, the most recent of which was Chairman of the Local Arrangements Committee for the 1992 meeting. In addition, he is a long time member of the International Association of Plant Taxonomists, American Society of Plant Taxonomy, Botanical Society of America, and Southern Appalachian Botanical Club. He has served on one or more committees for all above organizations except the IAPT. In addition, he was elected as a Fellow of the Linnean Society of London in 1987. Haynes has authored one book and more than 50 publications in scientific journals. He also has prepared one or more aquatic families for many floras ranging from the American tropics to North America. His research has been funded by several sources, but mostly by the National Science Foundation, from which he has received more than five grants. Haynes is the program director for SERFIS, a computer database that when complete will house label data for most herbarium specimens stored in herbaria in the Southeastern United States.

James C. Hull - Dr. Hull is Professor of Biology at Towson State University, Towson, MD. He received his Ph.D. in Biology from the University of California, Santa Barbara. His recent ecological research has examined photosynthetic responses of plants to environmental variables including nitrogen and transient light dynamics. His dedication to teaching led to his selection for the Outstanding Faculty Award in science in 1991 and his recent nomination for the Outstanding Graduate Faculty Teaching Award. He has presented numerous papers at ASB and published in regional, national and international journals. His research has been funded by state and federal grants. Jim was appointed in 1980-81 to Ecologist with the Smithsonian Environmental Research Center for study of Coastal Plain wetlands and as Visiting Scientist at Stanford University in 1984-85 for research on photosynthesis in annual grasslands. In addition to belonging to the Association of Southeastern Biologists for 16 years, he is a member of the Ecological Society of America, Southeastern Chapter of ESA, Southern Appalachian Botanical Club, American Institute of Biological Sciences, and Sigma Xi. Jim chaired the local arrangements committee for the 1990 Annual Meetings of ASB in Baltimore. He currently serves as Chair of the Place of Meetings Committee for ASB.

EXECUTIVE COMMITTEE

Beverly S. Collins - Dr. Collins is an Assistant Professor of Biology at Memphis State University. She received a B.S. degree in botany from the University of Kentucky and a M.S. and Ph.D. in botany and plant physiology from Rutgers University. She held a postdoctoral appointment at Savannah River Ecology Lab. In 1988, she joined the faculty at Memphis State University where she teaches undergraduate courses in general biology and ecological and environmental issues and graduate courses in physiological and community ecology. Research interests are mechanisms of plant species coexistence and community dynamics. Dr. Collins is currently a member of the ASB ad hoc committee on minorities, women and the handicapped in biology. She is also a member of the activities committee of the southeastern section of Botanical Society of America and secretary of the ecological section of BSA.

Claudia L. Jolls - Dr. Jolls received her B.S. in botany at the University of Michigan (1975) and her Ph.D. in biology at the University of Colorado at Boulder (1980). After a postdoctoral fellowship from Michigan State University at Kellogg Biological Station, she taught ecology at the University of Michigan Biological Station. She joined the Department of Biology at East Carolina University, Greenville, NC, where she is now Associate Professor. Her research in plant ecology deals with how population level processes relate to evolution and community structure. Her current interests are possible economic applications for a pestilent weed of the southeast, *Senna obtusifolia*, and the reproductive biology of a federally-listed endangered species, *Solidago houghtonii*. Her service includes student award committees of the Ecological Society of America, committee work for the local chapter of Sigma Xi, as well as membership and chair of the Botanical Society of America SE Activities Committee. She has been a member of ASB since her arrival to the Southeast in 1984. Her other professional affiliations include American Institute of Biological Sciences, American Men and Women in Science, Botanical Society of America, Ecological Society of America, NC Academy of Science and Southern Appalachian Botanical Club. She currently is active in recruitment and retention of women and minorities in science, curriculum design of the promotion of exemplary teaching, and regional environmental concerns.

Howard S. Neufeld - Dr. Neufeld is Associate Professor in the Department of Biology at Appalachian State University. He received his B.S. in forest ecology from Rutgers University and an M.F. from the Yale School of Forestry and Environmental Science. In 1984 he completed his Ph.D. in physiological plant ecology with Dr. Bruce Haines at the University of Georgia. He did postdoctoral work with Dr. Gary Cunningham at New Mexico State University in 1987. For the last few years, Dr. Neufeld's research has concentrated on evaluating the effects of ozone and acidic deposition on tree species in the southeastern United States, particularly in the southern Appalachian mountains. He has also worked on the ecology of cypress trees, desert shrubs, and understory herbs. In the fall of 1989 he was a visiting scientist at the Hawaiian Sugar Planter's Association where he worked with Dr. F.C. Meinzer on sugarcane water relations. Dr. Neufeld was the 1992 recipient of the ASB Outstanding Faculty Research Award, and the first recipient of the Wachovia Award for Achievement in Environmental Research at Appalachian State University. His research has been supported by the National Park Service, EPA, and TVA, as well as NSF. He is currently a member of the Place of Meeting Committee for ASB, and was the Program Chair for ASB when it was held at Appalachian State.

Donald R. Windler - Dr. Windler is Professor and Chair of the Biology Department at Towson State University in Towson, Maryland. He took his Bachelors Degree in Biology and his Masters Degree in Botany with Dr. Robert H. Mohlenbrock at Southern Illinois University in Carbondale. His Masters thesis was a revision of the Legume genus *Neptunia* Lour. After leaving Illinois, he completed the requirements for the Ph.D. under the direction of Dr. C.R. Bell at the University of North Carolina at Chapel Hill. His dissertation was an experimental study of the simple leaved members of the legume genus *Crotalaria* L. in North America. His research interests have concentrated on the systematics of genera of the Leguminosae and floristic studies in Maryland. He has 30 publications and several more in preparation. At Towson, Dr. Windler has been involved with the Masters program, serving on the committee which established the Biology Masters in 1970, serving on the campus Graduate Studies body, and directing the work of students. From 1984 to 1987, he served as Chair of the Biology department, following which he served as Acting Dean of the College of Natural and Mathematical Sciences (CONAMS) for a period of three years. Since leaving the Deanship, he has returned to the Departmental

Chair. In the Spring of 1991, he received the CONAMS Outstanding Faculty Award. Dr. Windler is a member of nine professional associations, including ASB and SABC. He was a founding member of the Towson State Sigma Xi group and served a term as its president. He initiated the invitation for Towson State to host the 1990 ASB meetings and while Dean, carried out several major responsibilities for the Towson Local Committee. He has been a supporter and served on the SABC Endowment Committee. In 1990, he established an endowment to fund the Richard and Minnie Windler Award in the SABC as a memorial to his parents.

ASB PAPER AND POSTER

SESSIONS

WEDNESDAY EVENING, 14 APRIL

PARASITOLOGY PRESIDENTS SYMPOSIUM

Coral Reef D

SPECIES CONCEPTS REVISITED

Sponsored by the Southeastern Society of Parasitologists

Presiding:		<i>B. Blagburn</i> , Auburn University
7:00	1	Lichtenfels, J. Ralph. (USDA, Agricultural Research Service) The morphological species.
7:40	2	Zarlenga, Dante S. (USDA, Agricultural Research Service) The biochemical species.
8:20	3	Hoberg, Eric P. (USDA, Agricultural Research Service) Species and the phylogenetic perspective.

THURSDAY MORNING, 15 APRIL

PLENARY SESSION - Beach Club B

8:30		James V. Koch , President of Old Dominion University. Welcoming remarks.
		Ross Hinkle , ASB President. Response.
		John Cairns, Jr. , VPI. Maintaining per capita ecosystem services while human population grows to ten billion: a major global challenge for biologists.

POSTERS - Beach Club A

- 4 **Waller, Deborah A. and Robert K. Vandermeer.** (Old Dominion University and USDA-ARS, Gainesville, FL) Biochemical identification of fire ants in Virginia.
- 5 **Watts, S.A., G.A. Hines, J.B. McClintock, K.R. Marion, and T.S. Hopkins.** (University of Alabama at Birmingham and University of Alabama) Chemical communication of echinoderms in marine communities.
- 6 **Rowley, Heather J., Brent C. Shealy, Irene Kokkala and Robert D. Hoyt.** (Furman University and Western Kentucky University) Development of cephalic and lateral line neuromasts of the fathead minnow, *Pimephales promelas*.
- 7 **Nordmeyer, Dana L. and James G. Herndon.** (Emory University) Female influence on male seasonality in Rhesus monkeys.
- 8 **Williams, Ray S. and David E. Lincoln.** (University of South Carolina) Responses of sawfly larvae to elevated carbon dioxide grown pines.
- 9 **Macarthur, K.J., D.C. Forester, and L.P. Mangurian.** (Towson State University) Prolactin binding sites in the central nervous system of *Desmognathus fuscus*.
- 10 **Hargrave, Barbara Y.** (Old Dominion University) Stimuli that cause secretion of atrial natriuretic peptide in the ovine fetus.
- 11 **Wubah, D.A.** (Towson State University) Anaerobic biotransformation of highly chlorinated PCB congeners by microorganisms in contaminated Ashtabula River sediments.
- 12 **Fisher, Hope, Abdiaziz Mohamood, Broderick Eribo and Attin Datta.** (Howard University and Food and Drug Administration) Characterization of Plasmids in Psychrobacter isolates.
- 13 **McBee, Ann, Ron Ferguson, Martha Griffin and Victoria Hollowell** (Columbia College and South Carolina Forestry Commission) A vernal floristic survey of Harbison State Forest, Richland County, South Carolina.

- 14 **Caspersen, John, Andrew Schnabel and Rebecca Sharitz** (Savannah River Ecology Laboratory) Seed bank composition of a southeastern riverine swamp.
- 15 **Adams, Harold S., Steven L. Stephenson, David M. Lawrence and Mary Beth Adams.** (Dabney S. Lancaster Community College, Fairmont State College, University of Virginia, and USDA Forest Service) The spruce/hardwood ecotone in the mid-Appalachians.
- 16 **Hedden, Roy L., Todd S. Fredericksen, and Stephen A. Williams.** (Baruch Forest Science Institute of Clemson University) Simulating catastrophic wind stress on Southern pine trees.
- 17 **Plyler, Daniel B. and Kevin M. Carrick.** (The University of North Carolina at Wilmington) Abscisic acid reversal of surgically induced germination in dormant seeds of *Spartina alterniflora*.
- 18 **Lehman, Mary and Udo Blum.** (North Carolina State University) Effects of cover crop debris on emergence of weeds.
- 19 **Chen, Dillion T. and Lafayette Frederick.** (Howard University) Studies on trichome form and ontogeny in *Ulmus*.
- 20 **Gazzera, Silvia B., Thomas F. Wilcox, Leonard A. Smock, and Greg C. Garman.** (Virginia Commonwealth University) Biotic response of a Virginia Coastal plain stream to experimental acidification.
- 21 **Menhinick, Edward F.** (University of North Carolina at Charlotte) Grayscale scanning for Scientific publications.
- 22 **Brewer, Gwen and Frank McKinney** (Frostburg State University and Bell Museum of Natural History) Nest defense by males in a tree-nesting duck.
- 23 **Perry, James W.** (Frostburg State University) Model construction as a means to teach three dimensional plant structure.

SYMPOSIUM - Beach Club B**BARRENS VEGETATION AND RESTORATION
ECOLOGY IN THE EASTERN UNITED STATES**

Sponsored by the SE Chapter, Ecological Society of America

Presiding: *Alice Long Heikens*, Franklin College of Indiana**PRE-SETTLEMENT VEGETATION**10:00 24 **Hutchison, Max D.** (The Nature Conservancy) The barrens of the Midwest: a historical perspective.**POST-SETTLEMENT VEGETATION**10:20 25 **Homoya, Michael A.** (Division of Nature Preserves, Indiana Department of Natural Resources) Indiana barrens: classification and description.10:40 26 **DeSelm, H.R.** (University of Tennessee) The Tennessee barrens.11:00 27 **Haney, Alan, and Steven I. Apfelbaum** (University of Wisconsin-Stevens Point and Applied Ecological Services, Inc.) Characterization of Oak Savanna Communities in the Upper Midwest.11:20 28 **Baskin, Jerry M., Carol C. Baskin, and Edward W. Chester.** (University of Kentucky and Austin Peay State University) The Big Barrens of Kentucky and Tennessee: An overview.**PLANT ECOLOGY, Session 1 - Captains Table A**Presiding: *James Hull*, Towson State University10:00 29 **Graves, James H.** (University of North Carolina at Chapel Hill) The importance of herbs in forests: resource ratios and competition between herbaceous and woody plants.10:15 30 **Pauley, Eric F. and Edward E.C. Clebsch.**(University of Tennessee) Episodic reproduction of red spruce (*Picea rubens* Sarg.) in West Virginia.

- 10:30 31 **Hickox, T. and B. Collins.** (Memphis State University) Competition between native and immigrant *Polygonum* congeners in contrasting light and water levels.
- 10:45 32 **Summers, Natama V. and Mary A. McKenna.** (Howard University) Inhibitory effects of Thymol on *Pythium* growth.
- 11:00 33 **Hull, James C.** (Towson State University) Transient light dynamics and photosynthesis in understory forest herbs.
- 11:15 34 **Tuberville, Tracey D., Peter G. Dudley, and A. Joseph Pollard.** (Furman University) Responses of invertebrate herbivores to plant stinging trichomes.
- 11:30 35 **Ely, Joseph S. and Dan K. Evans.** (The Ohio State University and Marshall University) The vegetation of selected embayments along the upper to mid-upper Ohio River floodplain.
- 11:45 36 **Neufeld, Howard S.** (Appalachian State University) A 25 cuvette auto-sequencing gas exchange system for the study of plant responses to ozone.

CELL AND MOLECULAR BIOLOGY - Captains Table B

- Presiding: *Robert Ratzlaff*, Old Dominion University
- 10:00 37 **McDaniel, Kerrie L. and Lightfoot, David A.** (Southern Illinois University) Cytokinin modulation of mRNA levels in *Phaseolus vulgaris* (L.).
- 10:15 38 **Toran, Eric and Elaine J. Davis** (Howard University) Partial Characterization of the Balsam Woolly Adelgid's Mitochondrial DNA.
- 10:30 39 **Wetmore, Dawn J. and Paul W. Doetsch** (Emory University) Isolation and characterization of a human DNA repair enzyme from HeLa carcinoma cells.
- 10:45 40 **Madigosky, Stephen R., Xavier Alvarez, and Jonathan Glass** (Widener University, Louisiana State University Medical Center) Intestinal aluminum uptake and transport are dependent on epithelial iron transport.
- 11:00 41 **Wilkerson, Charlie and Elaine J. Davis** (Howard University) Partial characterization of the origin of transfer region for the Plasmid R64drd11 in *E. coli* K-12.

- 11:15 42 **Miller, Christopher G., Schaffer, R.L. and I.T.D. Petty** (North Carolina State University) Examination of geminivirus host range specificity using chimeric viruses.
- 11:30 43 **Lauro, Stacie and A.A. Ansari** (Emory University) Does the "nef" gene contribute to the disease resistance of Sooty Mangabey monkeys (SMM)?
- 11:45 44 **Miller, Annette R.** (Appalachian State University) Effect of high vs moderate intensity exercise on natural killer cell activity.
- 12:00 45 **Robinson, Gerald D.** (Towson State University) Effects of reduced ambient pH on sodium balance in the red-spotted newt, *Notophthalmus viridescens*.
- 12:15 46 **Pons, Lara J., Mathius J. Sedivec, and Richard N. Henson** (Appalachian State University) A comparison of conduction velocities and axonal diameters of two sympatric species of scorpions, *Centruroides vittatus* (Say, 1821) and *Diplocentrus* sp.
- 12:30 47 **Byrd, Pamela and Dwayne A. Wise** (Mississippi State University) The effect of an antibody to a microtubule cap protein on PtK₂ cells.

PARASITOLOGY KEYNOTE SPEAKER - Coral Reef D

Presiding: *Sharon Patton*, University of Tennessee

10:00 **Oliver, James H. Jr.** (Georgia Southern University) Lyme Disease in the Southeastern United States.

SYMPOSIUM - Coral Reef D

ZOONOTIC DISEASES

Sponsored by the Southeastern Society of Parasitologists

Presiding: *D. Lindsay*, Auburn University

11:00 48 **Dubey, J.P.** (USDA, ARS Zoonotic Diseases Laboratory, Beltsville, MD) Toxoplasmosis.

11:30 49 **Fayer, Ron** (USDA, ARS Zoonotic Diseases Laboratory, Beltsville, MD) Epidemiology, Clinical Manifestations, and Treatment of Cryptosporidiosis.

- 12:00 50 **Tilahun, Getachew** (Addis Abbaba University, Addis Abbaba, Ethiopia) Parasitic Zoonoses in Ethiopia.

PLANT SYSTEMATICS, Session 1 - Coral Reef E

- Presiding: *Don Windler*, Towson State University
- 10:00 51 **Wiltshire, B. and D.L. Nickrent** (Southern Illinois University at Carbondale) Genetic diversity in *Astragalus tennesseensis* Gray and *Dalea foliosa* (Gray) Barneby.
- 10:15 52 **Lakshmi, Bharatha and Rebecca Norris** (Old Dominion University, and U.S. Department of Agriculture, Whiteville Methods Development Center) Allozyme studies of *Orobanche minor*.
- 10:30 53 **Pittman, Albert B.** (South Carolina Heritage Trust) Additional observations on a narrow-leaved *Lobelia* from the Carolina sandhills.
- 10:45 54 **Mohamed, Kamal I. and Lytton J. Musselman** (Old Dominion University) The genus *Striga* in Africa.
- 11:00 55 **Matthews, James F., Donna W. Ketron and Sandra F. Zane** (University of North Carolina at Charlotte) The taxonomy of *Portulaca oleracea* L.
- 11:15 56 **Weakley, Alan S.** (North Carolina Natural Heritage Program) A revision of *Trichostema*, section *Trichostema* (*Lamiaceae* or *Labiatae*).
- 11:30 57 **Weakley, Alan S.** (North Carolina Natural Heritage Program) A new species of *Sporobolus* (*Poaceae* or *Gramineae*) from pinelands of the Carolinas.
- 11:45 58 **Ely, Joseph S. and Evans, Dan K.** (The Ohio State University and Marshall University) The flora of selected embayments along the upper to mid-upper Ohio River floodplain.

INVERTEBRATE ZOOLOGY - Oceans

- Presiding: *Diane Nelson*, East Tennessee State University
- 10:00 59 **Tarter, Donald C. and Diane R. Nelson** (Marshall University, and East Tennessee State University) First records of tardigrades (Phylum: Tardigrada) from mosses in the Cranberry Glades Botanical Area in the Monongahela National Forest, Pocahontas County, West Virginia.
- 10:15 60 **Nelson, Diane R. and Gilbert Hale** (East Tennessee State University) Tardigrades from Buffalo Mountain Park, Washington County, Tennessee.
- 10:30 61 **Hustad, Heather and William Dewel** (Appalachian State University) The eyes of the heterotardigrade, *Echiniscus viridissimus*.
- 10:45 62 **Powers, Nancy and Donald Tarter** (Marshall University) Ecological observations of a disjunct population of the burrowing crayfish *Fallicambarus fodiens* (Cottle) in the Green Bottom Wildlife Management Area in southwestern West Virginia.
- 11:00 63 **Mullins, Lee Ann and Donald C. Tarter** (Marshall University) Low pH tolerance, under static bioassay conditions, of naiadal green jacket skimmers, *Erythemis simplicicollis* Say (Odonata: Libellulidae), from the Green Bottom Wildlife Management Area in southwestern West Virginia.
- 11:15 64 **Flowers, James R. and Grover C. Miller** (North Carolina State University) Molluscs collected from the Swift Creek basin in Wake and Johnston counties, North Carolina.
- 11:30 65 **McLachlan, James and Ruth Ann Dewel** (Appalachian State University) Sensory receptors of the median ocular region of the scorpion *Centruroides vittatus*.
- 11:45 66 **Hedgecock, Ashlee A., Gary L. Walker and Richard N. Henson** (Appalachian State University) The population ecology and genetic architecture of the scorpion *Centruroides vittatus*.

GENETICS AND ANIMAL PHYSIOLOGY - Captains Table C

- Presiding: *Dwayne Wise*, Mississippi State University
- 10:00 67 **Williams, Ann C. and Arthur L. Williams** (Howard University) Genetic expression of recombinant plasmids carrying *Coriolus versicolor* genes in *Escherichia coli* cells.
- 10:15 68 **Williams, Arthur L.** (Howard University) Ribonucleic acid analysis of an unusual valine-resistant mutant of *Escherichia coli* K-12.
- 10:30 69 **Duff, Robert J., and Edward E. Schilling** (University of Tennessee) The use of cpDNA restriction site data to characterize populations and estimate relationships among *Isoetes* L. in North America.
- 10:45 70 **Tyler, Stacie and Dwayne Wise** (Mississippi State University) Chiasma frequency and distribution in multivalents.
- 11:00 71 **Green, Becky L. and Dwayne A. Wise** (Mississippi State University) Nonrandom segregation in spermatocytes of the fleabeetle, *Alaqaosa bicolor* L.
- 11:15 72 **Masters, Brian S. and Forester, Don C.** (Towson State University) Genetic structure of populations of spotted salamander (*Ambystoma maculatum*) in Maryland.
- 11:30 73 **McCoy, George and Mary Fleming Finlay** (Benedict College) Reproductive effects of chronic exposure to PCBs in two generations of *Peromyscus polionotus*.
- 11:45 74 **Davis, Jennifer J. and Dwayne Wise** (Shorter College and Mississippi State University) Comparisons of chromosome abnormalities and larval survival between a laboratory stock and progeny of wild-captured females of the crane fly, *Nephrotoma suturalis*.
- 12:00 75 **Stone, Susan Lyon** (University of North Carolina at Chapel Hill) Effect of water quality on embryonic and larval survival and larval growth in *Ambystoma maculatum*.
- 12:15 76 **Blaker, William and Lynn Taylor** (Furman University) Hippocampal and visual laterality in the formation of short-term memory in rats.

THURSDAY AFTERNOON, 15 APRIL

SYMPOSIUM - Beach Club B

**BARRENS VEGETATION AND RESTORATION
ECOLOGY IN THE EASTERN UNITED STATES**

Sponsored by Southeastern Chapter, Ecological Society of America

Presiding: *R. Wayne Tyndall*, Maryland Natural Heritage
Division

RESTORATION ECOLOGY

- | | | |
|------|--------------|--|
| 1:30 | 77 | Faber-Langendoen, Don (The Nature Conservancy, Midwest Office) Management and restoration of oak barrens at Allison Savanna, east-central Minnesota. |
| 1:50 | 78 | MacDonald, Dana D. (University of Michigan School of Natural Resources and Environment) Landscape ecosystems of glaciofluvial outwash on the Stonington Peninsula within the Hiawatha National Forest, Upper Michigan. |
| 2:10 | 79 | Stritch, Lawrence R. (USDA Forest Service, Shawnee National Forest) Restoration of a barrens/woodland complex within an oak-hickory forest mosaic. |
| 2:30 | 80 | Heikens, Alice Long, K. Andrew West, and Philip A. Robertson (Franklin College of Indiana, Illinois Department of Conservation, Southern Illinois University) Effects of prescribed fire on chert and shale barrens in southwestern Illinois. |
| 2:50 | BREAK | |
| 3:10 | 81 | Tyndall, R. Wayne (Maryland Natural Heritage Program) Vegetation and restoration of Maryland serpentine barrens. |
| 3:30 | 82 | Anderson, Roger C. and John E. Schwegman (Illinois State University and Division of Natural Heritage) Long-term effects of fire and absence of fire on a southern Illinois Barren. |
| 3:50 | 83 | Heikens, Alice Long (Franklin College of Indiana) The role of fire in maintaining the barrens in southern Illinois. |

4:10

Panel Discussion

PLANT ECOLOGY, Session 2 - Captains Table A

- Presiding: *Edward Weiss*, Christopher Newport University
- 1:30 84 **Carstensen, Susan M.** (Emory University) A comparison of herbivory on kudzu (*Pueraria lobata*) in its native and introduced ranges.
- 1:45 85 **Muntan, Chad, John Parnell, and David Westmoreland** (Emory University) Floral display and female reproductive success in Queen Anne's lace, *Daucus carota* L.: I. The influence of color contrasts.
- 2:00 86 **Parnell, John, Chad Muntan, and David Westmoreland** (Emory University) Floral display and female reproductive success in Queen Anne's lace, *Daucus carota* L.: II. The influence of umbel size.
- 2:15 87 **Cook, R.A. and E.E.C. Clebsch** (University of Tennessee) Demography and size changes in two populations of *Cimicifuga rubifolia* Kearney.
- 2:30 88 **Newell, Claire L. and Robert K. Peet** (University of North Carolina, Chapel Hill) Vegetation of the Linville Gorge Wilderness, North Carolina.
- 2:45 89 **Wiser, Susan K.** (University of North Carolina at Chapel Hill) Prediction of rare plant occurrence on high elevation out-crops of the Southern Appalachians.
- 3:00 **BREAK**
- 3:15 90 **Allison, James R.** (Georgia Department of Natural Resources) A botanical "Lost World" in Central Alabama.
- 3:30 91 **Jones, William D.** (Sand Hills State Forest, Patrick S.C.) Floristic inventory and rare species management plans for Sand Hills State Forest.
- 3:45 92 **Moore, Peter D. and Veronique A. Delesalle** (Emory University) The cost of allocating resources to male and female functions in a monoecious cucurbit.

- 4:00 93 **Westbrooks, Randy G. and Lytton J. Musselman** (U.S. Department of Agriculture, Whiteville Methods Development Center and Old Dominion University) Ecology, weediness, and host specificity in two *Orobanchae* species (*Orobanchaceae*).
- 4:15 94 **Baskin, Carol C., Jerry M. Baskin and Edward W. Chester** (University of Kentucky and Austin Peay State University) Seed germination ecophysiology of four summer annual mudflat species of Cyperaceae.
- 4:30 95 **Walck, Jeffrey L.** (University of Kentucky) A contribution to the ecological life history of *Senecio antennariifolius*.
- 4:45 96 **Zettler, Lawrence W., Neeraj S. Ahuja, and Thomas M. McInnis, Jr.** (Clemson University) The pollination ecology of *Platanthera integrilabia* (Correll) Luer, an endangered terrestrial orchid.
- 5:00 97 **Stark, T.J., D.K. Evans, F.S. Gilliam, and P.A. Robertson** (Marshall University and Southern Illinois University at Carbondale) The vascular plant communities of Green Bottom Wildlife Management Area, middle Ohio River floodplain.
- 5:15 98 **Fredericksen, Todd S.** (Baruch Forest Science Institute of Clemson University) Crown and root response to interference between loblolly pine and two hardwood tree species.

INTERACTIVE LASER DISK VIDEO WORKSHOP -

Captains Table C

Organized by the ASB Education Committee
(Chair, Dean Cocking, James Madison University)

- 1:30 - 4:00 99 **Garrison, N.E.** (James Madison University) Interactive Laser Disk Video and Microcomputer Assisted Biology Teaching: Courseware Authoring.

AQUATIC ECOLOGY - Captains Table B

- Presiding: *Donald Tarter*, Marshall University
- 1:30 100 **Fuss, Carolyn L. and Leonard A. Smock.**
(Virginia Commonwealth University) Spatial and temporal variation of respiration rates in a blackwater stream.
- 1:45 101 **Lynde, Stuart R., Kym J. Reubush, Jeannie M. Roper, William J. Van Wart, J.R. Webster, and Donald S. Cherry.** (Virginia Polytechnic Institute and State University) The use of artificial streams in evaluating leaf degradation: a comparison of breakdown rates based on thermal addition.
- 2:00 102 **Copps, Stephen L. Jr., Thomas R. Carpenter, Luther P. Brown and Robert B. Jonas.** (George Mason University) Vertical profiles of three Bahamian (karst) Blue Holes.
- 2:15 103 **Carpenter, Thomas R., Stephen L. Copps, Jr., Luther P. Brown, and Robert B. Jonas.** (George Mason University) Variation in bacterial abundance and biovolume in Bahamian Blue Holes.
- 2:30 104 **Steffens, Thomas A., Luther P. Brown and Robert B. Jonas.** (George Mason University) Tarpon Blue Hole, Andros Island, Bahamas: Biogeochemical changes in an historically stable estuarine environment.
- 2:45 105 **Halpin, T.R., B. Graham, R.W. Heard and R.M. Overstreet** (Livingston University and Gulf Coast Research Laboratory) A preliminary Faunal and Ecological Survey of an Inland Saline Environment.
- 3:00 106 **Glover, James B.** (University of Louisville) Habitat and food selection of the caddisflies in the genus *Triaenodes* (Trichoptera: Leptoceridae).
- 3:15 **BREAK**
- 3:30 107 **Fischer, J.C., J.L. Farris, R.J. Neves and D.S. Cherry.** (Virginia Polytechnic Institute and State University) An examination of growth rates and age-class structure of freshwater mussels in the Clinch River, Virginia.

- 3:45 108 **Yeager, Mary M., Donald S. Cherry, and Richard Neves.** (Virginia Polytechnic Institute and State University) Interstitial feeding behavior of juvenile unionid mussels, *Villosa iris*.
- 4:00 109 **Emery, Erich, Dan Chafin, Marcia Harrison, Dan Evans, and Donald Tarter.** (Marshall University) Acute and chronic toxicity of ichthyothereol, and ichthyotoxin from *Clibadium asperum* (Aubul.) DC of (Asteraceae) of Amazonia, to the fathead minnow, *Pimephales promelas* (Rafinesque) and the central mudminnow, *Umbra limi* (Kirtland).
- 4:15 110 **Hayes, Tim P. and Donald C. Tarter.** (Marshall University) Food Habits of a disjunct population of the central mudminnow, *Umbra limi* (Kirtland), in relation to seasonal changes and age groups, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.
- 4:30 111 **Jones, Thomas G. and Donald C. Tarter.** (Marshall University) Spring season foraging patterns of fishes in the Greenbottom Wildlife Management Area, West Virginia, in relationship to macrobenthos and plankton community structures.
- 4:45 112 **Moore, Edward L., Erich B. Emery, and Donald C. Tarter.** (Marshall University) Low pH tolerance under laboratory conditions of a larval population of the alderfly *Sialis hasta* Ross (Megaloptera: Sialidae).
- 5:00 113 **Daniels, Katie L. and Donald C. Tarter.** (Marshall University) Reproductive biology of the bowfin, *Amia calva* Linnaeus, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.
- 5:15 114 **Fritz, J. Douglas, Frank J. Bulow, and Stephen E. Moore.** (Tennessee Technological University and Great Smoky Mountains National Park) Effects of trail-induced sediment loads on Great Smoky Mountains National Park high-gradient trout streams.

PARASITOLOGY, Session 1 - Coral Reef D

- Presiding: *C. Faulkner*, University of Tennessee
- 1:30 115 **Sapp, Kelli K. and Gerald W. Esch** (Wake Forest University) The strength of spatial and temporal heterogeneity as structuring forces of the infra- and component communities in *Helisoma anceps* and *Physa gyrina*.
- 1:45 116 **Kightlinger, Lon K. and John R. Seed** (University of North Carolina at Chapel Hill) Intestinal nematodes, growth status, and immunity in children in the rain forest of Madagascar.
- 2:00 117 **Wetzel, Eric J. and Gerald W. Esch** (Wake Forest University) Ecological determinants of larval trematode infection in 3 species of odonate naiads.
- 2:15 118 **Mars, Chrystal L. and William F. Font** (Southeastern Louisiana University) Seasonal dynamics of the introduced Asian tapeworm *Bothriocephalus acheilognathi* in mosquitofish *Gambusia affinis* from Louisiana.
- 2:30 119 **Tuttle, Robert H. and J.E. Hall** (University of North Carolina at Chapel Hill) Short-term aromatic amino acid metabolism in a *Leishmania donovani*-infected human monocytic model system.
- 2:45 120 **Stovall, Christina E., John Richard Seed, and Temitope O. Keku** (University of North Carolina at Chapel Hill) Increased virulence of *Trypanosoma brucei rhodesiense* maintained *in vitro*.
- 3:00 **BREAK**
- 3:15 121 **Cole, Rebecca A., David S. Lindsay, J.P. Dubey, Byron L. Blagburn and Donald C. Sorjonen** (Auburn University and ARS, USDA, Beltsville, MD) Transplacental transmission of *Neospora caninum* in bitches infected during early pregnancy.
- 3:30 122 **Assadi-Rad, Amir and Sharon Patton** (University of Tennessee College of Veterinary Medicine) The epidemiology of *Toxoplasma gondii* on swine farms in TN.

- 3:45 123 **Pinckney, Rhonda D., David S. Lindsay, P. Dubey, and Byron L. Blagburn** (Auburn University and USDA, Zoonotic Disease Laboratory) Effects of inoculation of nursing pigs with a temperature-sensitive mutant of *Toxoplasma gondii* on subsequent oocyst challenge.
- 4:00 124 **Diderrich, Vina R. and Sharon Patton** (University of Tennessee College of Veterinary Medicine) *Toxoplasma gondii* and feline immunodeficiency virus infection in nondomestic felids.
- 4:15 125 **Keku, T.O. and J.R. Seed** (University of North Carolina at Chapel Hill) Mechanisms of pathogenesis in African trypanosomiasis: indentification of the trypanosome growth inhibitor.
- 4:30 126 **Davis, Sara R., John C. Meade, and William B. Lushbaugh** (University of Mississippi Medical Center) Hydrogen peroxide induced an oxidative stress response in *Trichomonas vaginalis*.
- 4:45 127 **Finley, R.L. and W.B. Lushbaugh** (University of Mississippi Medical Center) Drug susceptibility testing of local *Trichomonas vaginalis* (Tv) isolates.

PLANT SYSTEMATICS, Session 2 - Coral Reef E

Presiding: *Ted Bradley*, George Mason University

- 1:30 128 **Ramsey, Gwynn W., Charles H. Leys, Robert A. S. Wright, Douglas A. Coleman, Aubrey O. Neas, and Charles E. Stevens.** (Lynchburg College, Central Virginia Biological Research Consortium, Wintergreen Resort, Mt. Rainier National Park, and Charlottesville, VA.) A Botanical Eden: The James River Gorge in the Central Blue Ridge Mountains of Virginia.
- 1:45 129 **Jones, Ronald L.** (Eastern Kentucky University) Wetland flora of the Cumberland Plateau in Kentucky.
- 2:00 130 **Stalter, Richard, and E.E. Lamont.** (St. John's University and The New York Botanical Garden) The vascular flora of the Outer Banks of North Carolina.
- 2:15 131 **Anderson, Loran C.** (Florida State University) Botanical richness of the western panhandle of Florida.

- 2:30 132 **Joyner, James and Edward W. Chester.** (Austin Peay State University) The wetland vascular flora of Cross Creeks National Wildlife Refuge, Stewart County, Tennessee.
- 2:45 133 **Kennemore, Douglas E., Brent S. Long, and John B. Nelson.** (University of South Carolina) Floristic survey and rare plants of Fort Jackson Army Installation, SC.
- 3:00 134 **Small, Virginia L. and B.E. Wofford.** (University of Tennessee) Vascular flora of Pickett State Park and Forest, Pickett and Fentress counties, Tennessee.
- 3:15 BREAK
- 3:30 135 **Wyrick, Daniel and B.E. Wofford.** (University of Tennessee) Vascular flora of Gee Creek Wilderness, Tennessee.
- 3:45 136 **Hyatt, Philip E.** (Sylamore Ranger District, Ozark National Forest) A survey of the vascular flora of Baxter County, Arkansas.
- 4:00 137 **Stark, T.J., and D.K. Evans.** (Marshall University) The flora of Green Bottom Wildlife Management Area, middle Ohio River floodplain.
- 4:15 138 **Hardin, James W.** (North Carolina State University) Foliar micromorphology of the U.S. Sapotaceae.
- 4:30 139 **Anderson, Loran C.** (Florida State University) Are *Arnoglossum* and *Yermo* congeneric? Anatomical and morphological considerations.
- 4:45 140 **Evans, D.K. and D.W. Chaffin.** (Marshall University) Plants used as fish poisons by the Shuar and Achuar of southeastern Ecuador.
- 5:00 141 **Rodgers, John C. III and Sally P. Horn.** (University of Tennessee) Modern pollen rain in Costa Rica.

ICHTHYOLOGY AND HERPETOLOGY, Session 1 - Oceans

- Presiding: *Kenneth Dodd*, National Ecology Research Center, USFWS
- 1:30 142 **Cody, Richard P.** (Museum of Natural Science, Louisiana State University) Behavioral ecology of the black caboso, *Mauligobius maderensis*.
- 1:45 143 **Holt, J.C., K.M. Tolson, and N.H. Douglas.** (Northeast Louisiana University) Use of carapace dimensions in the alligator snapping turtle, *Macrolemys temminckii*, to project body weight.
- 2:00 144 **Schmitt, Emily F. and Brian S. Masters** (Towson State University) Implementation of Random Amplification of Polymorphic DNA (RAPD) Technology in the Genetic Analysis of Yellow Perch (*Perca flavescens*) Populations in the Chesapeake Bay.
- 2:15 145 **Slack, William T., Stephen T. Ross and James M. Huebner.** (University of Southern Mississippi) Floodplain use in a Mississippi low order blackwater stream.
- 2:30 146 **Schwartz, F.J.** (Institute of Marine Sciences, University of North Carolina) External leech and monogenetic trematode parasites of some Elasmobranchs captured off North Carolina.
- 2:45 147 **Brenneman, William M.** (Indiana University of Pennsylvania) Larval abundance and reproductive timing in a south Mississippi headwater cyprinid assemblage.
- 3:00 BREAK
- 3:15 148 **Settle, Lawrence R.** (NOAA, National Marine Fisheries Service, Beaufort Laboratory) Spatial and temporal variability in the distribution and abundance of juvenile fishes associated with pelagic Sargassum.
- 3:30 149 **Mills, Glenn R. and Thomas K. Pauley.** (Marshall University) Seasonal analyses of stream substrate utilization and prey selection of *Desmognathus quadramaculatus* (Holbrook) in the northern most periphery of its range.

- 3:45 150 **McGuire, William R., William S. Woolcott and Eugene G. Maurakis.** (University of Richmond) Relation of epidermal morphology to breeding behavior in cyprinid fishes.

FRIDAY MORNING, 16 APRIL

SYMPOSIUM - Beach Club B

THE MINORITY THRUST:

TODAY AND TOMORROW

Organized by the ASB Minorities, Women and Handicapped Committee

- 9:00 - 10:30 Featured Speaker: Dr. Clarice Gaylord, Deputy Director, Environmental Equity Office, EPA.

PLANT ECOLOGY, Session 3 - Captains Table A

- Presiding: *Paul Schmalzer*, Bionetics Corp., Kennedy Space Center
- 8:00 151 **Nowlin, M.K. and F.S. Gilliam** (Marshall University) Effects of wildfire on the herbaceous layer of a southwestern West Virginia mixed hardwood forest.
- 8:15 152 **Nash, D.R., M.K. Nowlin, C. Vannatter, and F.S. Gilliam** (Marshall University) Bryophyte response to wildfire in a southwestern West Virginia mixed hardwood forest.
- 8:30 153 **Aulick, S.D., F.S. Gilliam, D.K. Evans and M.B. Adams** (Marshall University and Fernow Experimental Forest) Factors influencing herbaceous layer communities in a central Appalachian mixed hardwood forest.
- 8:45 154 **Turrill, N.L., F.S. Gilliam, and M.B. Adams** (Marshall University and Fernow Experimental Forest) Autogenic and allogenic controls of herb cover in mature and young stands of a central Appalachian hardwood forest.
- 9:00 155 **Gilliam, F.S., N.L. Turrill, and M.B. Adams** (Marshall University and Fernow Experimental Forest) Species composition of young vs. mature montane hardwood forests of West Virginia.

- 9:15 156 **Barden, Lawrence S.** (University of North Carolina, Charlotte) Differential plant productivity under equal cumulative light on the east and west sides of a forest canopy gap.
- 9:30 157 **Collins, B. and G. Wein** (Memphis State University and Savannah River Ecology Lab) Oldfield community responses to frequency and intensity of clipping.
- 9:45 **BREAK**
- 10:00 158 **Schildt, Amy and James Fralish** (Southern Illinois University) A study of presettlement forest in the Southern Coastal Plain Region of Illinois.
- 10:15 159 **Snyder, Pam and James Fralish** (Southern Illinois University) A study of oak re-establishment in clearcut forest at Land Between The Lakes, KY and TN.
- 10:30 160 **Strazzante, Lisa and James Fralish** (Southern Illinois University) Encroachment of *Acer saccharum* into the oak communities of the Ozark Hills region of Illinois.
- 10:45 161 **Franklin, Scott B., Philip A. Robertson, James S. Fralish and Stephan M. Kettler** (Southern Illinois University and Colorado Natural Heritage Program Boulder) Stratum analysis for separating successional from compositionally-stable stands.
- 11:00 162 **Philippi, Thomas E., Robert K. Peet, and Norman L. Christensen** (University of North Carolina, Chapel Hill and Duke University) Tree seedling demography in old-field *Pinus taeda* and mature mixed hardwoods stands in a Piedmont forest.
- 11:15 163 **Little, Jackie A. and John Rennie** (University of Tennessee) Impact of Hurricane Donna (1960) on the mangrove forest, Shark River, Everglades National Park.

TEACHING UPDATE WORKSHOP - Coral Reef C

Sponsored by the Southeastern Section, Botanical Society of America

- 9:00 - 10:30 164 **Neufeld, Howard S.** (Appalachian State University) Modern Instrumentation for the Teaching of Plant Ecophysiology.

PARASITOLOGY, Session 2 - Coral Reef D

- Presiding: *R. Cole*, Auburn University and *C. Mars*, Southeastern Louisiana
- 8:00 165 **El Sawalhy, Ahmed A., James E. Hall, and J. Richard Seed** (University of North Carolina-Chapel Hill) In vivo catabolism of aromatic amino acids by *Trypanosoma brucei evansi*.
- 8:15 166 **Johnson, Sandra S. and George A. Conder** (Upjohn Laboratories) Development and use of a novel anthelmintic assay utilizing jirds (*Meriones unguiculatus*) infected with the ruminant nematode *Haemonchus contortus*.
- 8:30 167 **Oliver, James H. Jr., Francis W. Chandler, and M. Page Luttrell** (Georgia Southern University, Medical College of Georgia, and University of Georgia) First isolation and transmission of the Lyme disease spirochete from southeastern United States.
- 8:45 168 **Butts, Jeffrey A., Vanya M. Greene, and Elizabeth B. Harris** (Appalachian State University) Prevalence of *Dirofilaria immitis* in Adjacent Counties in Northwestern North Carolina.
- 9:00 169 **Allman, C., B. Dowell, and J. Joy** (Marshall University) Mosquitoes of Western West Virginia.
- 9:15 170 **Duobinis-Gray, Leon F., Sheila Witt, and Edmund Zimmerer** (Murray State University) Detection of the causative agent of Lyme disease, *Borrelia burgdorferi*, in various tick hosts from mammals in western Kentucky utilizing the polymerase chain reaction technique.
- 9:30 171 **Ribeiro-Rodrigues, R., B.J. Bogitsh, and C.E. Carter** (Vanderbilt University) An ultrastructural study of *Trypanosoma cruzi* reservosomes during *in vitro* metacyclogenesis.
- 9:45 **BREAK**
- Presiding: *R. Pinckney*, Auburn University and *V. Diderrich*, University of Tennessee
- 10:00 172 **Dowell, B. and J. Joy** (Marshall University) A preliminary report of *Glythelmins quieta* (Trimatoda: Digena) from the spring peeper, *Pseudacris crucifer*, in Western West Virginia.

- 10:15 173 **Tilahun, Getachew and Sharon Patton** (Addis Ababa University, Ethiopia and University of Tennessee College of Veterinary Medicine) Serological studies on *dictyocaulus filaria* vaccine.
- 10:30 174 **Joy, J., E. Madan, and J. Harmon** (Marshall University) *Potamilus alatus* (Mollusca: Uniionidae) glochidia-induced histopathology in freshwater drum, *Aphodinotus grunniens*, from the Kanawha River, West Virginia.
- 10:45 175 **Faulkner, Charles T. and Sharon Patton** (University of Tennessee College of Veterinary Medicine) Parasitic infections of Mexican Indians and domesticated livestock in the State of Nayarit, Mexico: A preliminary study.
- 11:00 176 **Patton, Sharon, Clark S. Patton, Stewart Powell, and R.L. Glenn** (University of Tennessee College of Veterinary Medicine and Pellissippi Animal Hosptal) *Trichinella spiralis* in domestic dogs.
- 11:15 177 **Blagburn, Byron L., David S. Lindsay, Lisa C. Parsons, and Natasha S. Rippey** (Auburn University) Diclazuril inhibits development of *Cryptosporidium parvum* in Hsd:(ICR)BR Swiss and BALB/c mice.
- 11:30 178 **Lindsay, David S., Paul C. Smith, Frederic J. Hoerr, and Byron L. Blagburn** (Auburn University) Prevalence of encysted *Toxoplasma gondii* in wild turkeys and raptors from Alabama.

ICHTHYOLOGY AND HERPETOLOGY, Session 2 - Coral Reef E

- Presiding: *Don Forester*, Towson State University
- 8:00 179 **Forester, Don C. and Robert W. Miller.** (Towson State University) Distribution of the gray tree frogs, *Hyla chrysoscelis* and *Hyla versicolor* in Maryland.
- 8:15 180 **Baugh, Julia R.** (Towson State University) Territorial prior residence effect in the dart-poison frog, *Dendrobates pumilio*.
- 8:30 181 **Parkinson, Christopher L.** (University of Louisville) A Thermal Denaturation Study of Genomic DNAs of *Coluber Constrictor*.

- 8:45 182 **Dodd, C. Kenneth, Jr.** (National Ecology Research Center USFWS) Population structure of eastern narrow-mouthed toads during prolonged drought.
- 9:00 183 **Maurakis, Eugene and William Woolcott.** (University of Richmond) Agonistic behavior in *Nocomis* species: A test of the dear enemy phenomenon and cooperation defense coalitions.
- 9:15 184 **Bailey, Jeffrey E. and Thomas K. Pauley.** (Marshall University) Aspects of the natural history of the Cumberland Plateau salamander, *Plethodon kentucki*, in West Virginia.
- 9:30 185 **Pauley, Thomas K., Jeffrey E. Bailey, and James Kochenderfer.** (Marshall University and Fernow Experimental Forest) Impacts of herbicides and timbering operations on *Plethodon cinereus* (redback salamander) in northcentral West Virginia.
- 9:45 BREAK
- 10:00 186 **Ordiway, Linda D. and Thomas K. Pauley.** (Marshall University) A study of habitat selection between two salamanders: *Desmognathus ochrophaeus* and *Plethodon cinereus*.
- 10:15 187 **Caschetta, Abby R. and James H. Howard.** (Frostburg State University) Silvicultural effects on herptile abundance and diversity in western Maryland.
- 10:30 188 **Schmitt, Emily F. and Virginia C. Leslie.** (Towson State University and Rice University) A Comparison of Video Versus Visual Sampling Techniques to Assess the Abundance of Snappers (Family Lutjanidae) and Groupers (Family Serranidae) on Shallow Water Reefs.
- 10:45 189 **Burke, Vincent J.** (Savannah River Ecology Laboratory) The extended nesting phenomenon of common mud turtles, *Kinosternon subrubrum*.
- 11:00 190 **Koons, John and A. Floyd Scott.** (Jackson State Community College and Austin Peay State University) Summer Movements of Native and Introduced Alligator Snapping Turtles, *Macroclémys temminckii*, in Kentucky Lake.
- 11:15 191 **Rutherford, Nicolle R.** (Coastal Carolina College) Effects of nest relocation and beach microenvironment on loggerhead turtle nesting success.

PLANT PHYSIOLOGY AND PLANT ECOLOGY -
Coral Reef B

- Presiding: *Lytton Musselman*, Old Dominion University
- 8:00 192 **West, Traycie, H.G. Marshall and P.A. Tester.** (Old Dominion University and NOAA, Southeast Fisheries Sciences Center, Beaufort, N.C.) Phytoplankton assemblages associated with a bloom of *Ptychodiscus brevis* (*Gymnodinium breve*) off the North Carolina coast.
- 8:15 193 **Seaborn, David, Karen Soucek and H.G. Marshall.** (Old Dominion University) Phytoplankton composition and concentrations in the Pagan River, Va.: Preliminary results.
- 8:30 194 **Dillard, Gary E. and Nancy S. Dawson.** (Western Kentucky University) *Stephanosphaera pluvialis*, Cohn (Chlorophyceae: Volvocales) from Kentucky.
- 8:45 195 **Beard, Charles E. and Thomas M. McInnis, Jr.** (Clemson University) Amino acids and sugar alcohols as osmotica in the salt tolerant fungus, *Lagenidium callinectes* Couch.
- 9:00 196 **Chaffin, D.W., D.K. Evans, R. Deal, and M.A. Harrison.** (Marshall University and Shawnee State University) Internal secretory anatomy in leaves and involucre bracts of *Clibadium asperum* (Aubl.) DC. (Asteraceae).
- 9:15 197 **Musselman, Lytton J. and David A. Knepper.** (Old Dominion University, and U.S. Army Corps of Engineers, Norfolk District) Apogamy in *Isoetes*.
- 9:30 198 **Knepper, David A. and Lytton J. Musselman.** (U.S. Army Corps of Engineers, Norfolk District and Old Dominion University) The quill-worts (*Isoetes*) of Virginia.
- 9:45 BREAK
- 10:00 199 **Mickle, James E.** (North Carolina State University) Fossil fertile marattiacean fern foliage from the Wolfcampian of Texas.
- 10:15 200 **Frederick, Lafayette.** (Howard University) An

interesting *Enteridium* and some other myxomycetes from bark of *Taxodium*.

- 10:30 201 **Summers, Jevene M., David S. Hockey and Robert B. Jonas.** (George Mason University) Analysis of thymidine incorporation in estimating bacterial production.
- 10:45 202 **Hill, Suzanne M.** (Virginia Polytechnic Institute and State University) The heat tolerance response of the shale barren endemic *Eriogonum alleni*.
- 11:00 203 **McKenna, Mary A. and Natama N. Summers.** (Howard University) Effects of simulated acid rain on growth and reproduction in alpine plant communities.

FRIDAY AFTERNOON, 16 APRIL

CHESAPEAKE BAY ECOLOGY - Coral Reef C

- Presiding: *Susanne Wendker*, Old Dominion University
- 2:00 204 **Alden, Raymond W. III.** (Applied Marine Research Laboratory, Old Dominion University) Long-term trends in the lower Chesapeake Bay: statistical approaches for water quality and biological monitoring assessments.
- 2:20 205 **Alden, Raymond W. III, R. Michael Ewing, and Steven W. Sokolowski.** (Applied Marine Research Laboratory, Old Dominion University) Long-term trends in the lower Chesapeake Bay: water quality.
- 2:40 206 **Dauer, Daniel M.** (Old Dominion University) Long-term trends in the lower Chesapeake Bay: Benthos.
- 3:00 207 **Birdsong, R.S. and R.W. Alden III.** (Old Dominion University) Long term trends in the lower Chesapeake Bay: mesozooplankton.
- 3:20 BREAK
- 3:35 208 **Marshall, H.G. and R.W. Alden.** (Old Dominion University) Long term trends in the lower Chesapeake Bay: Phytoplankton.
- 3:50 209 **Madden, Jeffrey, Karen Soucek and H.G. Marshall.**

- (Old Dominion University) The comparison of seasonal phytoplankton populations in the lower Chesapeake Bay: 1990-1992.
- 4:05 210 **Weinstein, Mollie, Jeffrey Madden and H.G. Marshall.** (Old Dominion University) Seasonal autotrophic picoplankton concentrations in the lower Chesapeake Bay: 1990-1991.
- 4:20 211 **Nesius, Kneeland K. and Harold G. Marshall.** (Old Dominion University) Seasonal Productivity Study in three Estuarine River Systems of the Lower Chesapeake Bay.
- 4:35 212 **Wendker, S.M. and H.G. Marshall.** (Old Dominion University) Primary production of microalgal communities on mudflats in the lower Chesapeake Bay: Preliminary results.
- 4:50 213 **Marshall H.G. and Karen Soucek.** (Old Dominion University) Red tide blooms in the lower Chesapeake Bay: September 1992.
- 5:05 214 **Park, Gyung-Soo and H.G. Marshall.** (Old Dominion University) Microzooplankton representation within the lower Chesapeake Bay and in three tidal rivers: Preliminary results.

TEACHING BIOLOGY - Coral Reef D

- Presiding: *Dean Cocking*, James Madison University
- 2:00 215 **Mills, Edward and James W. Hall.** (Wingate College) An acid rain model for the biology laboratory.
- 2:15 216 **Nussbaum, Francis E.** (Kent State University: Tascaras Campus) Another look at undergraduate writing assignments.
- 2:30 217 **Lykins, Kathryn V.** (Shorter College) The "musical" method of teaching classification.
- 2:45 218 **Weiss, Edward and Harold Cones.** (Christopher Newport University) Taking Biology Beyond: A Multidisciplinary Field Experience.

- 3:00 219 **Baker, S.C., M.E.B. Carter, H.F. Sharp, Jr. and T.R. Wade.** (Oxford College, Emory University) Improving ecology in education: a teacher enhancement workshop.

PLANT ECOLOGY, Session 4 - Coral Reef E

Presiding: *Donald Young*, Virginia Commonwealth University

- 2:00 220 **Semones, Shawn W., David L. Erickson, Donald R. Young.** (Virginia Commonwealth University) Salinity, water relations and zonation of three common barrier island shrubs.
- 2:15 221 **Erickson, David L. and Donald R. Young.** (Virginia Commonwealth University) Oceanic transport and barrier island colonization by *Strophostyles umbelata*.
- 2:30 222 **Young, Donald R.** (Virginia Commonwealth University) Spatial and temporal growth dynamics of *Myrica* shrub thickets on Virginia barrier islands.
- 2:45 223 **Conn Thomas, Christine E. and Frank P. Day.** (Old Dominion University) Environmental influences on belowground decomposition rates along a barrier island chronosequence of ridge and swale formations.
- 3:00 224 **Stevenson, Mark and Frank P. Day.** (Old Dominion University) Fine root production along a chronosequence of barrier island communities.
- 3:15 BREAK
- 3:30 225 **Lakshmi, Bharatha and Frank P. Day.** (Old Dominion University) Soil nitrogen levels and mineralization along a community chronosequence on a coastal barrier island.
- 3:45 226 **Weber, Everett P. and Frank P. Day.** (Old Dominion University) The effect of nitrogen fertilization on the phenology of roots in a barrier island dune ecosystem: a minirhizotron analysis.

- 4:00 227 **Imm, Donald W. and Kenneth W. McLeod.** (Savannah River Ecology Laboratory, University of Georgia) Patterns of plant diversity and community structure in an upper coastal plain forest.
- 4:15 228 **McLeod, Kenneth W.** (Savannah River Ecology Laboratory, University of Georgia) Bottomland forest restoration.
- 4:30 229 **Hupp, Cliff R., Thomas M. Yanosky and Courtney T. Hackney.** (U.S. Geological Survey and University of North Carolina at Wilmington) Estuarine saltwater intrusion estimated from chloride in growth rings of bald cypress, *Taxodium distichum* (L.) Rich., in coastal wetlands.
- 4:45 230 **Atkinson, Robert B., David Jones, and John Cairns, Jr.** (Virginia Polytechnic Institute and State University) Ecology of accidental wetlands and implications for wetland creation on surface-mined lands.
- 5:00 231 **Shaffer, Gary P., Daniel W. Llewellyn, Nancy Jo Craig, Lisa A. Creasman, David Pashley and Mark Swan.** (Southeastern Louisiana University and The Nature Conservancy, LA.) Restoration of the Mississippi River Alluvial Floodplain as a network of functional ecosystems.
- 5:15 232 **Schmalzer, Paul A.** (The Bionetics Corporation, NASA, Biomedical Operations and Research Office, John F. Kennedy Space Center) Composition and structure of long unburned oak-saw palmetto scrub.

ANIMAL ECOLOGY -Coral Reef B

Presiding: *Robert Rose*, Old Dominion University

- 2:00 233 **Barry, Ronald E.** (Frostburg State University) Synchronous parturition of two syntopic species of hyrax in the Matobo National Park, Zimbabwe.
- 2:15 234 **Klenzendorf, Sybille, Luther Brown, and Brian Holmes.** (George Mason University and National Park Service) Bear-human interactions in Katmai National Park.

- 2:30 235 **Hilburn, Robert L.** (Coker College) Differences in pre-nesting activities of subadult and adult males of orchard orioles, *Icterus spurius*.
- 2:45 236 **Britson, Carol A. and Robert E. Kissell, Jr.** (Memphis State University and Montana State University) Effects of flood type on developmental characteristics of an ephemeral pond-breeding anuran, *Pseudacris triseriata feriarum*.
- 3:00 237 **Yeomas, S. Rebecca.** (University of Georgia/Savannah River Ecology Laboratory) Turtle orientation: field tests of a water-finding ability in adult aquatic turtles.
- 3:15 **BREAK**
- 3:30 238 **Appelget, Jeannie, and Wayne Van Devender.** (Appalachian State University) Distribution of Small Mammal Communities in northwestern North Carolina and effectiveness of sampling procedures.
- 3:45 239 **Greenberg, Cathryn H., Daniel G. Neary, and Larry D. Harris.** (USDA Forest Service and University of Florida, Gainesville, FL.) A comparison of herpetofaunal communities in catastrophically burned, clearcut, and mature sand pine scrub.
- 4:00 240 **Wilson, R. Gayle, Wade B. Worthen, and Sara Mayrose.** (Erskine College and Furman University) The effects of ant predation, larval density, and soil moisture on the survival of *Drosophila tripunctata* larvae.
- 4:15 241 **Mayrose, Sara, Wade B. Worthen, and R. Gayle Wilson.** (Furman University and Erskine College) The effects of ant predation, larval density, and soil moisture on the structure of mycophagous fly communities.
- 4:30 242 **Winstead, Joe E. and Kevin Peveler.** (Western Kentucky University) Insects, seral stages, elemental analysis and caloric value patterns in terrestrial ecosystems of Kentucky and Tennessee.

- 4:45 243 **Miller, Kimran E. and Harold Gouzoules.** (Emory University) Skeptical responding in rhesus macaques (*Macaca mulatta*).
- 5:00 244 **Blaylock, Robert A.** (National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory) National Marine Fisheries Service Marine Mammal Research in the South-eastern United States and the Southeast Marine Mammal Stranding Network.
- 5:15 245 **Lynch, Tracy K.** (Savannah River Ecology Laboratory) Ecology of ground skinks (*Scincella lateralis*) in South Carolina.

PLANT ECOLOGY, Session 5 - Coral Reef D

- Presiding: *Jerry Baskin*, University of Kentucky
- 3:30 246 **Ulrey, Chris J. and Donald E. McLeod.** (Mars Hill College) Vegetation Patterns and Diversity along Environmental Gradients of the Craggy Mountains of Western North Carolina.
- 3:45 247 **Smith, Gerald L., D. Brent Joye, and Walter S. Flory.** (High Point University and Wake Forest University) Studies on *Hymenocallis occidentalis* (Le Conte) Kunth.
- 4:00 248 **McLeod, Donald E. and Chris J. Ulrey.** (Mars Hills College) Attributes of Old Growth Mixed Mesophytic Forests of the Southern Appalachians.
- 4:15 249 **Stewart, C. Neal, Jr.** (Virginia Polytechnic Institute & State University) Phylogeny of cranberry (*Vaccinium macrocarpon*) populations from random amplified polymorphic DNA (RAPD) data.
- 4:30 250 **Abbott, J. Richard and Ralph L. Thompson.** (Berea College) A relict colony of coastal plain species on the eastern Mississippian Plateau in Pulaski County, Kentucky.

BETA BETA BETA
SOUTHEASTERN DISTRICT I, Captains Table A

- 1:00 251 **Buckley, Kevin.** (Tau Rho, St. Andrews Presbyterian College) Human Chromosome Analysis Using Restriction Endonucleases and Scanning Electron Microscopy.
- 1:15 252 **Battle, T.E. and T.W. Snell.** (Sigma Beta, Georgia Institute of Technology) Biochemical Characterization of the Mate Recognition Pheromone from *Brachionus plicatilis* (Rotifera).
- 1:30 253 **Buntin, Kim.** (Sigma Psi, Florida Institute of Technology) The effects of temperature and salinity on the Growth of *Macrobachium rosenbergii* Postlarvae.
- 1:45 254 **Frodyma, Michael E. and Alan C. Leonard.** (Sigma Psi, Florida Institute of Technology) In vivo footprinting the *Escherichia coli* Chromosome's Replication Origin.
- 2:00 255 **Napp, Teresa.** (Sigma Psi, Florida Institute of Technology) Effects of Temperature and Salinity on the Survival of Pink Shrimp, *Penaeus duorarum*.
- 2:15 256 **Nichols, Carol and Ryan Walley.** (Kappa Alpha, Shorter College) The Effects of Nicotine on the Embryonic Development of *Oryzias latipes* (a killifish).

BETA BETA BETA
SOUTHEASTERN DISTRICT II - Location to be announced

- 1:00 257 **Hix, Raymond.** (Beta Zeta, The University of North Alabama) Determining the metabolic status of microbial populations in polluted sediments using TLC-FID lipid analysis.
- 1:15 258 **Pellegrin, Dana M.** (Eta Lambda, Loyola University/New Orleans) Genetic variation in U.S. populations of *Phragmites australis*.

- 1:30 259 **O'Connell, Patrick H.** (Eta Lambda, Loyola University/New Orleans) Isozyme variation of the common reed in the Mississippi River delta.
- 1:45 260 **Vaglia, Janet L.** (Pi Delta Chapter, East Tennessee State University) How to get bigger: a comparison of skull development of two salamander species (genus *Desmognathus*).
- 2:00 261 **Walchak, Patty.** (Mu Gamma, Western Kentucky University) Interleukin-2 production in *Trypanosoma cruzi* infected mice maintained at elevated environmental temperature.
- 2:15 262 **Bodet, Valeria C. and Christopher J. Danner.** (Eta Lambda, Loyola University/New Orleans) Isolation of Organellar Genomes from the Chromophytic algal Genus *Synura*.
- 2:30 263 **Davis, Stephen E., M.D. Quillen, B.C. Reeder and F.H. Sklar** (Beta Upsilon, Georgetown College, Morehead State University and University of South Carolina) Advective Flux of Nutrients in Tidal Creeks of North Inlet, South Carolina.

Author Index for Paper, Poster, and Abstract Number

- | | | |
|--|---|---------------------------------------|
| Abbott, J. Richard -
250 | Blagburn, Byron L. -
121, 123, 177,
178 | Chester, Edward W. -
28, 94, 132 |
| Adams, Mary Beth -
15, 153, 154,
155 | Blaker, William - 76 | Christensen, N. - 162 |
| Adams, Harold S. -
15 | Blaylock, Robert A. -
244 | Clebsch, Edward E.C.
- 30, 87 |
| Ahuja, Neeraj S. - 96 | Blum, Udo - 18 | Cody, Richard P. -
142 |
| Alden, Raymond W. -
204, 205, 207,
208 | Bodet, Valeria C. -
262 | Cole, Rebecca A. -
121 |
| Allison, James R. -
90 | Bogitsh, B.J. - 171 | Coleman, Douglas A.
- 128 |
| Allman, C. - 169 | Brenneman, W. - 147 | Collins, B. - 31, 157 |
| Alvarez, Xavier - 40 | Brewer, Gwen - 22 | Conder, George A. -
166 |
| Anderson, Roger C. -
82 | Britson, Carol A. -
236 | Cones, Harold - 218 |
| Anderson, Loran C. -
131, 139 | Brown, Luther P. -
102, 103, 104,
234 | Conn-Thomas, C.E. -
223 |
| Ansari, A.A. - 43 | Buckley, Kevin - 251 | Cook, R.A. - 87 |
| Apfelbaum, S. - 27 | Bulow, Frank J. - 114 | Copp, Stephen L. Jr.
- 102, 103 |
| Appelget, Jeannie -
238 | Buntin, Kim - 253 | Craig, Nancy Jo - 231 |
| Assadi-Rad, Amir -
122 | Burke, Vincent - 189 | Creasman, Lisa A. -
231 |
| Atkinson, R. B. - 230 | Butts, Jeffrey A. - 168 | Daniels, Katie L. -
113 |
| Aulick, S.D. - 153 | Byrd, Pamela - 47 | Danner, Christopher
- 262 |
| Bailey, Jeffrey E. -
184, 185 | Cairns, Jr., John - 230 | Datta, Attin - 12 |
| Baker, S.C. - 219 | Carpenter, Thomas -
102, 103 | Dauer, Daniel M. -
206 |
| Barden, Lawrence S. -
156 | Carrick, Kevin M. -
17 | Davis, Elaine J. - 41,
38 |
| Barry, Ronald E. -
233 | Carstensen, Susan M.
- 84 | Davis, Stephen E. -
263 |
| Baskin, Carol C. - 28,
94 | Carter, C.E. - 171 | Davis, Jennifer J. - 74 |
| Baskin, Jerry M. - 28,
94 | Carter, M.E.B. - 219 | Davis, Sara R. - 126 |
| Battle, T.E. - 252 | Caschetta, Abby R. -
187 | Dawson, Nancy S. -
194 |
| Baugh, Julia R. - 180 | Caspersen, John - 14 | Day, Frank P. - 223,
224, 225, 226 |
| Beard, Charles E. -
195 | Chaffin, D.W. - 140,
196 | Deal, R. - 196 |
| Birdsong, R.S. - 207 | Chafin, Dan - 109 | Delesalle, Veronique
- 92 |
| | Chandler, Francis -
167 | |
| | Chen, Dillion T. - 19 | |
| | Cherry, Donald S. -
101, 107, 108 | |

- DeSelm, H.R. - 26
 Dewel, William - 61
 Dewel, Ruth A. - 65
 Diderrich, V. R. - 124
 Dillard, Gary E. - 194
 Dodd, C. Kenneth, Jr.
 - 182
 Doetsch, Paul W. - 39
 Douglas, N.H. - 143
 Dowell, B. - 169, 172
 Dubey, J.P. - 48, 121,
 123
 Dudley, Peter G. - 34
 Duff, Robert J. - 69
 Duobinis-Gray, Leon
 - 170
 El Sawalhy, Ahmed -
 165
 Ely, Joseph S. - 35,
 58
 Emery, Erich B. -
 109, 112
 Eribo, Broderick - 12
 Erickson, David L. -
 220, 221
 Esch, G. W. - 115,
 117
 Evans, D.K. - 35, 58,
 97, 109, 137,
 140, 153, 196
 Ewing, R. Michael -
 205
 Faber-Langendoen,
 D. - 77
 Farris, J.L. - 107
 Faulkner, Charles -
 175
 Fayer, Ron - 49
 Ferguson, Ron - 13
 Finlay, Mary F. - 73
 Finley, R.L. - 127
 Fischer, J.C. - 107
 Fisher, Hope - 12
 Flory, Walter S. - 247
 Flowers, James R. -
 64
 Font, William F. -
 118
 Forester, Don C. - 9,
 72, 179
 Fralish, James - 158,
 159, 160, 161
 Franklin, Scott B. -
 61
 Frederick, Lafayette -
 19, 200
 Fredericksen, Todd S.
 - 16, 98
 Fritz, J. Douglas -
 114
 Frodyma, Michael -
 254
 Fuss, Carolyn L. -
 100
 Garman, Greg C. - 20
 Garrison, N.E. - 99
 Gazzera, Silvia B. -
 20
 Gilliam, F.S. - 97,
 151, 152, 153,
 154, 155
 Glass, Jonathan - 40
 Glenn, R.L. - 176
 Glover, James B. -
 106
 Gouzoules, Harold -
 243
 Graham, B. - 105
 Graves, James H. - 29
 Green, Becky L. - 71
 Greenberg, Cathryn -
 239
 Greene, Vanya M. -
 168
 Griffin, Martha - 13
 Hackney, Courtney T.
 - 229
 Hale, Gilbert - 60
 Hall, James E. - 119,
 165
 Hall, James W. - 215
 Halpin, T.R. - 105
 Haney, Alan - 27
 Hardin, James W. -
 138
 Hargrave, B. Y. - 10
 Harmon, J. - 174
 Harris, Elizabeth B. -
 168
 Harris, Larry D. - 239
 Harrison, Marcia -
 109, 196
 Hayes, Tim P. - 110
 Heard, R.W. - 105
 Hedden, Roy L. - 16
 Hedgecock, Ashlee A.
 - 66
 Heikens, Alice Long -
 80, 83
 Henson, Richard N. -
 46, 66
 Herndon, James G. -
 7
 Hickox, T. - 31
 Hilburn, Robert L. -
 235
 Hill, Suzanne M. -
 202
 Hines, G.A. - 5
 Hix, Raymond - 257
 Hoberg, Eric P. - 3
 Hockey, David S. -
 201
 Hoerr, Frederic J. -
 178
 Hollowell, Victoria -
 13
 Holmes, Brian - 234
 Holt, J.C. - 143
 Homoya, Michael -
 25
 Hopkins, T.S. - 5
 Horn, Sally P. - 141
 Howard, James H. -
 187
 Hoyt, Robert D. - 6
 Huebner, J. M. - 145
 Hull, James C. - 33
 Hupp, Cliff R. - 229
 Hustad, Heather - 61
 Hutchison, M. D. - 24
 Hyatt, Philip E. - 136
 Imm, Donald W. -
 227

- Johnson, Sandra - 166
- Jonas, Robert B. - 102, 103, 104, 201
- Jones, Thomas G. - 111
- Jones, Ronald L. - 129
- Jones, David - 230
- Jones, William D. - 91
- Joy, J. - 169, 172, 174
- Joye, D. Brent - 247
- Joyner, James - 132
- Keku, T.O. - 120, 125
- Kennemore, Douglas - 133
- Ketron, Donna W. - 55
- Kettler, Stephan M. - 161
- Kightlinger, Lon K. - 116
- Kissell, Jr., Robert E. - 236
- Klenzendorf, Sybille - 234
- Knepper, David A. - 197, 198
- Kochenderfer, J. - 185
- Kokkala, Irene - 6
- Koons, John - 190
- Lakshmi, Bharatha - 52, 225
- Lamont, E.E. - 130
- Lauro, Stacie - 43
- Lawrence, David M. - 15
- Lehman, Mary - 18
- Leonard, Alan C. - 254
- Leslie, Virginia C. - 188
- Leys, Charles H. - 128
- Lichtenfels, J. R. - 1
- Lightfoot, David A. - 37
- Lincoln, David E. - 8
- Lindsay, David S. - 121, 177, 178, 123
- Little, Jackie A. - 163
- Llewellyn, Daniel - 231
- Long, Brent S. - 133
- Lushbaugh, William - 126, 127
- Luttrell, M. Page - 167
- Lykins, Kathryn V. - 217
- Lynch, Tracy K. - 245
- Lynde, Stuart R. - 101
- Macarthur, K.J. - 9
- MacDonald, Dana D. - 78
- Madan, E. - 174
- Madden, Jeffrey - 209, 210
- Madigosky, Stephen - 40
- Mangurian, L.P. - 9
- Marion, K.R. - 5
- Mars, Chrystal L. - 118
- Marshall, Harold G. - 192, 193, 208, 209, 210, 211, 212, 213, 214,
- Masters, Brian S. - 72, 144
- Matthews, James F. - 55
- Maurakis, Eugene - 150, 183
- Mayrose, Sara - 240, 241
- McBee, Ann - 13
- McClintock, J.B. - 5
- McCoy, George - 73
- McDaniel, Kerrie L. - 37
- McGuire, William - 150
- McInnis, Jr., Thomas - 96, 195
- McKenna, Mary A. - 32, 203
- McKinney, Frank - 22
- McLachlan, James - 65
- McLeod, Kenneth W. - 227, 228
- McLeod, Donald E. - 246, 248
- Meade, John C. - 126
- Menhinick, Edward - 21
- Mickle, James E. - 199
- Miller, Annette R. - 44
- Miller, Robert W. - 179
- Miller, Kimran E. - 243
- Miller, Grover C. - 64
- Miller, Christopher - 42
- Mills, Edward - 215
- Mills, Glenn R. - 149
- Mohamed, Kamal I. - 54
- Mohamood, Abdiaziz - 12
- Moore, Stephen E. - 114
- Moore, Edward L. - 112
- Mooreside, Peter D. - 92
- Mullins, Lee Ann - 63
- Muntan, Chad - 85, 86
- Musselman, Lytton J. - 54, 93, 197, 198
- Napp, Teresa - 255
- Nash, D.R. - 152

- Neary, Daniel G. - 239
- Neas, Aubrey O. - 128
- Nelson, John B. - 133
- Nelson, Diane R. - 59, 60
- Nesius, Kneeland K. - 211
- Neufeld, Howard S. - 36, 164
- Neves, Richard - 107, 108
- Newell, Claire L. - 88
- Nichols, Carol - 256
- Nickrent, D.L. - 51
- Nordmeyer, Dana L. - 7
- Norris, Rebecca - 52
- Nowlin, M.K. - 151, 152
- Nussbaum, Francis E. - 216
- O'Connell, Patrick H. - 259
- Oliver, James H. Jr. - 167
- Ordiway, Linda D. - 186
- Overstreet, R.M. - 105
- Park, Gyung-Soo - 214
- Parkinson, C. L. - 181
- Parnell, John - 85, 86
- Parsons, Lisa C. - 177
- Pashley, David - 231
- Patton, Clark S. - 176
- Patton, Sharon - 122, 124, 173, 175, 176
- Pauley, Eric F. - 30
- Pauley, Thomas K. - 149, 184, 185, 186
- Peet, Robert K. - 88, 162
- Pellegrin, D. M. - 258
- Perry, James W. - 23
- Petty, I.T.D. - 42
- Peveler, Kevin - 242
- Philippi, Thomas E. - 162
- Pinckney, R. D. - 123
- Pittman, Albert B. - 53
- Plyler, Daniel B. - 17
- Pollard, A. J. - 34
- Pons, Lara J. - 46
- Powell, Stewart - 176
- Powers, Nancy - 62
- Quillen, M.D. - 263
- Ramsey, Gwynn W. - 128
- Reeder, B.C. - 263
- Rennie, John - 163
- Reubush, Kym J. - 101
- Ribeiro-Rodrigues, R. - 171
- Rippey, Natasha S. - 177
- Robertson, Philip - 80, 97, 161
- Robinson, Gerald - 45
- Rodgers, John C. III - 141
- Roper, Jeannie M. - 101
- Ross, Stephen T. - 145
- Rowley, Heather J. - 6
- Rutherford, Nicolle - 191
- Sapp, Kelli K. - 115
- Schaffer, R.L. - 42
- Schildt, Amy - 158
- Schilling, E. E. - 69
- Schmalzer, Paul A. - 232
- Schmitt, Emily F. - 144, 188
- Schnabel, Andrew - 14
- Schwartz, F.J. - 146
- Schweginan, John - 82
- Scott, A. Floyd - 190
- Seaborn, David - 193
- Sedivec, Mathius J. - 46
- Seed, John R. - 116, 120, 125, 165
- Semones, Shawn W. - 220
- Settle, Lawrence R. - 148
- Shaffer, Gary P. - 231
- Sharitz, Rebecca - 14
- Sharp, Jr., H.F. - 219
- Shealy, Brent C. - 6
- Sklar, F.H. - 263
- Slack, William T. - 145
- Small, Virginia L. - 134
- Smith, Gerald L. - 247
- Smith, Paul C. - 178
- Smock, Leonard A. - 20, 100
- Snell, T.W. - 252
- Snyder, Pam - 159
- Sokolowski, Steven - 205
- Sorjonen, Donald - 121
- Soucek, Karen - 193, 209, 213
- Stalter, Richard - 130
- Stark, T.J. - 97, 137
- Steffens, Thomas A. - 104
- Stephenson, Steven - 15
- Stevens, C. E. - 128
- Stevenson, Mark - 224
- Stewart, C. Neal, Jr. - 249
- Stone, Susan Lyon - 75

- Stovall, Christina E. - 120
 Strazzante, Lisa - 160
 Stritch, Lawrence R. - 79
 Summers, Natama - 32, 203
 Summers, Jevene - 201
 Swan, Mark - 231
 Tarter, Donald C. - 59, 62, 63, 109, 110, 111, 112, 113
 Taylor, Lynn - 76
 Tester, P.A. - 192
 Thompson, Ralph - 250
 Tilahun, Getachew - 50, 173
 Tolson, K.M. - 143
 Toran, Eric - 38
 Tuberville, Tracey - 34
 Turrill, N.L. - 154, 155
 Tuttle, Robert H. - 119
 Tyler, Stacie - 70
 Tyndall, R. Wayne - 81
 Ulrey, Chris J. - 246, 248
 Vaglia, Janet L. - 260
 Van Devender, Wayne - 238
 Van Wart, William J. - 101
 Vandermeer, Robert - 4
 Vannatter, C. - 152
 Wade, T.R. - 219
 Walchak, Patty - 261
 Walck, Jeffrey L. - 95
 Walker, Gary L. - 66
 Waller, D. A. - 4
 Walley, Ryan - 256
 Watts, S.A. - 5
 Weakley, Alan S. - 229
 56, 57
 Weber, Everett P. - 226
 Webster, J.R. - 101
 Wein, G. - 157
 Weinstein, Mollie - 210
 Weiss, Edward - 218
 Wendker, S.M. - 212
 West, Traycie - 192
 West, K. Andrew - 80
 Westbrooks, Randy - 93
 Westmoreland, David - 85, 86
 Wetmore, Dawn J. - 39
 Wetzel, Eric J. - 117
 Wilcox, Thomas F. - 20
 Wilkerson, Charlie - 41
 Williams, Stephen - 16
 Williams, Arthur L. - 67, 68
 Williams, Ann C. - 67
 Williams, Ray S. - 8
 Wilson, R. Gayle - 240, 241
 Wiltshire, B. - 51
 Winstead, Joe E. - 242
 Wise, Dwayne A. - 47, 70, 71, 74
 Wisner, Susan K. - 89
 Witt, Sheila - 170
 Wofford, B.E. - 134, 135
 Woolcott, William - 150, 183
 Worthen, Wade B. - 240, 241
 Wright, R. A. S. - 128
 Wubah, D.A. - 11
 Wyrick, Daniel - 135
 Yanosky, Thomas -

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ABSTRACTS

1

LICHTENFELS, J. RALPH. Agricultural Research Service, Beltsville, MD--The Morphological Species

Biologists generally accept the biological species concept. As defined by Mayr (1963), "Species are groups of interbreeding natural populations that are reproductively isolated from other such groups". A systematist uses any and all available information when making specific determinations, but frequently only structural or morphological characters are available. When using morphological characters, the systematist must estimate the probability that morphological variants belong to different gene pools. Thus, characters must be evaluated for their stability under various environmental stresses. Observed variability must be evaluated as either intraspecific or interspecific. Although modern theoretical computerized methods have added to the systematists capabilities, a species is still what a knowledgeable systematist says that it is. The experience of the systematist with the group of organisms is the most important factor in species determinations. Examples will be presented of difficult species determinations among economically important nematode parasites of food animals.

2

ZARLENGA, DANTE S. Agricultural Research Service, Beltsville, MD--The Biochemical Species

Biochemical characteristics are employed for species determination usually when more conveniently observed characteristics are not available. For diagnoses, or identification of a specific genetic type, biochemical characters may be determined by personnel with no specialized knowledge of the organism. Commonly used biochemical characters are allozyme profiles and various methods of determining DNA structure. Allozyme profiles are considered to be a less direct assessment of the genotype than are studies of DNA. Furthermore, the latter are applicable to all life cycle stages of an organism. In studies of the classification of species, the systematist must evaluate biochemical characters like any others and distinguish between intraspecific and interspecific variability. He must know the organism and include the biochemical characters when making species level classification decisions. Various methods for obtaining DNA data will be described and advantages and disadvantages for species level systematics will be discussed.

3

HOBBERG, ERIC P. USDA, Agricultural Research Service, Biosystematic Parasitology Laboratory--Species and the phylogenetic perspective.

Application of phylogenetic systematics has resulted in a broadened view of species that subsumes the Biological Species Concepts (BSC) (Mayr, 1963). In particular, the BSC while recognizing the importance of species, has focused at the level of local populations rather than taxa, is nondimensional, and is only applicable to sexually reproducing organisms. As such, recognition of patterns of differentiation and evolutionary history of discernable populations is complicated by the definition of composite species and paraphyly. In contrast, the evolutionary or phylogenetic species concept (ESC) of Simpson (1961) and Wiley (1981) considers species as recognizable historical entities with continuity in time and linked by common ancestry rather than by reproductive isolation or the ability to interbreed. Species are represented by terminal taxa and species groups are monophyletic. Thus the ESC reintroduces history, provides an alternate means for determination of species boundaries and constitutes a definition that is nonarbitrary at the supraorganismal level. These concepts will be examined within the framework of helminth systematics.

4

WALLER, DEBORAH A.¹ and ROBERT K. VANDERMEER². Old Dominion University¹ and USDA-ARS, Gainesville, FL²--Biochemical identification of fire ants in Virginia.

Two species of fire ants were introduced into the southeastern US in the early 1900's. The red imported fire ant, Solenopsis invicta Buren, has expanded its range northward through reproductive flights and transport with nursery stock. The black imported fire ant, S. richteri Forel, remains restricted to the border between Mississippi and Alabama, but a viable invicta x richteri hybrid has colonized Alabama, Mississippi and Georgia. It is unknown whether cold northern temperatures will limit the spread of S. invicta and/or the hybrid. In the present study we examined the species identity of fire ants that have recently invaded the Tidewater area of Virginia and Richmond, the northernmost limit of their range. Biochemical analyses of venom alkaloids and cuticular hydrocarbons were used to separate

3. *invicta* from the hybrid because these ants are morphologically identical. Information resulting from this study will be useful in tracking the movement and establishment patterns of these important pests.

5

WATTS, S.A.¹, G.A. HINES¹, J.B. McCLINTOCK¹, K.R. MARION¹, and T.S. HOPKINS². University of Alabama at Birmingham¹ and University of Alabama²-- Chemical communication of echinoderms in marine communities.

The abundance of echinoderms in near shore and deep water communities has a highly significant impact on community structure. Understanding echinoderm intra- and inter-species chemical communication will increase our knowledge of processes which influence community structure in marine ecosystems. We have initiated studies to determine the production and influence of hormones and steroid-based pheromones from several species of echinoderms in the Gulf of Mexico. We have determined that: (1) echinoderms produce a variety of steroid metabolic products that are homologous to those found in vertebrates (androgens and estrogens) and that these hormones appear to regulate physiological processes such as reproduction; (2) several echinoderm species produce large quantities of water-soluble steroid conjugates that are considered to have pheromonal activity in other vertebrates (such as teleosts); and (3) some echinoderms produce 11-oxy androgens, which were previously found only in teleosts, suggesting a biochemical evolutionary link among these groups. These data suggest that these chemical signals regulate physiological processes within the organisms and influence the interactions of organisms within and among species. Knowledge of these biochemical signals can be used: (1) to predict and enhance mariculture production of economically-important echinoderms; (2) to chemically define developmental, reproductive and growth processes in echinoderms; and (3) to assess populations of organisms which might be modified by anthropogenic effects, including various sources of pollution.

6

ROWLEY, HEATHER J.,¹ BRENT C. SHEALY,¹ IRENE KOKKALA,¹ and ROBERT D. HOYT.² Furman University¹ and Western Kentucky University²-- Development of cephalic and lateral line neuromasts of the fathead minnow, *Pimephales promelas*.

Fathead minnows were reared from eggs, and larvae were collected at regular intervals over a 60 day period. The emergence and distribution of free neuromasts in prehatching and posthatching larvae was determined with the use of scanning electron microscopy. The first free neuromasts appeared in the cephalic region of prehatching larvae at approximately 60 hrs. after fertilization. The supraorbital,

infraorbital, premaxillary, opercular, mandibular and supraopercular neuromast lines appeared by 120 hrs. At 100 hrs. after fertilization neuromasts were distributed in a single row along the trunk lateral line and extended from the post cephalic region to the proximal portion of the caudal fin contrary to the incomplete lateral line observed in adults. By 600 hrs. multiple lines of free neuromasts were observed in the cephalic region and the number of neuromasts of each line had increased. A second row of transitory neuromasts appeared dorsal to the trunk lateral line. Trunk neuromasts appeared in association with scales, in groups of three or four, by 1350 hrs. Canal formation on the head began by 1560 hrs., with the appearance of pores in the premaxillary and infraorbital regions. Generally development of free and lateral line neuromasts followed patterns shown in other cyprinid fishes.

7

NORDMEYER, DANA L. and JAMES G. HERNDON. Emory University -- Female Influence on Male Seasonality in Rhesus Monkeys.

This study was designed to determine whether exposure to females and the opportunity to copulate influence the timing of the annual reproductive season in male rhesus monkeys. Beginning in October (early in the normal mating season), a control group of male monkeys (n=7) was tested twice a week with sexually receptive females and sexual behaviors were scored. In a second group (n=7), exposure to females was delayed until April, when this group was also tested with females. Thus, the delayed-exposure group was denied access to females until the very end of their normal breeding season, when sexual behavior was declining in the control group. The levels of sexual behavior and testis size in the two groups were compared to see if the delayed exposure to females postponed or prevented the seasonal cycle. In fact, the testis sizes of the two groups were synchronized during the normal breeding season. Further, when testing was begun in the delayed-exposure group, they showed levels of copulation comparable to the now declining levels of the controls. These findings suggest that the underlying mechanism of seasonality in male rhesus monkeys does not depend upon exposure to females.

8

WILLIAMS, RAY S. and DAVID E. LINCOLN. University of South Carolina-- Responses of sawfly larvae to elevated carbon dioxide grown pines.

The performance of second instar Red-headed Pine Sawfly, *Neodiprion lecontei*, fed needles of Loblolly Pine, *Pinus taeda*, grown under four levels of CO₂ was investigated. Feeding trials were conducted for 96 h. under ambient light and temperature. Relative growth rates were not affected by CO₂ treatment, while the relative consumption rate significantly increased on elevated CO₂ grown plants (P<0.0001). This response was strongly related to leaf nitrogen (N) content, which declined as CO₂ levels increased (P<0.0001). The decline at the highest CO₂ level could be attributed, in part, to a significant increase in

leaf starch (S) content. When expressed as a ratio of S:N, there was a step-wise significant increase as CO₂ levels rose. Although consuming a larger quantity of leaf material, the rate of N consumption was lower for insects feeding on elevated CO₂ grown plants. Larvae, however, maintained the same accumulation rates of N across all treatments by increasing their ability to utilize available N. While elevated CO₂ grown plants represented a poorer food source due to a reduced leaf N, larval compensatory mechanisms allowed them to maintain the same growth rates. This study suggests that a potential reduction in foliar quality brought on by an increasing atmospheric CO₂ concentration may be overcome by some herbivorous insects.

9

MACARTHUR, K.J., FORESTER, D.C., and MANGURIAN, L.P., Department of Biological Sciences, Towson State University--Prolactin binding sites in the CENTRAL NERVOUS SYSTEM of *Desmognathus fuscus*.

Prolactin (PRL) has been shown to stimulate maternal behavior in rats and doves: the areas responsive to PRL are located in the anterior hypothalamus. The reproductive behavior of amphibians are also influenced by PRL. Specific binding sites have been demonstrated in the toad *Bufo arenarum* and in *Xenopus laevis* brain. This study was designed to regionally localize PRL binding sites in *Desmognathus fuscus* which exhibit parental care behavior. The localization of PRL receptors was carried out using an in vitro autoradiography technique. Ovine PRL was radiolabeled with ¹²⁵I by the lactoperoxidase method. Twentyµ thick frozen brain sections were incubated with the radiolabeled hormone alone or with a 500 fold excess unlabeled oPRL. Brain sections were apposed to MRF-33 film after incubation. The film was developed after three weeks of exposure and the autoradiograms were analyzed using a JAVA image analysis system. Specific binding was observed in the CNS of *Desmognathus fuscus*.

This work was supported by a TSU student research grant (M.,K.J.).

10

HARGRAVE, BARBARA Y. Old Dominion University--Stimuli that cause secretion of atrial natriuretic peptide in the ovine fetus.

Atrial natriuretic peptide (ANP) is a hormone found in the atria and ventricles of the developing fetus. Although evidence of the natriuretic, vasorelaxant and aldosterone-inhibitory properties in adults suggests an involvement of ANP in the maintenance of fluid balance and hemodynamic control, the stimuli which cause the secretion of ANP or determine its physiological role in the developing fetus are unclear. However, it is known that

the plasma concentration of ANP is greater in the ovine fetus than in the ewe. We performed three different experiments in an effort to ascertain the causes of endogenous secretion of ANP in the ovine fetus. The experiments determined the ANP-secretion responses of: 1) phenylephrine-induced increases in blood pressure, 2) the intrauterine closure of the ductus arteriosus, and 3) cocaine administration. Each stimulus increased plasma concentrations of ANP in the fetus, indicating that the third-trimester fetus is capable of secreting ANP in response to intrauterine stimuli.

11

WUBAH, D. A. Towson State University -- Anaerobic biotransformation of highly chlorinated PCB congeners by microorganisms in contaminated Ashtabula River sediments.

Polychlorinated biphenyl (PCB) mixtures are among the most recalcitrant pollutants in the Great Lakes. On the basis of PCB congener profiles of sediments from various depths, it has been suggested that biotransformation of PCBs by indigenous microbes is currently taking place in the Great Lakes. This project was designed to determine the reductive biotransformation capacity of microorganisms in sediments from the Ashtabula River.

Sediments obtained from the Ashtabula River were spiked with 2,3,3',4,4'-pentachlorobiphenyl, 2,3,3',4,4',5-hexachlorobiphenyl and 2,2',3,4,5,6,6'-heptachlorobiphenyl and incubated under anaerobic conditions. Each congener was added individually and in combination with the other two congeners. The rate of degradation was analyzed using a gas chromatograph equipped with an electron capture detector. Dechlorination of the added congeners was observed after a lag period of 5, 3 and 4 months for the penta-CB, hexa-CB and hepta-CB, respectively. Biotransformation occurred after 6 months when the sediment was spiked with two or three congeners. A decrease in the indigenous tetra-CB and penta-CB coupled with an increase in the mono-CB and di-CB congeners was also observed.

12

FISHER, HOPE,¹ ABDIAZIZ MOHAMOOD,¹ BRODERICK ERIBO,¹ and ATTIN DATTA,² Howard University¹ and Food and Drug Administration² --Characterization of Plasmids in *Psychrobacter* isolates.

A total of 25 psychrotrophic gram-negative bacterial isolates belonging to the genus, *Psychrobacter* were examined for their plasmid DNA content. Multiple plasmids were detected in 21 (87%) of the 25 isolates. Four different plasmid profiles were clearly distinguishable among the isolates. The plasmid sizes ranged from 1.5 kb to 23 kb. Colony hybridization with purified plasmid DNA from one of the *Psychrobacter* spp.,

which was resistant to penicillin, carbenicillin and ampicillin, revealed a high degree of homology among the plasmids. Similar antibiotic resistance pattern was detected in all isolates except the four isolates which did not contain plasmids. The relationship between these plasmids and antibiotic resistance is not clear at this time. The plasmids were not transferable to competent strains of either penicillin-sensitive *Escherichia coli* or *Psychrobacter immobilis*.

13

McBEE, ANN¹, RON FERGUSON², MARTHA GRIFFIN¹ and VICTORIA HOLLOWELL¹. Columbia College¹ and South Carolina Forestry Commission²--A vernal floristic survey of Harbison State Forest, Richland County, South Carolina.

Harbison State Forest comprises 2202 acres of mixed Piedmont woodlands between the Broad River to the northeast and U.S. Highway 76 to the west. Purchased by the South Carolina Forestry Commission in 1946, portions of Harbison Forest have been under periodic silviculture since. Other tracts within Harbison Forest have been managed as an urban forest natural area, arboretum, and woodlands skills area. Pine forests constitute the major assemblage within Harbison Forest. Low alluvial woods and abandoned fields predominate along the Broad River and two creek systems which drain Harbison Forest. Oak-hickory assemblages are limited to less-disturbed, upland locales. Forested, steep, north-facing bluffs are an interesting floristic feature. In 1965, J.F. Logue conducted a summer-autumn survey of the vascular flora of Harbison Forest as a master's thesis project. A vernal survey has been initiated to detect vascular plant species missing from the earlier study. This survey is part of an undergraduate research project at Columbia College. In addition, stratigraphic characterization and sedimentological analysis are planned to yield a geological characterization of Harbison Forest.

14

Caspersen, John, Andrew Schnabel and Rebecca Sharitz. Savannah River Ecology Laboratory--Seed bank composition of a southeastern riverine swamp.

Seed bank composition was examined in a *Taxodium distichum* L. - *Nyssa aquatica* L. (cypress-tupelo) swamp forest and an adjacent botomland hardwood forest on the floodplain of the Congaree River in South Carolina. The species composition of the seed banks was also compared with the composition of the standing vegetation. Thirty 0.01 m soil cores were collected in each community from February 1 to March 5 and germinated in the greenhouse. Measures of similarity in species composition were based on the presence or absence of species. There was no significant difference in seed density between the two communities. The herbaceous seed banks of the two communities were similar in species composition; whereas, the woody seed banks were

dissimilar. The woody seed banks also contained fewer species than were found in the standing vegetation. Flooding regimes likely contribute to differences in composition of the woody species seed bank by differentially affecting the dispersal and persistence of seeds.

15

HAROLD S. ADAMS, STEVEN L. STEPHENSON, DAVID M. LAWRENCE, and MARY BETH ADAMS. Dabney S. Lancaster Community College, Fairmont State College, University of Virginia, and USDA Forest Service--The spruce/hardwood ecotone in the mid-Appalachians.

The ecotonal boundaries that exist between mid-Appalachian red spruce communities and the hardwood communities that surround them are usually quite narrow and abrupt. This is in marked contrast to hardwood/hardwood ecotones in the same region, where communities tend to intergrade almost imperceptibly and form a mosaic of vegetational continua. What factors account for this difference in the two types of ecotones? Are spruce communities excluded from sites occupied by surrounding hardwoods by competition, or are environmental influences related to microclimate and edaphic factors more important? Available data are inconclusive, and ecotonal relationships of spruce and surrounding hardwoods have not been studied in the mid-Appalachians. Recent evidence from a number of studies suggests that high-elevation red spruce forests throughout the eastern United States are declining, possibly in response to airborne chemical pollutants. Using techniques of direct gradient analysis, we are currently investigating patterns of species composition and distribution, ecologically important population processes, and microenvironmental gradients in permanent transects (each consisting of a series of contiguous 100 m² quadrats) established across spruce/hardwood ecotones at a number of localities in the mountains of central West Virginia and southwestern Virginia. Primary emphasis of our research is directed toward testing three basic hypotheses: (1) red spruce communities in the mid-Appalachians are decreasing in areal extent due to encroachment of surrounding hardwood communities, (2) stress-induced growth decline in red spruce is a factor in this decrease, and (3) the direction and rate of successional change can be predicted from models developed from quantitative data obtained from field studies of spruce/hardwood ecotones. Preliminary data obtained during the 1992 field season suggest that mid-Appalachian red spruce communities presently exist in static equilibrium with respect to surrounding hardwoods. (Supported in part by funds provided by the USDA Forest Service.)

16

HEDDEN, ROY L., TODD S. FREDERICKSEN, and STEPHEN A. WILLIAMS. Baruch Forest Science Institute of Clemson University--Simulating catastrophic wind stress on Southern pine trees.

Southern pine forests are frequently subjected to strong winds from tornadoes, thunderstorms, and hurricanes. This poster describes a method of simulating the acute wind stress on pines from these storms which can be used to scientifically study the mechanical, physiological, and ecological effects of strong winds on trees. Simulated wind stress involves bending tree stems with a winch and cable system and crown reduction by branch pruning.

- 17 PLYLER, DANIEL B. and KEVIN M. CARRICK, The University of North Carolina at Wilmington--Abscisic acid reversal of surgically induced germination in dormant seeds of *Spartina alterniflora*.

Seeds of *Spartina alterniflora* are dispersed in the fall of the year but remain dormant until early spring. We have shown previously that germination can be induced in dormant seeds by removing a portion of the scutellum (presumably by allowing a germination inhibitor to leach out). In this study, intact and surgically altered seeds were pre-treated with abscisic acid, ABA, (10 mg/l) or distilled water (control) for 12 hours, and then transferred to Petri plates containing 10 ml distilled water. The plates were then incubated in the dark at 26 C, and germination assessments were made daily for 5 days. Results revealed that dormancy remained unbroken in the seeds pre-treated with ABA as well as the intact control seeds. As expected, dormancy was significantly broken in the non-treated, surgically altered seeds, 98% of which germinated during the incubation period. ABA is active in restoring seed dormancy in a number of plants and there is evidence that it may actually function as a natural germination inhibitor in some species. Our results indicate that applied ABA acts to reverse induced germination by restoring the dormancy previously maintained by a natural germination inhibitor which may, in fact, be abscisic acid itself.

- 18 LEHMAN, MARY and UDO BLUM. North Carolina State University--Effects of cover crop debris on emergence of weeds.

Field studies have indicated that cover crop debris (rye, wheat, crimson clover, and subterranean clover) affect soil temperature and moisture and, in some cases, are allelopathic. This study examines how debris species affect the emergence of selected weeds (red-root pigweed and ivy-leaf morningglory) under controlled conditions of temperature and soil moisture. Living and glyphosate-desiccated plant tissue was collected monthly, freeze-dried, ground, and incorporated into soil at concentrations ranging from 0 to 15 mg/g soil. Seeds were germinated in these soil-debris mixtures. All debris collected prior to glyphosate desiccation inhibited both weed species. One month after desiccation only crimson clover and wheat debris were inhibitory. Beyond two months, only pigweed emergence was inhibited by wheat. Temperature and debris effects were independent. Emergence

of pigweed increased with increasing temperature (25 to 35°C.) and was strongly inhibited by the highest soil moisture level used (17.3%). Morningglory emergence was not affected by the temperatures and soil moisture levels used (9.3 to 17.3%).

- 19 CHEN, DILLION T. and LAFAYETTE FREDERICK. Howard University -- Studies on trichome form and ontogeny in *Ulmus*.

Trichome form and ontogeny has been studied in several species of *Ulmus*. Observations have been made with scanning electron microscopy of trichomes on surfaces of mature and immature leaves, petioles, stems, stipules, cotyledons, flowers, and fruits. Light microscope observations have been made of paraffin-embedded transections of immature leaf blades and petioles as well as sections of leaf buds of *U. americana* and *U. pumila* to elucidate trichome ontogeny. Structurally, two basic trichome types are found in *Ulmus*, viz., unicellular and multicellular forms. Unicellular forms predominate in all species observed. They vary from short forms (30 to 60 μm) to long forms (over 60 μm), that may be curved, straight, strongly hooked with acute tips, acicular to clavate, thickwalled or thinwalled with globose to broadly flared bases. Occasional forked unicellular trichomes were observed. Multicellular forms are thinwalled and vary from short (12 to 25 μm) to long (up to 75 μm) two to four-celled trichomes with bulbous tips. These trichomes are commonly referred to as glandular and have tips that may be one to three-celled. In leaves glandular trichomes originate from normal protodermal initials by vertical elongation of the cell followed by periclinal divisions of the initial. Unicellular trichomes originate from protodermal initials that are broadly expanded. The upper surface of the initial becomes extended in a narrow conical fashion and attenuates into a sharply acute tip. Cytoplasm persists throughout the length of the trichome during maturation and results in the deposition of a thickened wall from the tip to the base of the trichome.

- 20 GAZZERA, SILVIA B., THOMAS F. WILCOX, LEONARD A. STOKX, and GREG C. GARMAN. Virginia Commonwealth University--Biotic response of a Virginia Coastal plain stream to experimental acidification.

This study determined the effects of simulated pulsed acidification, as might occur from precipitation-induced, on benthic community respiration and the macroinvertebrate and fish communities of a small blackwater stream on Virginia's Coastal Plain. The pH of a 270-m stretch of the stream was depressed monthly over one year to 4.5 by the addition of H_2SO_4 . Benthic community respiration, measured using six plexiglass metabolism chambers, was significantly lower during acidification than in an upstream control section. Respiration had returned to control levels by two weeks after acidifications, suggesting rapid recovery and thus no long-term effect on the microbial community. Macroinvertebrate drift rates significantly increased over rates in control sections during acidifications showing a behavioral response of these organisms to the acid. In the experimental stream, cosmopolitan species abundance (e.g. creek chub and tessellated

darter) declined from 165.3 fish/h to 68.2 fish/h. In contrast, acid-endemic species (e.g. pirate perch, eastern mudminnow, mud sunfish sawcheck darter) increased from 22.1 fish/h to 151.6 fish/h. The proportion of acid-endemic species in the experimental stream increased from 0.11 to 0.68 during the study. The reference stream exhibited no such trends. In addition, changes in vagility, annual fish production, and diet of representative fish species were evaluated.

21
MENHINICK, EDWARD F. University of North Carolina at Charlotte--Grayscale scanning for scientific publications.

Recent advances in grayscale scanners permit production of camera-ready halftones from continuous tone drawings or photographs. Advantages include the following. Originals can be shaded directly instead of with thousands of tiny dots. Once an illustration has been scanned into a computer, the author can retouch them and can vary their intensity, contrast, size, angle, and even relative shape using an image editing program. The illustrations can then be imported into a desktop publishing program along with graphs, drawings, and text. Many of the problems associated with working with printing companies can thus be avoided: poor placement and alignment of figures, poor gray tone reproduction (too light, too dark, poor contrast), long delays in making corrections, extra charges for making corrections, and poor placement of text, illustrations and figures. In addition, providing camera-ready copy can save thousands of dollars in printing costs, and negatives can be produced directly with "Linotronic" printers. Shaded illustrations of fishes were scanned using the equivalent of a "Umax GS" 600 DPI grayscale/color scanner. They were manipulated with "Adobe Photoshop" on a "Macintosh II" computer and imported into "Quark Express" along with maps generated using "Adobe Illustrator", and text from "WriteNow" and "Microsoft Word". Graphs from "Cricket Graph" were occasionally used. (Programs cited have been used by the author and do not constitute specific endorsement of the product).

22
BREWER, GWEN AND FRANK MCKINNEY.
Frostburg State University, and
Bell Museum of Natural History.
--Nest Defense by Males in a
Tree-nesting Duck.

Competition for nest sites does not occur in ground-nesting ducks, but there are opportunities for such competition in species that nest in cavities. Although males of cavity-nesting ducks escort their mates during nest-site prospecting they do not usually participate in defense of chosen sites. During a 2-year study in Argentina, we observed the tree-nesting behavior of Speckled Teal (*Anas flavirostris*), a South American dabbling duck. Males behaved aggressively toward other teal in the vicinity of their arboreal nest sites and appeared to play important roles in protecting the nest from intruding conspecifics. Males directed a greater proportion of aggressive actions at

intruding females rather than at other males, especially when the aggressor's mate was inside the nest. This exceptional behavior appears to be related to the preference of Speckled Teal for nesting in the colonial nests that Monk Parakeets (*Myiopsitta monachus*) build in trees. These woven, covered stick nests frequently contain several cavities for which teal and parakeets compete. Most tree-nesting ducks use dispersed, cryptic sites. The use of clumped, conspicuous, arboreal sites by Speckled Teal may explain the presence of nest defense by males in this species. Implications for male and female breeding strategies and mating systems will be presented, and comparisons to other arboreal-nesting species will be discussed.

23
PERRY, JAMES W. Frostburg State University--Model Construction as a Means to Teach Three Dimensional Plant Structure.

While the goal of botany courses, even those dealing primarily with anatomy and morphology, should be to teach concepts, the interpretation of structure is necessary for understanding plant function. Many beginning botany students have difficulty translating the mostly two dimensional images of plant structures seen on microscope slides into three dimensional structure. Models are available for purchase from biological supply companies, but these are expensive and deprive students of valuable learning experiences. In plant morphology courses at FSU, students create three dimensional models of anatomical features from commonly available materials. Each model submitted for evaluation is accompanied by a labeled line drawing describing the model. The best models are placed into a collection for illustrative use in subsequent semesters. Students who have created models have a clearer mental image of botanical structures when asked to interpret them on exams. To date, students have made models depicting leaf gaps, differential secondary wall deposition in various tracheary elements, plugging in secondary walls, plasmodesmata traversing primary walls in pit fields, the Casparian strip in endodermal cells, initials and their derivatives in vascular cambium, and differences between sieve cells and sieve tube members. This poster illustrates several of these models.

24
HUTCHISON, MAX D. The Nature Conservancy--The barrens of the Midwest: a historical perspective.

The common term used by early travelers to describe lands in the Midwestern wilderness that were neither "good prairie" nor "good forest" is barrens. This natural type changed quickly after disturbance, and few examples are left to document its original character. Confusion exists among ecologists today as to the definition and proper use of the term. Some doubt that it has any place in modern classification systems. Very few sites have been recognized by the barrens

name in modern inventories. After studying and comparing historical descriptions of the barrens, and after examining original barrens areas in several of the Midwestern states, it appears that the barrens term was, and still is, a legitimate name for a natural community type distinct from forest and prairie. Although all have been affected by unnatural disturbance, good examples still exist and should be recognized and preserved.

25

HOMOYA, MICHAEL A. Division of Nature Preserves, Indiana Department of Natural Resources--Indiana barrens: classification and description.

At least seven different types of barrens, as recognized by the Indiana Department of Natural Resources, have been determined to occur in Indiana. All of these types--chert, clay, sand, gravel, limestone, sandstone, and siltstone--possess substrates that are excessively drained, and are vegetated by species adapted to drought and seasonally high temperatures. Physiognomically, Indiana barrens range from being primarily open and graminoid, to a mosaic of herbs, shrubs and open grown trees. Fire is an important component of these systems.

26

DeSELM, H. R. University of Tennessee--The Tennessee barrens.

Plant explorers and diarists of the late eighteenth century report grassy areas across Tennessee which they called barrens. The open barrens are a perennial grass vegetation class. Study beginning in 1954 reveals a large flora (1347 taxa, 91 percent native) in open barrens as well as peripheral thickets and forests and in a few areas some rock cedar-pine glades. Sixty-eight taxa occur on the Tennessee rare plant list. Most of this vegetation occurs on xeric sites but some occur on mesic or hydromesic sites suggesting that mechanisms of maintenance have been various. The usual main floristic elements occur; percentages of species in the various elements suggest considerable past influence of environmental change that has fostered species arrival. Most surviving open barrens vegetation is dominated by *Schizachyrium scoparium*, sometimes *Andropogon gerardii* or *Panicum virgatum* stands occur. A small stand of *Spartina pectinata* is known historically; a secondary stand of *Tripsicum dactyloides* is currently known.

27

HANEY, ALAN,¹ and STEVEN I. APFELBAUM²
University of Wisconsin-Stevens Point¹ and Applied Ecological Services, Inc.²--Characterization of Oak Savanna Communities in the Upper Midwest

Oak savannas on a wide range of sites throughout northern Indiana, Michigan, Illinois, and Wisconsin were studied to determine 1) species composition, 2) age structure, reproduction, and recruitment of dominant trees, 3) position and stability along the fire successional gradient, and 4) relationship to hydrology, soil characteristics, and topography. Results reveal that savannas on drier sites are most stable. In the absence of frequent fire, savannas on more mesic sites soon are invaded by non-savanna species including exotics,

resulting in a loss of characteristic structure and a reduction of diversity. Five distinct types of savannas were identified: 1) Black oak sand savanna, 2) Bur oak clay-loam savanna, 3) Mesic loam savanna, 4) White oak bluff savannas, and 5) Northern sand savanna (barrens). Biodiversity is maintained and enhanced by fire, even intense fire, in all savannas. Although there are many species in common to all well-maintained savannas, they are characterized by widely spaced dominant canopy trees of various oak species which differ among savanna types. All have a sparse understory, and a rich herbaceous layer in which grasses and sedges, particularly *Carex pensylvanica*, are abundant.

28

BASKIN, JERRY M., CAROL C. BASKIN and EDWARD W. CHESTER. University of Kentucky and Austin Peay State University--The Big Barrens of Kentucky and Tennessee: An overview.

The historical occurrence of extensive areas of grassland interspersed with stunted trees and shrubs ("barrens") on the limestone karst plain of the Mississippian Plateau of KY and northwestern Middle TN is well documented. Today, much of this region is in agriculture. Various stages of secondary succession are common in some areas. Natural or semi-natural plant communities are not extensive, but include cedar glades (edaphic climax on shallow limestone soil dominated by annual and/or perennial forbs and/or annual grasses), dry (limestone) prairies (edaphic climax dominated by perennial grasses), upland and lowland forests, and aquatic vegetation of sinkhole ponds. Only a few examples of barrens (culturally-maintained prairies dominated by perennial grasses) remain in the region. Transeau included the Big Barrens on his original (1935) and revised (1956) maps of the Prairie Peninsula, implying that they were formed during the Hypsithermal interval of the Holocene, and this idea generally has been accepted by plant ecologists and geographers. However, we previously concluded that the Big Barrens should not be considered part of Transeau's Prairie Peninsula. Additional evidence from the literature on paleovegetation, paleoclimate, and plant and animal geography will be presented as further support for our conclusion.

29

GRAVES, JAMES H. University of North Carolina at Chapel Hill--The importance of herbs in forests: resource ratios and competition between herbaceous and woody plants.

Although herbs typically contribute only a minor fraction of the total biomass of production of a forest, they may be important in regulating forest composition and dynamics through competition with tree seedlings. Resource competition theory leads to the prediction that under conditions of abundant soil nutrients and moisture but low light, herbaceous plants will win in competition with woody plants.

Experimental quadrats have been established on a resource-rich herb-dense forest site on Bluff Mountain in North Carolina to test the hypothesis that the light:soil-resource-supply ratio determines the outcome of herb-tree competition in the herb layer. Survivorship and growth rates of planted seedlings and seed of Acer saccharum, Betula lutea, Fraxinus americana, Liriodendron tulipifera, and Quercus rubra are being observed in a randomized block factorial design of resource levels (resource reduction, control, resource addition), canopy conditions (gap, nongap), and herb cover (gap, nongap). Results demonstrate that forest herbs may greatly reduce growth rates and survivorship of tree seedlings on nutrient-rich sites. Tree seedling success is low under intact herb layers. Greater success of tree seedlings in resource-reduction treatments as well as in light gaps supports the hypothesis that woody species are more successful in herb layers as the light:resource ratio increases.

30

PAULEY, ERIC F. and EDWARD E. C. CLEBSCH. University of Tennessee--
Episodic reproduction of red spruce
(Picea rubens Sarg.) in West Virginia.

Some tree populations occasionally generate large seed crops and thus large seedling cohorts. Early mortality within cohorts may produce commonly observed spatial patterns of seedlings. We examined the effect of such a reproductive episode on seedling pool size and the changes in microsite distributions of a cohort of red spruce (Picea rubens Sarg.). A large 1989 seed crop in second-growth forests of the Cranberry Wilderness, West Virginia produced 294 seedlings/m² by August 1990. After 2 yr, cohort size had declined by 97%. Changes in log_e(density) of this cohort were adequately explained by linear and negative exponential models. A power function fit these survivorship data less well. The models gave widely differing predictions of seedling density after 5 yr. The linear function suggested little effect of this cohort on total seedling pool size, while the negative exponential and power function models both suggested that pool size would increase several-fold. First-year mortality was inversely dependent upon initial density, indicating that conditions favoring germination also favored early survival. Seedling associations with rooting substrates changed erratically, perhaps because of the shallow rooting of these small seedlings. However, seedlings developed an early and persistent association with bryophyte-covered surfaces.

31

HICKOX, T. and B. COLLINS.
Memphis State University--
Competition between native and
immigrant Polygonum congeners in
contrasting light and water
levels.

Native Polygonum punctatum and immigrant P. caespitosum are annual

herbs that coexist along forest margins in west Tennessee. We varied light and water levels, and the identity and density of neighbors, around individual plants of each species to determine if competition influences coexistence of these congeners. We measured height; biomass allocation to root, stem, and racemes; and number and size of leaves of target plants. Alone, both species grew taller in sun than in shade, and in low compared to high water level. Increasing the number of conspecific neighbors led to shorter target plants of each species. Increasing the number of congeneric neighbors had no effect on P. punctatum height, but led to shorter P. caespitosum. However, the immigrant was not competitively displaced by its native congener.

32

SUMMERS, NATAMA V. and MARY A. MCKENNA. Howard University--
Inhibitory Effects of Thymol on
Pythium Growth

The identity of the most likely winner in any plant-pathogen encounter is strongly affected by environmental conditions and the presence of plant exudates (Burdon, 1987) and allelopathic chemicals (Fisher, 1979). Monoterpenes, a group of plant secondary compounds, have been shown to inhibit fungal respiration and enzyme activity. The aim of this study was to determine whether thymol, a monoterpene component of the essential oil of Thymus, would inhibit growth of Pythium. Pythium is a common soil-borne pathogen responsible for damping-off disease. Corn Meal Agar (CMA) plates with concentrations of 0.02, 0.04, 0.08, 1.0, and 2.0 mg thymol/ml CMA were inoculated with Pythium irregulare and Pythium ultimum. Control plates containing CMA only were also inoculated with each species. Although both species showed vigorous growth on control plates by the third day after inoculation, growth of both species of Pythium was completely inhibited in plates with all concentrations of thymol. A second trial was set up using thymol concentrations lower or equal to the amount naturally occurring in the essential oil of Thymus (0.00, 0.01, 0.05, 0.10 mg thymol/ml CMA). Two days following inoculation, vigorous growth of both Pythium species was observed on control plates and on plates with the lowest concentration of thymol (0.01 mg/ml CMA). No growth was observed for either species in plates at the remaining concentrations up to three weeks after inoculation. These results suggest that the production of thymol may protect Thymus against Pythium infection.

33

HULL, JAMES C. Towson State University--
Transient light dynamics and photosynthesis in
understory forest herbs.

The photosynthetic responses of four understory herbs (*Erythronium americanum*, *Podophyllum peltatum*, *Arisaema triphyllum* and *Smilacina racemosa*) were measured in alternating light regimes of a deciduous forest understory and in the laboratory. Responses measured included PPFD - P_n , light induction responses and CO_2 -burst effects. Laboratory experiments measured the ability of different PAR to induce photosynthesis. Understory herbs demonstrate a progression of photosynthetic responses from early spring to summer. Early spring herbs (eg. *E. americanum*) responded similarly to full-sun plants with a higher light compensation point, greater P_n at light saturation, lower quantum use efficiency, greater PAR needed to maintain induction, and a greater CO_2 -burst effect. Summer green herbs (eg. *A. triphyllum*) had a lower light compensation point, lower light saturation P_n , higher quantum use efficiency, lower PAR needed to maintain induction and a less pronounced CO_2 -burst effect.

34

TUBERVILLE, TRACEY D., PETER G.
DUDLEY, and A. JOSEPH POLLARD.
Furman University--Responses of
invertebrate herbivores to plant stinging
trichomes.

A taxonomically diverse group of plants, all commonly known as nettles, bear trichomes that cause painful stings when touched by humans. Earlier research has shown that nettle stings deter grazing by mammalian herbivores including rabbits, sheep, and cattle. However, no previous studies have investigated whether stinging trichomes deter or interfere with feeding by invertebrates. We examined defensive function by comparing leaf area consumed on leaf pieces bearing differing numbers of stinging trichomes, in laboratory feeding trials. We studied two members of the Urticaceae: *Laportea canadensis*, a native North American species, and *Urtica dioica*, an introduction from Europe. Herbivores investigated were grasshoppers (native generalists), Japanese beetles (introduced generalists), caterpillars of the red admiral butterfly (native specialists), and snails (native generalists). Grasshoppers have not been observed to eat nettles in the field while the other three species have. In all cases, there was no association between stinging trichome density and amount of leaf eaten. Movement of snails along stems was also not hindered by trichomes. The size, weight, and behavior of the herbivores seem to prevent puncture by the trichomes. This, rather than physiological immunity, appears to explain the lack of response of invertebrates. These results suggest that stinging trichomes have evolved as defenses against mammalian, not invertebrate, herbivory.

35

JOSEPH S. ELY¹ and DAN K. EVANS².
The Ohio State University¹ and
Marshall University²--The
vegetation of selected embayments
along the upper to mid-upper Ohio
River floodplain.

Classical and multivariate methods were used to describe plant communities and associations of selected embayments along the mid-upper to upper Ohio River floodplain. Cover abundance data from 464 1m² sample plots of ground cover and aquatic elements were analyzed through importance values (IV), two-way indicator species analysis (TWINSPAN) and detrended correspondence analysis (DECORANA). Importance values of the shrub-sapling and canopy layers were calculated from 35 and 21 sample plots, respectively. The analyses revealed 20 plant communities and 19 plant associations. The bottomland hardwood community was characterized by Silver Maple with minor differences among sites. The shrub and sapling layer exhibited greater diversity within Silver Maple associations and sub-associations. Further, one Hazel Alder community was observed. The ground cover community consisted of 14 Rice Cutgrass associations and 4 Broad-leaved Arrow-head associations. Two aquatic and one sub-aquatic communities were revealed. Ground cover elements generally followed a moisture gradient.

36

NEUFELD, HOWARD S. Appalachian State University--
A 25 cuvette auto-sequencing gas exchange system
for the study of plant responses to ozone.

The uptake of ozone by plants occurs primarily through the stomata. Exposure to ozone, however, can cause stomatal closure and impairment of the biochemical processes of photosynthesis. These reductions in photosynthesis, coupled with premature leaf loss, often lead to growth reductions over a prolonged period of exposure. Attempts to link growth decreases with reductions in stomatal conductance and photosynthesis in the field have been less than successful, mainly because single cuvette systems are cumbersome and obtaining sufficient numbers of data points takes a long time. In addition, traditional portable gas exchange systems require high labor inputs. The relatively low number of gas exchange measurements thus gives the impression that there is no correlation between growth and gas exchange. The low resolution also results in an inability to detect subtle changes in gas exchange due to ozone, because ozone effects are confounded with time of day effects. I describe herein an auto-sequencing gas exchange system with 25 cuvettes that overcomes many of these limitations. The system can measure photosynthesis and transpiration every 30 seconds, 24 hours per day, such that a single leaf can be read 4 times an hour. The clamp-on cuvettes have an internal fan for mixing the air, a thermocouple for leaf temperature, and a PAR sensor. Cuvette sequencing is done by a datalogger, which also stores all the data for later analysis on a computer. Cuvettes have been left on leaves of tulip poplar and black cherry for 3-4 days at a time, without any apparent deleterious effects. Data obtained can be analyzed for hourly trends, or integrated over the entire day. The system is very cost-effective when evaluated in terms of numbers of data points obtained per dollar invested.

37

MCDANIEL, KERRIE L. and LIGHTFOOT, DAVID A. Southern Illinois University--
Cytokinin modulation of mRNA levels in Phaseolus vulgaris (L.). Cytokinins are plant growth substances defined by the ability to promote cell division. Cytokinin-active compounds can be chemically very different. Physiological experiments have determined differences in activity between several chemically distinct cytokinin-active compounds which may be attributed to several mechanisms. This paper explores the possibility that chemically distinct cytokinins differentially alter the pattern of gene expression. Phaseolus vulgaris (L.) plants were grown in the greenhouse. Benzyladenine, thidiazuron, and zeatin (1 μ M, 10 μ M, 50 μ M) were applied to the abaxial side of the leaf. Samples were gathered at 1,4, and 24 h after exogenous cytokinin application. The mRNA was isolated by cesium chloride gradient. In addition, suspension cell cultures were derived from callus of the bean. The cultures were starved of cytokinin to deplete the endogenous cytokinin supply and then exposed to treatments of different cytokinins. Northern hybridizations to total mRNA of both leaves and the suspension cultures with cDNA probes encoding chalcone synthase and ferredoxin were used to quantify specific mRNAs. Differential mRNA abundances were noted upon exogenous application of cytokinin.

38

TORAN, ERIC and ELAINE J. DAVIS. Howard University-- Partial Characterization of the Balsam Woolly Adelgid's Mitochondrial DNA.

The Balsam Woolly Adelgid (BWA), a tiny sucking insect was initially introduced into N. America (Maine and Nova Scotia) in the early 1900's followed by separate colonizations of unknown origin in other mountainous areas in the US. Since the insect reproduces parthenogenetically, and no genetic information available, the mitochondrial DNA (mtDNA) was chosen as the genic probe to determine the maternal lineage of the organism. Thus BWA mtDNA collected from insects representing two different geographic locations (Mt. Rogers, VA and Elk River, Idaho) was isolated by means of a solid phase electrophoretic process, digested with HindIII and cloned into the vector pBR322. Recombinant plasmids revealed three fragments with kilobase sizes of 9.55 (Mt. Rogers), 2.73 and 1.74 (Mt. Rogers and Idaho). Comparative restriction analyses, involving seventeen different endonucleases, suggest that both populations originated from a common source. It will be interesting to determine whether or not any changes in the mtDNA can be detected by means of nucleotide sequencing.

39

WETMORE, DAWN L. and PAUL W. DOETSCH. Emory University--Isolation and characterization of a human DNA repair enzyme from HeLa carcinoma cells.

Oxidative damage to DNA occurs on a regular basis, and if left unrepaired this damage could have serious repercussions to the cell. Ultraviolet radiation, ionizing radiation, mutagenic chemicals, and free radicals produced in the cell as a result of cellular metabolism are all causes of these damages that have the potential to cause cell death or mutations which can eventually result in tumorigenesis. Cells have evolved defenses, such as DNA repair enzymes, to combat these potentially deadly damages. There are DNA repair enzymes that recognize various oxidative damages as well as certain lesions produced by UV radiation. In this study we focused on a human DNA repair enzyme that is similar in certain respects to E. coli endonuclease III, a DNA repair enzyme which recognizes a variety of oxidatively damaged products. This enzyme has been purified from HeLa carcinoma cells through a series of chromatography steps, and characterized using DNA sequencing methodologies. We have found that this enzyme appears to be relatively stable and recognizes a guanine UV photoproduct. Currently, we are carrying out experiments to determine the nature of the guanine photoproduct. The results of these studies suggest we may have discovered a new human DNA repair enzyme.

40

MADIGOSKY, STEPHEN R.,¹ XAVIER ALVAREZ,² and JONATHAN GLASS.² Widener University,¹ Louisiana State University Medical Center.²--Intestinal aluminum uptake and transport are dependent on epithelial iron transport.

Human derived Caco-2 cells grown in bicarmel chambers were used to study the cell biology of aluminum (Al) and iron (Fe) transport in vitro. Al was offered on the apical surface of Caco-2 cell monolayers as either Al-citrate, Al-lactate, or Al-nitrilotriacetate at 1:2 molar ratios. The Fe status of the cells was established by culturing the Caco-2 monolayers prior to the exposure to Al in media with either low (0.1 M), normal (1 M), or high (50 M) Fe concentrations with resulting cellular Fe content measured by atomic absorption spectrophotometry (AAS) to be 0.6, 1.2 and 5.2nmoles Fe/mg of cell protein respectively. With each chelate the Al uptake was greatest in the Fe deficient cells (e.g. 41+ versus 11+2 nmoles Al/mg cell protein in low Fe versus high Fe cells respectively for Al-citrate) as was the transfer of Al to the basal chamber suggesting that Al uptake pathways are similar to those used by Fe. However, both Al uptake and transfer to the basal chamber were affected by the chelator used. These results suggest that the Fe status of the cell can modulate the transport of Al and that the form of Al presentation is critical in the transfer of Al across the monolayer.

41 WILKERSON, CHARLIE and ELAINE J. DAVIS. Howard University--Partial Characterization of the Origin of Transfer Region for the Plasmid R64drd11 in E. coli K-12.

The origin of transfer (*oriT*) region for the plasmid R64drd11 was isolated and cloned as a 'composite' fragment into the *Hind*III site of pBR322 exhibiting a total kilobase size of approximately 8.9 Kb. The larger two of the three fragments (4.445 Kb, 3.98 Kb, 0.57 Kb) have been subcloned, separately, and by means of triparental matings determined to possess origin of transfer activity (transferability). A partial restriction map of the composite fragment has been constructed. The endonuclease *Sst*I only cleaves the 3.98 Kb fragment (2.0 and 1.98 Kb) whereas *Pvu*I, the 4.445 fragment. Each of the *Sst*I generated 3.98 Kb fragments were subcloned separately, exposed to triparental matings, and the surviving 1.98 Kb fragment subcloned into pUC18. Examination of the 1.98 Kb fragment revealed a loss of approximately 0.2 bp without the loss of *oriT* activity. The *Pvu*I generated 2.36 Kb fragment from the 4.445 Kb also possessed *oriT* activity. It appear that the conjugative plasmid R64drd11 possesses two *oriT* regions and based upon the partial restriction map, the two do not represent regions of genic duplication.

42 MILLER, CHRISTOPHER G., SCHAFFER, R.L. and I.T.D. PETTY. North Carolina State University--Examination of geminivirus host range specificity using chimeric viruses.

The variety of organisms which a virus can infect describes the host range of that virus. Viruses generally interact closely with their host's cellular machinery, and therefore, molecular interactions between viral and host cell components are important factors in limiting viral host range. Tomato golden mosaic virus (TGMV) and bean golden mosaic virus (BGMV) belong to the geminivirus group of plant DNA viruses. Each of the viral genomes is divided into two genome components, designated A and B, which are necessary for viral replication and viral movement through the infected plant, respectively. The TGMV and BGMV encoded proteins have between 81.6% and 95.2% homology (allowing conservative amino acid substitutions). Despite this similar genetic background, the two viruses share no plant host species. Early results indicate that BGMV can replicate in tobacco (non-host) at points of inoculation, but cannot move efficiently from cell-to-cell. Chimeric viruses have been constructed in which homologous B-component genes have been switched between TGMV and BGMV. Through introduction of these chimeras into tobacco and

bean plants we will be able to determine whether any of the viral gene products examined are determinants of host specificity. It appears at the present time that some of the chimeras do affect viral host range.

43

LAURO, STACIE and A.A. ANSARI. Emory University--Does the "nef" gene contribute to the disease resistance of Sooty Mangabey monkeys (SMM)?

How certain species of primates, naturally infected with a lentivirus, remain disease resistant has yet to be defined. Disease susceptible rhesus macaques (RM) when infected with a pathogenic SIV clone with a deletion in the "nef" gene remained resistant whereas wild type SIV caused disease and death in recipients. We wanted to determine whether disease resistance in SMM was secondary to the selective *in vivo* propagation of SIV isolates with a defective "nef" gene in this species. Based on nucleotide sequence analysis, "nef" clones from SMM and RM appear to define 2 "nef" gene families for SIV_{SMM}. "Nef" from *in vitro* derived SIV_{SMM} isolates all belonged to one family, as well as "nef" clones isolated from animals that had been experimentally infected with the *in vitro* derived SIV_{SMM9} isolate. Following experimental infection with SIV_{SMM9}, however, a higher sequence divergence was recorded for "nef" genes isolated from SMM than from RM after equivalent periods of time post infection. More importantly, at the peptide level, whereas full length "nef" clones were isolated from experimentally infected RM, all the "nef" genes found in SMM, whether naturally or experimentally infected, had randomly distributed premature stop codons, resulting in truncated and most likely nonfunctional "nef" proteins.

44

MILLER, ANNETTE R. Appalachian State University--Effect of high vs moderate intensity exercise on natural killer cell activity.

The effect of 45 min of high (80% V02max) vs moderate (50% V02max) intensity treadmill exercise on natural killer cell cytotoxic activity (NKCA) was investigated in 10 well-conditioned young males. Blood samples were taken before and immediately after exercise, with 3 more samples taken during 3.5h of recovery, and analyzed for number of NK cells and NKCA using a chromium release assay with separated mononucleated cells (effector cells) and chromium labeled K562 target cells. The % lysis was calculated using the mean counts per minute of the triplicate values for four E:T ratios, and the NK lytic units were calculated as the number required to give 20% lysis per 10⁷ cells. Treatment order on the treadmill (graded walking vs level running) was counterbalanced, with subjects acting as their own controls. Exercise at 80% vs 50% V02max resulted in a greater immediate post-exercise increase in circulating numbers of NK cells followed by a sustained decrease for both intensity conditions during 3.5h of recovery. The pattern of change in NKCA over time was not significantly different between conditions, although NKCA rose significantly

above pre-test levels following high but not moderate intensity exercise. A strong time effect was shown for NKCA in both conditions, with 1h post-exercise levels dropping significantly below pre-test levels, and then rising back to baseline values by 3.5h post-exercise. When NKCA was expressed on a per NK cell basis, however, the time effect was erased with no differences seen between conditions for all time points. We conclude that the post-exercise decrement in NKCA is due to perturbations in the number of NK cells and not because of alterations in the ability of each NK cell to lyse target cells.

45
ROBINSON, GERALD D. Towson State University--Effects of reduced ambient pH on sodium balance in the red-spotted newt, *Notopthalmus viridescens*.

Aspects of electrolyte balance were studied in red-spotted newts under several treatment regimes. Newts subjected to aged tapwater (ATW) at control pH (6.20 - 7.40) did experience a slight net Na^+ loss, as determined by monitoring changes in bath Na^+ concentration. However, the rate of net Na^+ loss after acute exposure to low pH (4.24 - 4.32) media was significantly greater than the loss rate in control animals. Chronic exposure to low pH, followed by a final transfer to pH 4.22 - 4.37, promoted a diminution in the rate of net Na^+ loss, compared to controls. Total body Na^+ and K^+ contents, obtained by analysis of acid-digested carcasses, were correspondingly less in newts subjected to low pH than in control animals. Chronic exposure to low pH induced increases in body Na^+ and K^+ content. The rate of unidirectional Na^+ influx, measured with radioactive tracers, was also significantly less in newts acutely transferred to low pH ATW than it was in control animals, but chronic low pH exposure lead to a slight elevation in Na^+ influx. The rate of unidirectional Na^+ efflux was higher in control newts than it was in animals acutely or chronically exposed to low pH. Apparently, in red-spotted newts, chronic exposure to low pH ameliorates the state of negative Na^+ balance which generally accompanies habitat acidification.

46
PONS, LARA J., MATHIUS J. SEDIVEC, and RICHARD N. HENSON. Appalachian State University--A comparison of conduction velocities and axonal diameters of two sympatric species of scorpions, *Centruroides vittatus* (Say, 1821) and *Diplocentrus* sp..

Conduction velocities and axonal diameters were compared between two similar-sized, sympatric species of southwestern scorpions collected from Brewster and Presidio Counties, Texas. *C. vittatus* is a non-burrowing species while *Diplocentrus* sp. is a burrowing species. Transmission electron microscopy is being employed to compare various axonal diameters of the separate species. *Diplocentrus* sp., the burrowing species, has been observed

in the field to have slower surface movement than the non-burrowing *Centruroides vittatus*. These observations indicate that a rate of movement, if limited by physical factors, could result from slower conduction velocities along the ventral nerve cords. To test this hypothesis, conduction velocities were measured from the ventral nerve cords using hook electrodes with the stimulating electrode positioned at the third mesosomal segment and the recording electrode positioned at the first, second or third metasomal segment. Transmission electron microscopy is being used to measure axonal diameters in cross-section. Preliminary studies are still inconclusive as to whether it supports or disputes the hypothesis.

47
BYRD, PAMELA and DWAYNE A. WISE. Mississippi State University--The effect of an antibody to a microtubule cap protein on PtK₂ cells.

PtK₂ cells were injected with a polyclonal antibody to the 97-KD microtubule cap protein (claspin) of *Tetrahymena* cilia to determine what effect it had on mitosis. Previous work showed that this antibody localizes to the kinetochores in mitotic cells (Miller, J.M., W. Wang, R. Balczon, and W.L. Dentler. 1990. J. Cell. Bio. 110:703-714). Injections were done to determine if the antibody localized to the kinetochores *in vivo* and if the binding of the antibody to the kinetochores interfered with the ability of the chromosomes to attach to the kinetochore microtubules. *In situ* localization of the antibody was determined by immunofluorescent staining of the kinetochores with the use of an anti-rabbit IgG, and by staining the chromosomes with DAPI. Microtubule bundles were stained with a monoclonal anti-tubulin antibody to test the hypothesis that anti-claspin interferes with kinetochore microtubule binding. In preliminary observations, it was noted that the injection of the antibody into cells at metaphase caused the spindle to decrease in size from one polar end to the other. We are presently working on the hypothesis that the anti-claspin antibody interferes with kinetochore microtubule binding.

48

Abstract Not Available

49

Abstract Not Available

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Abstract Not Available

- 51 WILTSHIRE, B. and D. L. NICKRENT. Southern Illinois University at Carbondale -- Genetic diversity in *Astragalus tennesseensis* Gray and *Dalea foliosa* (Gray) Barneby.
The Tennessee milk vetch and the leafy prairie clover are cedar glade endemics with disjunct populations in Illinois. Conservation efforts require some knowledge of the genetic diversity of these species within and among their populations, as well as the degree of divergence of the disjunct populations from those in Tennessee and Alabama. Leaf tissue was collected from eighteen populations of *Astragalus tennesseensis* and eight populations of *Dalea foliosa* in Illinois, Tennessee, and Alabama. The tissue was examined electrophoretically for isozyme variation to assess levels of heterozygosity and polymorphism. The following enzyme systems were detected in both species: AAT, ADH, EST, IDH, LAP, MDR, MDH, 6-PGD, PGI, and TPI, as well as G-3-PDH in *Dalea* and G-6-PDH in *Astragalus*. The isolated Illinois populations of both species were monomorphic for all enzyme systems except AAT, while the Tennessee populations showed more variation. *Dalea foliosa* was monomorphic in both the Alabama and Illinois populations and shared identical alleles in most cases. The alleles present in the restricted populations of both species represented a subset of those detected in the Tennessee populations. Geographically isolated populations appear to be genetically depauperate.
- 52 LAKSHMI, BHARATHA¹ and REBECCA NORRIS². Old Dominion University, Department of Biological Sciences¹ and U. S. Department of Agriculture, Whiteville Methods Development Center². -- Allozyme studies of *Orobancha minor*.
Orobancha minor is a root parasitic weed of agricultural importance in Asia, Africa, Europe and New Zealand. with a broad host range including clover, tobacco and sunflower. It is not indigenous to the United States but has been found on clover in South Carolina, Georgia and Florida. This is of concern since this species could become a threat to tobacco. An estimation of genetic diversities between the populations would reveal if they are from a single or many introductions. Genetic diversities in *O. minor* were studied by analyzing allozymes using starch gel electrophoresis. A South Carolina population was monomorphic for loci coding for isocitrate dehydrogenase, shikimic acid dehydrogenase and phosphoglucosmutase. The loci coding for malate dehydrogenase and glucose-6-phosphate dehydrogenase were found to be polymorphic. A comparison of these loci in different populations of *O. minor* could help identify the source(s) of introduction.
- 53 PITTMAN, ALBERT B. South Carolina Heritage Trust--Additional observations on a narrow-leaved lobelia from the Carolina sandhills.
Bowden in 1959 included all the lobelias of the southeastern US in his section *Lobelia*. The phylogeny he outlined for this section hypothesizes four lines of speciation with hybridization and polyploidization forming a number of described tetra- and hexaploid species ($X=7$). A hitherto undetermined, narrow-leaved lobelia has been found in seepy pocosins of the Carolina sandhills. Somatic chromosome counts indicate a diploid with a number of $2N=14$. Analysis of this plant's morphological characters support the view that it is very similar but distinct from *Lobelia flaccidifolia* ($2N=14$) and *L. elongata* ($2N=28$).
- 54 MOHAMED, KAMAL I. and LYTTON J. MUSSELMAN. Old Dominion University, Department of Biological Sciences -- The genus *Striga* in Africa.
A number of factors contribute to the taxonomic difficulty of *Striga* (witchweeds). Among them is the failure to look at the genus as a monophyletic group sharing a common ancestry. Thus, treatments that do not take into consideration the whole group may be misleading. Another taxonomic problem is the inherent variability of some species which are widespread weeds. We recognize 26 African species based on extensive herbarium and field studies. A new species from Angola is described. *Striga asiatica*, a widespread variable taxon, is divided into three subspecies based on morphology, host range, and biogeography. Our taxonomy in general follows that of Hepper (1969) who recognized five subspecies of *S. bilabiata*. We recognize *S. ledermannii* as a fifth subspecies of *S. bilabiata* and not as a separate species. We propose *S. linearifolia* as the sixth subspecies of *S. bilabiata*. *Striga yemenica*, previously considered an Arabian endemic, is reported from Ethiopia. This is the first African record. Special attention is given to the problem of the development of host specific strains in *S. gesnerioides* and *S. hermonthica*, wide ranging and serious pathogens of numerous crops in sub-Saharan Africa. While these strains may include distinct morphotypes, we accord them no taxonomic status. The general morphology, seed features, distribution, and host range of the 26 species are summarized.
- 55 MATTHEWS, JAMES F., DONNA W. KETRON and SANDRA F. ZANE. University of North Carolina at Charlotte --The taxonomy of *Portulaca oleracea* L.
Portulaca oleracea is one of the most aggressive weeds in the world, having been noted as the eighth most frequent plant in the world. It is self-pollinating and tends to produce local populations that may exhibit physiological and/or morphological variability. Plants grown in rich habitats are robust but the species may be depauperate in dry soils of low fertility.

The genus has variable chromosome numbers from a base of $X=4,5,8$ and 9 . In *P. oleracea* the reports are $2n=18, 36, 45, 52(?)$ and 54 . Taxonomically the species has been relatively stable worldwide. Cultivars used for food have been maintained under *P. oleracea* var. *sativa* DC. In the U.S. two species have been segregated: *P. neglecta* Mackenzie and Bush and *P. retusa* Engelm. Both are either robust specimens or specimens with spiny seed surfaces, respectively, whose features otherwise fall within the range of variation for *P. oleracea*. Danin named nine subspecies based on seed size, shape, surface pattern and chromosome number. Seven of these occur in the U.S., five in overlapping populations that reflect local population variation when compared to the variation within the species. We have looked at the variation of this species and consider it best treated as a single polymorphic species.

56

WEAKLEY, ALAN S. North Carolina Natural Heritage Program--A revision of *Trichostema*, section *Trichostema* (Lamiaceae or Labiatae).

An herbarium and field study of eastern North American *Trichostema* was initiated because of confusion over the validity of *T. suffrutescens* Kearney and the identity of a puzzling *Trichostema* found in the Carolinas. *T. dichotomum* L. is widespread in eastern North America. It is a rather weedy annual, with considerable infraspecific variation. *T. setaceum* Houttuyn, another annual, is more restricted in geographic range and morphologic variability. *T. suffrutescens*, a perennial, was found to be a valid species, endemic to Florida. An ovate-leaved perennial from barrier islands of the Carolinas was found to be a previously undescribed species. Taxonomic characters useful in distinguishing the four species include stem pubescence, corolla shape, size, and pigmentation, style branching, leaf size and shape, anther color, growth form, duration, habitat, and phenology. These four species comprise section *Trichostema*, characterized by characters of habit, calyx, pollen structure, and geographic range. The affinities of *Trichostema brachiatum* (*Isanthus brachiatus*) are with western species presently treated in *Trichostema*. Recent studies raise issues (not fully resolved) as to the appropriate familial, generic, and subgeneric treatment of the members of traditional *Trichostema*.

57

WEAKLEY, ALAN S. North Carolina Natural Heritage Program--A new species of *Sporobolus* (Poaceae or Gramineae) from pinelands of the Carolinas.

A *Sporobolus* with narrow leaves and diffuse panicles, found in North and South Carolina, has been variously determined by earlier workers as belonging to either *S. teretifolius* Harper, *S. curtissii* (Vasey ex Beal) Small ex Scribn., or *S. floridanus* Chapman. This diversity of opinion has resulted from a

failure to recognize it as a previously undescribed species, readily separable from each of the three by characters of the leaf and inflorescence. Occurring in pine savannas of southern North Carolina and immediately adjacent South Carolina, it is sympatric only with *S. teretifolius*. The two species sometimes occur as codominants in savannas of the outer Coastal Plain, where they are distinguishable and show no sign of hybridization. Like many other pineland grasses, *Sporobolus* sp. nov. flowers only following fire. Recognition of the species in vegetative condition has revealed that it is locally common (sometimes dominating hundreds of acres), and removed confusion between it and co-occurring *Calamovilfa brevipilis*, *Sporobolus teretifolius*, and *Aristida stricta*, with which it has often been confused.

58

JOSEPH S. ELY¹ and DAN K. EVANS². The Ohio State University¹ and Marshall University²--The flora of selected embayments along the upper to mid-upper Ohio River floodplain.

Embayment areas adjacent to the Ohio River were formed when normal pool elevation was raised in conjunction with the operation of the locks and dams for river navigation. Vascular plants in these embayments have not been inventoried nor studied except for a few isolated studies performed through agents of the USA Corps of Engineers. Specific objectives of this study were to: 1) inventory vascular plant species associated within each embayment; 2) describe any rare, endangered and threatened taxa as defined by Federal and State guidelines; and 3) identify both native and introduced taxa. The floristic inventory of eight embayments resulted in a total of 76 families, 169 genera and 262 species, including many rare and unreported taxa. The flora was rich in native taxa and supported few to many exotics. The Poaceae (Grass) was the largest single family inventoried, yet the flora was predominantly dicot with the Asteraceae (Composite) the largest representative. Floristic similarity coefficients show a mid to high range of similarities among the eight sites. All sites shared a common similarity coefficient of at least 0.608 with a maximum similarity of 0.802.

59

TARTER, DONALD C. and DIANE R. NELSON. Marshall University, and East Tennessee State University--First records of tardigrades (Phylum: Tardigrada) from mosses in the Cranberry Glades Botanical Area in the Monongahela National Forest, Pocahontas County, West Virginia. Nine species of tardigrades, including two state records and one new species, were collected from mosses in the Cranberry Glades Botanical Area located in the Monongahela National Forest in West

Virginia. The Cranberry Glades area, located at an elevation of 3400 feet, comprises about 600 acres of land covered with bog forest, shrubs, and areas of sedges, mosses, and lichens. Most of the area is underlain with peat varying in thickness from a few inches to 11 feet. Soil in the area is acid (pH, 3.8-6.2). This bog, known as a "muskeg" in the northern sections of our continent, is a refugium for plants and animals whose ancestors were forced into the Southern Appalachians by glaciers during the Pleistocene period. The following species of tardigrades, including the state records, *Macrobiotus pseudofurcatus* Pilato and *M. spectabilis* Thulin, were identified from mosses: *Diphascon* n. sp., *Hypsibius convergens* (Urbanowicz), *Isohypsibius suttleri* (Richters), *Macrobiotus harnsworthi* Murray, *Milnesium tardigradum* Doyere, *Minibiotus intermedium* (Plate), and *Ramazottius oberhaeuseri* (Doyere). The four year survey involving the distribution of tardigrades in West Virginia will be reviewed.

60

NELSON, DIANE R. and GILBERT HALE. East Tennessee State University--Tardigrades from Buffalo Mountain Park, Washington County, Tennessee. Tardigrades were collected from mosses and lichens at five sites in Buffalo Mountain Park, Washington County, Tennessee, in 1991-1992. Sixteen samples were collected from three of the sites on February 14, 1991. Five additional samples were taken from one of the sites on January 22, 1992, to obtain more individuals of certain species. On May 13, 1992, ten samples were collected from two sites in a different part of the park. The elevation of the sites varied between 2100' and 3300'. Over 500 specimens were mounted on slides for identification. Genera present included: *Echiniscus*, *Pseudechiniscus*, *Milnesium*, *Macrobiotus*, *Minibiotus*, *Hypsibius*, *Ramazottius*, *Diphascon*, and *Itaquascon*. Males of *Milnesium tardigradum* and embryonate eggs of *Macrobiotus pustulatus* were photographed for the first time. *Echiniscus virginicus* was the dominant heterotardigrade.

61

HUSTAD, HEATHER AND WILLIAM DEWEI Appalachian State University--The eyes of the heterotardigrade, *Echiniscus viridissimus*. The eyes of tardigrades consist of a pair of small ocelli embedded in the brain. Each eyespot is composed of a cup-shaped pigmented cell and both ciliary and microvillous photoreceptive cells. Although most tardi-

grades have black eyespots, three genera, including *Echiniscus*, are synapomorphic for red pigmented eyespots. In *E. viridissimus* several unusual features have been revealed by cryofixation. 1) The eyespots lie within the posterior regions of distinct lobes formed by the cell bodies of chemoreceptive neurons from the cephalic papillae. The dendritic processes of the photoreceptive cells lie medial to the rim of the chemoreceptive cell bodies and project into the "cup" of the pigmented cell. 2) A "support" cell with large phagocytic vacuoles underlies the pigmented cell. 3) A lens-like structure, previously unknown in tardigrades, lies lateral to the microvillous processes. It is formed by the outer dendritic segment of a ciliary receptor and lamellae of endoplasmic reticulum that appear to have been induced in an adjacent cell. Partial support provided by NSF-III Grant # USF-905 1823

62

POWERS, NANCY and DONALD TARTER. Marshall University--Ecological observations of a disjunct population of the burrowing crayfish *Fallicambarus fodiens* (Cottle) in the Green Bottom Wildlife Management Area in southwestern West Virginia. *Fallicambarus fodiens* is known only for two sites in West Virginia. Both localities on the Ohio River floodplain are in the valley of the preglacial Marietta River which was a tributary of the Teays River. The nearest population to the West Virginia sites is Jackson County, Ohio approximately 60 km northwest of Green Bottom Wildlife Management Area (GBWMA). Ecological observations were made on disjunct population from the GBWMA located 26 km northeast of Huntington, West Virginia. The area (ca. 338 ha) contains a valuable wetland habitat (ca. 57 ha). A proposed habitat alteration to add marshland by building dykes has prompted this study. The ecological information will establish a baseline prior to habitat perturbation. Burrow diameters were used to determine the age classes in the population. Stomach content analysis (25/season), including a grid method to estimate volume of detritus, was used to determine the seasonal food habits. The breeding cycle was documented for the population including attempted observations of amplexus, first form mares, ovigerous females, hatching time, fecundity, and sex ratios. Meristic and morphometric data were compiled for males and females and correlated statistically by linear regression analysis using carapace and chela lengths as regressors. Information from this study of a disjunct population will be compared to the species within the normal range.

- 63 MULLINS, LEE ANN and DONALD C. TARTER. Marshall University--Low pH tolerance, under static bioassay conditions, of naiadal green jacket skimmers, *Erythemis simplicicollis* Say (Odonata: Libellulidae), from the Green Bottom Wildlife Management Area in southwestern West Virginia.

Although adult odonates are highly vagile and thus of limited value as pollution indicators, the naiads as a group are highly sensitive to habitat degradation. Naiads of the green jacket skimmer, *Erythemis simplicicollis*, were experimentally tested under static bioassay conditions to determine their tolerance to low pH. Naiads were exposed to four pH values (1.5, 3.0, 5.0, and 7.0) in the laboratory investigation. The 96-hour TLM (median tolerance limit) test was used as the measure of acute toxicity to low pH. The straight-line graphical method was employed to determine the pH value at which 50 percent of the naiads survived after 96 hours. Tests were duplicated and the mean was plotted as the final TLM value. Results from this investigation will be compared with other pH tolerance studies of naiadal odonates.

- 64 FLOWERS, JAMES R. and GROVER C. MILLER. North Carolina State University--Molluscs collected from the Swift Creek basin in Wake and Johnston counties, North Carolina.

A molluscan survey of the Swift Creek basin in North Carolina was conducted during the summer of 1992. Stations at 1 mile intervals on Swift Creek and its tributaries were intensively explored for molluscan species. One hundred eighteen stations were explored. After preliminary identifications, an estimated twenty-one molluscan species or more were collected. Fourteen gastropod species were collected including such species as *Gyraulus deflectus*, *Menetus alabamensis*, *Planorbella trivolvis*, *Leptoxis carinata*, *Laevapex fuscus*, *Fossaria humilis*, and several others. At least seven bivalve species were collected representing such genera as *Elliptio*, *Anodonta*, *Musculium*, *Sphaerium*, *Pisidium*, and the introduced clam, *Corbicula fluminea*. Of the 118 stations searched, 68 supported both a gastropod and bivalve fauna, 47 supported only a gastropod fauna, and 3 lacked a molluscan fauna. Support for this study was contributed by the North Carolina Wildlife Resources Commission, NCAS R. R. Bryden Research Grant, and Reinard Harkema Memorial Endowment.

- 65 MCLACHLAN, JAMES and RUTH ANN DEWEL. Appalachian State University--Sensory receptors of the median ocular region of the scorpion *Centruroides vittatus*.

The area bounded by the lateral ocular furrow, including the

superciliary keel and the median ocular furrow, of the scorpion *Centruroides vittatus* contains, in addition to the eyes, the following sensory receptors: 1) several pairs of curved mechanoreceptive hairs that lie at both ends of the superciliary keels, 2) shorter unpaired chemoreceptive hairs that are staggered along the median furrow, 3) a single pair of slit sensilla that are located at the anterior bases of the superciliary keels, and 4) sensory receptors lacking an external hair process that underlies the surface tubercles. These receptors possess large receptor lymph cavities that are filled with microvilli and contain at least three dendrites. They are the most common receptor and are similar in structure to tarsal organs that are thought to be either olfactory or hygroreceptors. Partial support provided by NSF-ILI Grant# USE-905 1823

- 66 HEDGECOCK, ASHLEE A., GARY L. WALKER and RICHARD N. HENSON. Appalachian State University--The population ecology and genetic architecture of the scorpion *Centruroides vittatus*.

The scorpion *Centruroides vittatus* is common throughout Texas, but is also found in parts of New Mexico, Oklahoma, Arkansas, Louisiana, and Missouri. In addition to its wide but discontinuous distribution, *C. vittatus* is found in a variety of vegetational life zones. To gain insight into the population ecology of *C. vittatus*, especially the extent of its movement and dispersal, an electrophoretic survey was conducted consisting of 20 populations across its range in Texas. Approximately 200 individuals were analyzed at 17 allozyme loci, six of which were polymorphic. Preliminary results indicate significant levels of genetic variation within some populations and genetic heterogeneity among populations across the range.

- 67 WILLIAMS, ANN C. and ARTHUR L. WILLIAMS--Genetic expression of recombinant plasmids carrying *Coriolus versicolor* genes in *Escherichia coli* cells.

Coriolus versicolor is a white-rot basidiomycete which elaborates cellulolytic and ligninolytic enzymes both *in situ* and *in vitro*. Because the fungus can be 'batch-cultured' in defined medium, it may be a 'model system' to achieve over production and enhanced secretion of industrial enzymes. In this study, purified *Coriolus versicolor* DNA was utilized to generate a gene library. From this library, an array of recombinant molecules of plasmid pBR325 was selected carrying genomic DNA inserts. Subsequent to the transformation of *Escherichia coli* cells, two recombinant plasmids appeared to direct the synthesis of a protein around 60 kDa. This protein exhibited polyphenol oxidase-like activity and its production was increased by catechol. Antibody probing analysis revealed

that this protein reacted with fluorescein-tagged antibodies made against tyrosinase (e.g. polyphenol oxidase). Supported by DOE-ACID subcontract 19X-SJ848V.

68

WILLIAMS, ARTHUR L. Howard University
Ribonucleic acid analysis of an unusual valine-resistant mutant of *Escherichia coli* K-12.

We have previously reported the isolation and partial characterization of a valine-resistant (Val^r) mutant that also exhibited growth resistance to the leucine analogue, azaleucine. In this study, we report RNA analysis of this mutant as revealed by RPC-5 chromatography and polyacrylamide gel system. Reversed-phase column chromatographic fractionations revealed altered mobilities of isoleucine tRNA and a 10% polyacrylamide gel electrophoretic system indicated a defect in the accumulation of small stable RNA species (including 4S; the fraction representing tRNAs). Acquisition of Val^r/Aza^s results in the restoration of normal regulation of both the *ilv* biosynthetic enzymes and aminoacyl-tRNA synthetases and normal pattern of tRNA^{ile} species. The overall regulatory patterns suggest differential participation of isoleucine valine and/or isoleucyl- and valyl-tRNAs in control of expression of the respective genes. Supported by NIH-MERS grant.

69

DUFF, ROBERT J., and EDWARD E. SCHILLING.
Botany Dept., University of Tennessee--The use of cpDNA restriction site data to characterize populations and estimate relationships among *Isoetes* L. in North America.

Recent allozyme data collected regarding two taxa of *Isoetes* (*I. caroliniana* and *I. engelmannii*) in the southeastern U.S. suggested that electrophoretic data may be too variable to yield useful phylogenetic information regarding the relationships of anything but closely related taxa. As a result, chloroplast restriction site data was generated to address broader phylogenetic questions among *Isoetes* in North America. Samples of DNA representing 20 species of North American taxa and multiple samples representing some southeastern U.S. taxa (*I. engelmannii*, *I. caroliniana*, *I. tegitififormans*, and *I. melanopoda*) were digested with 22 restriction enzymes and southern blots hybridized to lettuce cpDNA probes. Results show that most of the restriction site mutations observed are present only within individual taxa. Several restriction site differences have been observed between samples from multiple populations of *I. caroliniana* and *I. engelmannii*. These data concur with allozyme and morphological data from past research, supporting the recent distinction of *I. caroliniana* as a separate species. Many phylogenetically useful restriction site mutations have also been observed. These data indicate that relationships among taxa in North America may be different than those postulated using traditional taxonomic characteristics. For example; relationships based on these data do not correspond with taxonomic groupings based on spore ornamentation or habitat preference. The data collected demonstrate that cpDNA can provide valuable new information regarding the relationships of taxa in North America and may help us to better understand the evolution of morphological characters in this genus.

70

TYLER, STACIE and DWAYNE WISE.
Mississippi State University--Chiasma frequency and distribution in multivalents.

The *Romalea microptera* male has 11 pairs of telocentric autosomes with a chiasma frequency of 2 to 3 chiasmata in the medium and long bivalents. Multivalents were produced in spermatocytes by gamma irradiation of nymphs. We have statistically analyzed chiasma frequency and placement in bivalents of irradiated grasshoppers and compared them to those of bivalents of unirradiated grasshoppers. Having found no significant difference between the two groups we concluded that irradiation does not affect chiasma frequency. We wished to test the hypothesis that the distribution of chiasmata in multivalents follows a uniform pattern that is influenced by sensitivity to other chiasmata within the structure. We have found that chiasmata are not randomly dispersed within the multivalent. Instead, certain regions along the multivalent length show a higher incidence of chiasmata than do others. We offer some speculations about the control of chiasma formation in multivalents.

71

GREEN, BECKY L. and DWAYNE A. WISE.
Mississippi State University--Nonrandom segregation in spermatocytes of the fleabeetle, *Alagoasa bicolor* L.

Spermatocytes of the neotropical fleabeetle, *Alagoasa bicolor* L., contain ten pairs of autosomes and X and Y chromosomes. The autosomes are located on a mitochondria-sheathed main spindle domain, while the sex chromosomes are located on an adjacent spindle domain. The sex chromosomes segregate nonrandomly in anaphase I of meiosis. Results from light microscopy give information about the possible mechanism of the nonrandom segregation by using the technique of micromanipulation of the chromosomes. Immunofluorescence microscopy was used to determine the number of spindles and centrosomes in the spermatocyte. Data from serial sections examined in the transmission electron microscope were used to determine how the sex chromosomes were oriented to the poles and in relation to each other. Preliminary experiments have shown that the sex chromosomes are syntelically oriented in anaphase I after having been amphitelically oriented in prometaphase.

72-

MASTERS, BRIAN S. and FORESTER, DON C., Towson State University --
Genetic structure of populations of spotted salamander (*Ambystoma maculatum*) in Maryland.

Salamanders, and other relatively sedentary species, would be expected to be particularly vulnerable to habitat fragmentation because of their limited ability to migrate. As available habitat dwindles, an understanding of factors affecting the exchange of genetic information between surviving populations becomes increasingly important for the conservation and management of impacted species. Mitochondrial DNA was analyzed in samples of spotted

salamander eggs collected from six breeding ponds in Maryland separated by varying distances and geographical conditions. Fst values derived from these analyses indicate a quite limited ability for genetic exchange when populations are separated by more than ten kilometers. The data described here suggest that rivers may play a role in promoting gene exchange. Two of three populations examined on Maryland's eastern shore possessed no detectable variation in haplotype, presumably due to genetic drift resulting from long term habitat fragmentation caused by agricultural development.

73

McCOY, GEORGE and MARY FLEMING FINLAY.
Benedict College--Reproductive effects of chronic exposure to PCBs in two generations of *Peromyscus polionotus*.

The effects of chronic, life-long exposure to low levels (below 10 ppm) of dietary PCBs has received little attention. In the first generation of exposure, fifteen monogamous pairs of Old Field Mice (*Peromyscus polionotus*) were fed 5 ppm PCBs (Aroclor 1254) in ground rodent blocks using ethanol as the carrier. Matched control pairs were fed the same diet prepared without Aroclor. In the second generation of exposure, six week old offspring from the first generation exposed and control groups were monogamously paired within the same group avoiding sib matings. Feeding levels remained the same as in the first generation. All matings were maintained for one year and mice were maintained under standard conditions of laboratory care. Mean birth weights were significantly lower in the first and second generation exposed relative to controls, although there was no difference in litter size. Weaning weights were also significantly lower in the first and second generation exposed mice. These findings indicate that even at this low level, PCBs have a depressing effect on reproduction in a generalized, omnivorous mammal. (Supported by GM 08117--MBRS)

74

DAVIS, JENNIFER J. and DWAYNE WISE.
Shorter College and Mississippi State University--Comparisons of chromosome abnormalities and larval survival between a laboratory stock and progeny of wild-captured females of the crane fly, *Nephrotoma suturalis*.

An inbred laboratory stock of the crane fly, *Nephrotoma suturalis*, is characterized by an elevated level of chromosome abnormalities (including autosomal univalents, anaphase bridges, and fragmented chromosomes) and a reduced larval survival. The offspring of paired matings of the laboratory stock were raised in two temperature environments. The mean percent chromosome abnormalities and mean percent larval survival of the laboratory stock were determined and compared to that of progeny of wild-captured females of *N. suturalis* which were also raised in two temperature environments. Current evidence

indicates a significantly higher level of chromosome abnormalities and a significantly lower larval survival in the laboratory stock compared to the progeny of wild-captured *N. suturalis*.

75

STONE, SUSAN LYON. University of North Carolina at Chapel Hill--Effect of water quality on embryonic and larval survival and larval growth in *Ambystoma maculatum*.

Research has shown that pH and the cations, Al and Ca, can affect embryonic survival and that pH can affect growth rate of this species. Four egg masses were taken from both high and low pH ponds. The egg masses were quartered with two replicates placed in each pond. Range of mean pH 4.9-6.1. The animals were contained through the embryonic period and part of the larval period. Mortality and growth were recorded. Water quality variables measured included pH, alkalinity, cations, conductivity, dissolved organic carbon, D.O., temperature and zooplankton. Two-way ANOVA indicated that the receiving pond significantly ($p < 0.05$) affected survival of embryos and larvae. Two-way ANOVA showed that the receiving pond significantly affected growth of the larvae. Multiple regression indicated that alkalinity was the water quality variable that significantly affected larval growth. Analysis of the growth curves of can-sampled populations in two ponds indicated that there was significantly better growth in the pond with higher pH and alkalinity. This research was partially funded by a Grant in Aid of Research from Sigma Xi.

76

BLAKER, WILLIAM and LYNN TAYLOR.
FURMAN UNIVERSITY--Hippocampal and visual laterality in the formation of short-term memory in rats.

In both humans and animals, bilateral hippocampal damage produces profound deficits in short-term memory formation, whereas unilateral damage has little permanent effect. We investigated the hypothesis that the effects of unilateral hippocampal damage are more apparent when sensory input to the brain is limited to the damaged side. Since about 98% of the retinal projections from each eye of the rat crosses to the opposite side of the brain, we used visual system limitations to test the hypothesis. Each experimental rat was trained on a 12-arm radial maze (a measure of visually based short-term spatial memory), electrolytically lesioned in either the right or left hippocampus, and then retested daily on the maze. Before each post-lesion test, all the rats were fitted with a temporary visual occluder over either their left or right eyes. The occluded side was alternated between trial days. The average performance during trials in which the occluder was on the side opposite the lesion was significantly higher than during trials with an ipsilateral occluder.

We conclude that each hippocampus is best able to form short-term memories from visual information which initially reaches the cerebral cortex on its side.

77

FABER-LANGENDOEN, DON. The Nature Conservancy, Midwest Office--Management and restoration of oak barrens at Allison Savanna, east-central Minnesota.

Oak barrens at Allison Savanna have been managed with a variety of prescribed burns since 1962. However, no measures of restoration or preferred fire frequency have been undertaken. We constructed a pre-settlement map of the area to determine vegetation structure in the 1850s, and used aerial photos to investigate changes in tree canopy cover between 1938 and 1960 (prior to prescribed burns) and between 1960 and 1987 (with and without burns). Presettlement oak barrens were described as "scattering burr and black oak and oak brush." Canopy cover in 1938 was 6%, and in 1960 was 21%. By 1987 prescribed burning successfully reduced canopy cover to approx. 16% at fire frequencies ranging from every 1-2 yrs to every 3-4 yrs. The highest fire frequencies were not much more effective in reducing canopy cover than intermediate frequencies. Without fire, canopy increased to approx. 45% by 1987. These results support recent management decisions to reduce fire frequencies to once every four yrs. Vegetation plot data indicate that current tree composition and structure resembles presettlement barrens. Thus at a local scale, Allison Savanna represents a successful restoration.

78

MACDONALD, DANA D. University of Michigan School of Natural Resources and Environment--Landscape ecosystems of glaciofluvial outwash on the Stonington Peninsula within the Hiawatha National Forest, Upper Michigan.

Jack pine (*Pinus banksiana* Lambert) barrens or savannas of the upper midwest have long been of ecological interest. Perceived typically as a pine-dominated vegetation type, the literature describing such areas suggests, however, that they consist of diverse landforms, physiognomies, and vegetation. Thus, a holistic approach was used to identify, describe, and map the landscape ecosystems on a 2023 ha portion of the Stonington Peninsula, Hiawatha National Forest, Upper Michigan. Field reconnaissance and analysis of landforms (hierarchical clustering and principal component analysis) suggest two major landscapes characterized by differing patterns of dune development following outwash deposition. Within these landscapes, hypothesized ecosystem types were sampled using a stratified random method. Preliminary results indicate the presence of four landscape ecosystem types. The four types occur on level outwash above 201 m elevation, level outwash below 201 m elevation, outwash channels below 195 m elevation, and Nipissing age dunes. Stand age mapping and historical records indicate

a fire return interval of 10-15 years across all ecosystem types. Ecosystem differences in landform, soil, and vegetation (principally understory and ground cover layers) under a similar fire return interval are compared and contrasted.

79

STRITCH, LAWRENCE R. USDA Forest Service, Shawnee National Forest--Restoration of an barrens/woodland complex within an oak-hickory forest mosaic.

Prior to Euro-american settlement, oak-dominated forests, woodlands, and barrens of the eastern deciduous forest were stable, pyric dis-climax communities. With the removal of fire from the landscape, oak woodlands and barrens have succeeded to oak forests. In recent decades the invasion of these ecosystems by mesophytic, fire-intolerant species has been documented. Decline in fire frequencies and modern-day fire exclusion policies are the primary factors for this phenomenon.

In 1989 the Shawnee National Forest initiated an ecological restoration of a degraded oak-hickory mosaic at the Simpson Township Barrens Ecological Area. With the use of geologic and soil maps, historical aerial photography, and baseline floristic inventory data a management prescription was prepared along with an accompanying environmental analysis. Restoration activities included selective woody removal, prescribed fire, and exotic species control. Species richness has increased, canopy closure has decreased, herbaceous ground cover has increased, and woody mesophytic species have been reduced. Restoration goals have been achieved and future management will consist of periodic prescribed fire and exotic species control.

80

HEIKENS, ALICE LONG, K. ANDREW WEST, and PHILIP A. ROBERTSON. Franklin College of Indiana, Illinois Department of Conservation, Southern Illinois University --Effects of prescribed fire on chert and shale barrens in southwestern Illinois.

Brown Shale Barrens and Wolf Creek Chert Barrens are small, high-quality natural forest openings in extreme southwestern Illinois. Brown Barrens, dominated by *Quercus stellata* and *Schizachyrium scoparium*, and Wolf Creek Barrens, dominated by *Quercus stellata*, *Ulmus alta* and *Fraxinus americana*, are increasing in woody cover as documented by examining historical aerial photographs. In 1988 thirty 0.005 ha circular plots were sampled at Brown Barrens using a modified Daubenmire canopy cover method; permanent plots were established. In 1989 twenty-eight similar plots were established at Wolf Creek. Following a prescribed burn, both sites were resampled. Preliminary results indicate that the fire did not significantly reduce the arboreal components nor increase the herbaceous component of either barrens. Additional management is being conducted and proposed for the sites in order to reduce woody encroachment.

81

TYNDALL, R. WAYNE. Maryland Natural Heritage Program--Vegetation and restoration of Maryland serpentine barrens

Only four serpentine areas remain in Maryland, comprising less than 5% of

presettlement coverage. In three areas, indigenous grassland and oak savanna communities have been almost completely lost to conifer expansion. At Soldiers Delight, the largest serpentine area in the eastern U.S., more than 50% of presettlement grass- and savanna coverage has been displaced by conifer expansion. This study tested restoration tactics in three study areas at Soldiers Delight. A 20-year-old Virginia pine woodland was subjected to two consecutive spring burns to determine the effect on tree and sapling survival. Since only leaves within 2-3 m of the ground were killed, mortality was negligible. In another pine woodland, effects of winter clearing and clearing + two consecutive fall burns were studied. Bare soil coverage and abundance of the Federally Endangered Acalinis acuta increased in the experimental unit cleared and burned but not in the unit cleared only. Burning before leaf drop was effective in controlling Smilax rotundifolia. These tactics were repeated on a series of SW-facing ridges. Similarly, bare soil coverage increased on the ridge cleared and burned, but it decreased on the ridge cleared but not burned. Abundance of A. acuta was significantly greater on the ridge cleared and burned than on the ridge cleared but not burned.

82
ANDERSON, ROGER C.¹ and JOHN E. SCHWEGMAN².
The Department of Biology, Illinois State University 61761 and Division of Natural Heritage, IDOC, Springfield, IL 62701.
Long-term effects of fire and absence of fire on a southern Illinois Barren.

Maintenance of barren and savanna communities in presettlement times was dependent upon periodic fires to retard the growth of woody species and encourage the growth of associated herbaceous prairie plants. In 1968, we began a study to determine the response of a Southern Illinois barren to fire. After two prescribed burns, the frequency of prairie plants and annual legumes increased and tree basal area and density declined. A few woody species were eliminated by burning but two species of shrubs, silky dogwood (Cornus amomum) and prairie willow (Salix humilus), increased in density. During a fifteen year period without prescribed burns on the site, the frequency of prairie plants and the density of the two shrubs declined, while the frequency of woodland herbs and density of tree seedlings and saplings increased. In 1990, prescribed burning was again applied to the site. After three burns, prairie plants are increasing in abundance, while the abundance of woodland plants is declining. Nevertheless, our data suggest that continued burning may not return the site to those conditions which existed when we began our study.

83
HEIKENS, ALICE LONG. Franklin College of Indiana--The role of fire in maintaining the barrens in southern Illinois.

It is believed that fire frequency decreased in the 1800's as Europeans inhabited the Midwest. It is further believed that the decline in fire has adversely affected many plant community types in the Midwest, including barrens. In 1988 twenty-two natural forest openings were studied in an attempt to classify and define the barrens plant community type. Of these twenty-two sites, four sites were classified as barrens: Brown Shale Barrens, Gibbons Creek Sandstone Barrens, Gyp Williams Sandstone Barrens, and Wolf Creek Chert Barrens. Evidence, including aerial photography and presettlement and postsettlement reports, indicates that these sites are experiencing woody encroachment. In an attempt to determine the role of fire in the barrens, 299 tree stumps on four oak-hickory sites in the Ozark and Shawnee Hills of southern Illinois were examined for evidence of fire. No trees examined dated to presettlement times; however, the data indicate that fire frequency was greatest 60 to 80 years ago and has declined substantially in the past 50 years. In addition, it appears as though these fires were quite patchy in that typically a few trees on a given slope were scarred yet the remainder showed no fire damage. In an attempt to maintain the herbaceous component of the barrens, landscape fires were prescribed for the barrens. Preliminary results of a prescribed burn on Brown Barrens and Wolf Creek Barrens indicate that management tools other than fire may be required to maintain these endangered plant communities.

84
CARSTENSEN, SUSAN M. Emory University--
A comparison of herbivory on kudzu (Pueraria lobata) in its native and introduced ranges.

A common hypothesis for the success of introduced plants is escape from the herbivores that control the plant's growth in its native range. This paper evaluates the escape hypothesis for kudzu (Pueraria lobata). Both herbivory rates (measured as % standing leaf area removed) and invertebrate herbivore communities of native (Japanese) and introduced (Georgian) kudzu populations were measured and compared. Preliminary analysis suggests that herbivory rates in Japan are not significantly higher than in Georgia. The amount of herbivory in Georgia leads us to reject the escape hypothesis, but other aspects of herbivory may be important in controlling kudzu's growth. Georgia kudzu populations support a large and diverse community of invertebrate herbivores (>34 species in 8 orders), but Japanese kudzu supports an even larger community (>65 species in 10 orders). The communities differ substantially in guild composition. Japanese kudzu supports a higher proportion of internal feeders (12.3% vs. 3.3% of species) and a higher proportion of kudzu specialists (>10% vs. 0% of species). The comparison of these herbivore communities supports Strong, Lawton, and

Southwood's hypothesis (1984) that introduced plants will rapidly recruit external feeders and generalists, but internal feeders and specialists will be recruited much more slowly if at all.

85

MUNTAN, CHAD, JOHN PARNELL, AND DAVID WESTMORELAND. Emory University--Floral display and female reproductive success in Queen Anne's lace, *Daucus carota* L.: I. The influence of color contrasts.

Flowers of bisexual species have two outlets for reproductive success: seed production and pollen donation. The pollen donation hypothesis predicts that when fruit maturation is limited by resources, female reproductive success should be largely unaffected by variation in the color of floral displays. We tested this hypothesis by modifying the secondary umbels of Queen Anne's lace. In each of three study sites (IA, KY, & NY), 40 plants were randomly selected from natural populations and assorted into 20 pairs on the basis of size and stage of development. One of each pair was used as a control; in the other, a cluster of red central florets was removed from the umbels prior to anthesis. Thus, treatment umbels were uniformly white whereas control umbels were bicolored. Of the four most common families of insect visitors (Sciaridae, Formicidae, Calliphoridae, & Syrphidae), only one (Syrphidae) showed a preference for control umbels. This was not correlated with higher reproductive success, however: treatment and control plants did not differ in the median number of seeds produced (T, 5775 seeds; C, 5778 seeds; $P = 0.83$). Furthermore, site-to-site variation in pollinator abundance did not influence seed set. These findings lend support to the pollen donation hypothesis.

86

PARNELL, JOHN, CHAD MUNTAN, AND DAVID WESTMORELAND. Emory University--Floral display and female reproductive success in Queen Anne's lace, *Daucus carota* L.: II. The influence of umbel size.

The pollen donation hypothesis predicts that the size of a floral display will have little or no effect on female reproductive success. Tests have given contradictory results: size has a strong influence in some species, and little effect in others. These findings may be reconciled by considering the complicating factor of resource limitation: when the resources necessary for fruit maturation are unlimited, a plant's seed set will be determined by the efficiency of pollinator visitation, and thus a more attractive floral display will lead to higher seed production. When resources are limited, however, a plant cannot develop all of the ovules that are fertilized, and thus attractiveness will not necessarily correlate with higher seed set. Queen Anne's lace is an ideal species for testing these ideas because the first (primary) umbel to open is not resource limited, but later (secondary) umbels are. We examined the relationships between umbel size and fruit set for 120 plants from three locations (IA, KY, & NY). In primary umbels, a 1-cm² increase in area corresponded to an increase

of 9.48 fruits, while in secondary umbels the same increase in area led to only 0.9 more fruits ($P < 0.05$). This and other trends were consistent for all three study sites, supporting the idea that resource limitation decreases the influence of floral attractiveness on female reproductive success.

87

COOK, R.A. and E.E.C. CLEBSCH. University of Tennessee--Demography and size changes in two populations of *Cimicifuga rubrifolia* Kearney.

Cimicifuga rubrifolia Kearney (Ranunculaceae) is a herbaceous perennial found primarily in the Ridge and Valley of Tennessee and Virginia with disjuncts in Alabama, Kentucky, Illinois, and Indiana. To begin to understand the population biology of this proposed C2 candidate, a study was begun in 1987. A simple model of leaf area was constructed using field measurements compared to Licor area measurements. Individuals were marked and measured. Size was considered to be the sum of the areas of all its leaves. Both populations were monitored through 1990. Plants were relocated and measured yearly with missing individuals being noted. Recruits were marked and measured. Size frequency plots produced reverse J-shaped curves. Population composition varied between populations and years with the greatest variation resulting from uneven seedling production. Single shoot individuals were significantly ($p < 0.05$) smaller than those with multiple shoots. Changes in shoot number on a rhizome did not always cause a significant size change. Mean size of flowering plants was significantly larger than nonflowering plants. Mean size of plants present all years (78.1 and 71.8% of the populations) was significantly larger than mean size of those absent for 1 or more years. About 8% of those absent reappeared in later years. This study indicates that size is an important correlate in the state of individuals of *C. rubrifolia* although precipitation appears to be a controlling influence.

88

NEWELL, CLAIRE L. and ROBERT K. PEET. University of North Carolina, Chapel Hill --Vegetation of the Linville Gorge Wilderness, North Carolina.

The 4570 ha Linville Gorge Wilderness occupies a rugged, 600 meter deep valley that cuts into the Blue Ridge Escarpment in west-central North Carolina. The vegetation of the wilderness was sampled using a nested quadrat method. Species composition and abundance were analyzed using TWINSPLAN, DCCA and DCA to identify the major plant communities and to determine their distribution in relation to topographic and edaphic variation. Most sites have shallow, acidic, infertile soils. This accounts, in part, for the predominance of low diversity, *Quercus* and evergreen heath dominated communities, on most slopes, and the presence of *Pinus rigida* and *P. pungens* on most exposed ridgelines. Old-growth *Tsuga* spp. and *Pinus strobus* with evergreen heaths occupy the steep lower slopes of the gorge. Sites on phyllite, regardless of topographic position, lack evergreen heaths and have a greater diversity of both

tree and herbaceous species. Rare and disjunct species are concentrated on the east rim of the gorge where thin soils keep tree density low. Vegetation composition is less like typical Blue Ridge forests than those found on outlying monadnocks immediately to the east.

89 WISER, SUSAN, K. University of North Carolina at Chapel Hill--Prediction of rare plant occurrences on high elevation outcrops of the Southern Appalachians

A prerequisite to rare species protection is accurate knowledge of current distributions. Even in areas as highly studied as the Southern Appalachians, new populations of rare species are still being discovered. Thus, predictive models of rare species occurrence could aid in determining localities for additional populations and assessing the likelihood of success in preserving or introducing rare species at a given site. In this study, 4 methods are used to predict the occurrence of 10 rare plants restricted to high elevation outcrops. The first two predict occurrence based on the physical environment at a site by 1) using regression to determine which environmental parameters best predict species presence, and 2) determination of all sites where habitat parameters fall within the known ranges of those for the rare species in question. The remaining two approaches predict occurrence based on the presence of species that co-occur with a particular rare plant. Predicting occurrence based on all known habitat parameters gave the most accurate predictions for 9 of the 10 species. The specific environmental parameters that best predict species occurrence differ among species. Predictions based on all four methods were most accurate for Calamagrostis cainii, Hypericum buckleyi and Minuartia groenlandica, and least accurate for Carex misera and Scirpus cespitosus. For all species the accuracy of the predictions varied widely among methods.

90 ALLISON, JAMES R. Georgia Department of Natural Resources--A botanical "Lost World" in Central Alabama

A remarkable, heretofore undescribed plant community occurs in central Alabama (Bibb County), at the southern edge of the Ridge and Valley Physiographic Province. This community-type occurs at more than 2 dozen outcrops of an unusually pure dolomite (Ketona formation). Distributed over these "cedar glades" are, at the least, 5 new endemic species (of Castilleja, Dalea, Erigeron, Liatris and Silphium) and 5 state records (Notholaena integerrima, disjunct from Texas; nationally Endangered Spigelia gentianoides, disjunct from Florida; Paronychia virginica bridging a gap between Virginia and Arkansas; Rhynchospora capillacea disjunct from Tennessee; and R. thornei, a Candidate for federal protection known previously from only 4 collections from 3 states). Additional rarities on these glades include nationally Threatened Marshallia mohrii; Silene regia, a national Candidate previously feared extinct in the state; 5 additional national Candidate species; and 10 other taxa tracked by the state Natural Heritage Program. Nearby a few of these glades grow still more

rarities, including nationally Endangered Xyris tenesseeensis and the Candidate species Jamesianthus alabamensis, both disjunct by about 100 miles from previously known sites in NW Alabama. Possible explanations for the existence of this extraordinary assemblage include a combination of (1) geographical isolation; (2) edaphic specialization, e.g. for soils high in magnesium but low in silica; (3) relictualism in that portion of the Ridge and Valley which would likely have experienced the mildest climate during the Pleistocene; and (4) chance dispersal events (immigration).

91 JONES, WILLIAM D. Sand Hills State Forest, Patrick, S.C.--Floristic inventory and rare species management plans for Sand Hills State Forest

Recent interest in ecosystem management has prompted a study of the vegetative components of Sand Hills State Forest, particularly concerning the plants associated with long-leaf pine (Pinus palustris Miller). The purpose of the inventory is to identify sensitive plant species, and to modify management practices on the forest to increase or stabilize the population of these sensitive species. The effects of prescribed burning, pine straw raking, site preparation, and timber harvesting on sensitive plants' habitats are being monitored. By altering the timing and frequency of prescribed burns, lengthening the rotation of pine straw raking, surveying sale areas before raking, and tailoring site preparation and harvesting methods to each site, the diversity of flora on the forest can be maintained. These modifications and the proximity of Carolina Sandhills National Wildlife Refuge combine to maintain the uniqueness of the area.

92 MOORESIDE, PETER D. and VERONIQUE A. DELESALLE. Emory University--The cost of allocating resources to male and female functions in a monoecious cucurbit

Monoecious plants provide ideal systems to independently measure allocation to male and female functions. In particular, in cucurbits like Lagenaria siceraria, the sex expression of flower buds (male vs female) can be assessed early in bud development. This allowed us to compare control cosexual plants to three treatment groups of male, female, and neuter plants. For example, we created "male" plants by removing all female flower buds on these plants. Reproductive costs were measured by the plants' vegetative growth and additional flower production in response to treatments. This experimental design replicates Silvertown's 1987 study. However, we used field-collected seeds rather than cultivated seeds and we independently assessed the costs of female flower production and of fruit production.

We found significant costs (decreased vegetative growth and flower production) to allocation to both male and female functions. However, the costs of flower production are hidden in plants allowed to set fruit. Fruit production shuts down both male and female flower production. Finally, future floral sex expression was adjusted to compensate for removal of buds of a particular gender.

93 WESTBROOKS, RANDY G.¹ and LYTTON J. MUSSELMAN². U.S. Department of Agriculture, Whiteville Methods Development Center¹ and Old Dominion University, Department of Biological Sciences² -- Ecology, weediness, and host specificity in two *Orobanche* species (Orobanchaceae).

Orobanche minor (small broomrape) has been widely distributed in North America and can cause serious damage to a diversity of food and forage crops including clovers, carrots, and tobacco. Because of its potential, small broomrape is a Federal Noxious Weed. Native to Europe and parts of the Middle East, it has been documented as repeatedly introduced into North America during the past century chiefly through packing material and contaminated seed. Extant populations in South Carolina, Georgia and Virginia have been studied to determine host range and to predict potential spread and damage. The species should be considered as a pathogen and treated accordingly.

Orobanche uniflora, a native broomrape, has spread rapidly in southern Georgia on an introduced South American weed, *Hypochoeris brasiliensis*. Once restricted to mesic sites, *O. minor* now often forms large populations under weedy conditions but only on *Hypochoeris brasiliensis*.

94 BASKIN, CAROL C., JERRY M. BASKIN and EDWARD W. CHESTER. University of Kentucky and Austin Peay State University--Seed germination ecophysiology of four summer annual mudflat species of Cyperaceae.

Cyperus erythrorhizus, *C. flavicomus*, *Fimbristylis autumnalis* and *F. vahlii* are summer annuals on mudflats that form in summer/autumn when water levels in Lake Barkley, an impoundment on the lower Cumberland River, are lowered. Seeds of each species were buried under nonflooded conditions and exposed to natural temperature cycles for 28 months. Each month, exhumed seeds were tested for germination in light and darkness at 12/12 h daily thermoperiods of 15/6 to 35/20°C. At maturity in autumn, seeds of *C. flavicomus* were dormant, while those of the other species germinated to high percentages at high temperatures. Seeds of the four species afterripened during winter and germinated to 93-100% in light at 25/15, 30/15 and 35/20°C by

February. During the remaining 25 months of burial, seeds germinated to 91-100% in light at simulated May, June, July, August and September temperatures in each respective month. Maximum germination in darkness was 0-73%. Flooding did not inhibit afterripening nor cause nondormant seeds to re-enter dormancy. These responses allow seeds of the four species to germinate any time during the growing season if the mudflats become exposed.

95 WALCK, JEFFREY L. University of Kentucky--A contribution to the ecological life history of *Senecio antennariifolius*.

Phenology, population dynamics, survivorship, and sexual reproduction were studied in two populations (A and B) of *Senecio antennariifolius* from 1986 to 1988. *Senecio antennariifolius* flowered from mid-April to late May; by mid-June, all seeds were dispersed. Number of adults in population A decreased by 15% between 1986 and 1987, and by 49% between 1987 and 1988. However, the total number of genets remained nearly constant over a three-year period due to a large number of seedlings in 1988. In population B, the number of adults decreased by 17% between 1987 and 1988, but the number of seedlings in 1988 more than replaced the number of adults that died. Adults in population A produced flowers when they had 4 rosettes, and in population B when they had 10 rosettes. Mortality was greatest among small adults, and was caused by erosion, invasion of *Lonicera japonica*, and possibly the failure to produce new basal rosettes.

96 ZETTLER, LAWRENCE W., NEERAJ S. AHUJA, and THOMAS M. McINNIS, JR. Clemson University--The pollination ecology of *Platanthera integrilabia* (Correll) Luer, an endangered terrestrial orchid.

The pollination ecology of the endangered orchid, *Platanthera integrilabia* was studied for the first time at the largest remaining population in McMinn Co., TN during peak flowering (12-15 August, 1992). Nectar measurements and insect activity were monitored hourly during two time periods (13 hrs, morning to early evening, and 24 hrs continuous). Of the 109 flowers sampled, a mean of 4.4 µl nectar containing 18.9% sugar was recorded per flower. No significant statistical differences (p=0.05) were observed among nectar volume and sugar concentrations over a 24 hr period. Three day-flying Lepidoptera, *Epagyris clarus*, *Papilio glaucus*, and *P. troilus*, were determined to be the pollinators of this orchid, however, several flower visits were often required for pollinia adherence, particularly for the *Papilio* species. Mean viscidia distance (4.7 mm per flower) was

greater than compound eye width of the three pollinators suggesting that more efficient pollinators may be those with larger eyes such as night-flying moths. Only one moth (Sphingidae) was briefly observed at inflorescences after dark (2:00 a.m.) and did not appear to carry pollinia. Other flower visitors (pollinia absent) included Coleoptera (Mordellidae), Diptera (Syrphidae), and Hymenoptera (Apidae, Vespidae). All pollination and visitation occurred between 7:00 a.m. and 5:00 p.m. with the exception of the single sphingid visitor. Over half of all flowers (56.9%) successfully set fruit two months later (October 7) with a mean of 4.6 capsules per inflorescence. The lack of an efficient pollinator may represent another natural factor responsible for the decline of this orchid species.

97 Stark, T.J.,¹ D.K. Evans,¹ F.S. Gilliam,¹ and P.A. Robertson.² Marshall University¹ and Southern Illinois University at Carbondale²--The vascular plant communities of Green Bottom Wildlife Management Area, middle Ohio River floodplain.

Plant communities of the 338 hectare Green Bottom Wildlife Management Area were described by several multivariate and classical methods, including canonical community ordination and principal components analysis (CANOCO). Overstory and shrub layer species from 147 100m² plots were treated separately, as were herb layer cover data from 588 1m² subplots along the same overstory transects. Gross community types include bottomland hardwood forest, river sand and mud flat, marsh and wet meadow, full canopy swamp, and open canopy shrub swamp. Several areas have recently become or are rapidly becoming permanently inundated. The relative age of these areas is known. Classification of the sample points, and their arrangement on moisture and soil texture gradients, provide insight into temporal community succession in the rapidly expanding wetland. This information is necessary for making management decisions concerning wetland conservation, restoration, and creation projects.

98 FREDERICKSEN, TODD S. Baruch Forest Science Institute of Clemson University--Crown and root response to interference between loblolly pine and two hardwood tree species.

A replacement series field experiment was established in 1989 on the Virginia Piedmont to determine the mechanisms of interference between loblolly pine (*Pinus taeda* L.) and two hardwood tree species, red maple (*Acer rubrum* L.) and black locust (*Robinia pseudoacacia* L.). Pine seedlings were planted with each hardwood species in stands of varying proportions at a constant (1x1 m) spacing. Pure stands of each species were

planted as controls. Invading natural vegetation was controlled with herbicides. During the third growing season, crown dimensions were measured and root biomass was estimated by soil coring. Crowns of all three species had larger diameters and greater heights in mixed stands compared to pure stands, indicating that they adjusted morphologically to interspecific interference. Fine root biomass was greater in mixed stands than in pure stands. These results indicate the existence of more efficient niche partitioning for trees in mixed stands compared to pure stands.

99 GARRISON, N. E. James Madison University--Interactive Laser Disk Video and Microcomputer Assisted Biology Teaching: Courseware Authoring
Laser disk players and computers are technologies that complement and extend the capabilities of each other. Information stored on a laser disk in one of 54,000 frames can be accessed in as little as 0.5 sec, depending on the player's speed, and a computer can be used to control the access interactively. Courseware authoring programs add yet another dimension by coordinating information on the computer screen with that on the laser disk.

For the first part of this workshop, a tutorial course, dealing with early embryonic development, will be demonstrated and examples of media and software in other areas of biology will be briefly surveyed.

Secondly, a question and answer period will include information about equipment acquisition, estimates of cost, and other topics.

Finally, in the third part of the workshop, a new interactive course session will be constructed from the beginning to illustrate some methods of authoring which will include discussion of the following formats: text, audiovisual (both still and motion clips), multiple choice, fill in the blank, excursion (to produce a menu), and transport (goto and gosub). Methods of selecting frames from laser disks and the use of text overlays will be illustrated.

100 FUSS, CAROLYN L. AND LEONARD A. STOKK. Virginia Commonwealth University--Spatial and temporal variation of respiration rates in a blackwater stream.

Microbial respiration on leaf packs and woody debris and in surface and hyporheic sediments was measured in a sand-bottomed blackwater stream in southeastern Virginia. Respiration rates were measured monthly over one year in polyethylene chambers placed in the stream. Mean respiration rate per unit surface area (m²) of habitat was highest for woody debris, followed by leaf packs, surface sediments and the hyporheic sediments. Respiration rates, expressed per unit volume (m³) of habitat, were highest in the surface sediments followed by the hyporheic sediments, woody debris, and leaf packs. Respiration rates for the surface sediments, leaf packs, and woody debris varied seasonally, being positively correlated with temperature. The hyporheic sediments showed little seasonal variation. The rate of respiration was also dependent on the amount and quality of organic matter in each habitat. The latter two factors changed seasonally, thereby providing an additional temporal component to respiration rates. The results indicate a spatial and temporal variation of respiration rates in stream ecosystems.

101

LYNDE, STUART R., KYM J. REUBUSH, JEANNIE M. ROPER, WILLIAM J. VAN WART, J. R. WEBSTER, and DONALD S. CHERRY. Department of Biology, Virginia Polytechnic Institute and State University--The use of artificial streams in evaluating leaf degradation: a comparison of breakdown rates based on thermal addition.

Artificial streams have been used in toxicological testing and to model numerous types of lotic conditions. Advantages of these systems lie in the ability to manipulate test conditions. A comparative study was carried out in the fall of 1992 in the East River and in artificial streams located at the Glen Lyn Power Plant, Virginia. Leaf packs were placed above, within and at the margin of the plant's thermal discharge into the East River, and simultaneously in the artificial stream system. Processing rates were derived for each experiment based on mass loss and leaf penetrance (a measure of leaf toughness). Mass loss was similar in the control site and artificial streams but was more rapid in the thermally influenced stations of the East River. Leaf penetrance was reduced in the heated streams and river stations, relative to the artificial stream and river control systems. Data obtained from artificial streams indicated an accurate representation of field conditions with respect to microbial conditioning of leaves, but a difference with respect to the effect of physical factors such as abrasion.

102

COPPS, STEPHEN L. JR., THOMAS R. CARPENTER, LUTHER P. BROWN AND ROBERT B. JONAS. George Mason University--Vertical profiles of three Bahamian (karst) Blue Holes.

Karst sink holes (Blue Holes) occur widely on Andros Island, Bahamas. Many are relatively undisturbed anthropogenically and are physically stable and highly stratified in the vertical field, with fresh water overlying saline water. These seldom studied systems provide a unique environment for investigating interface (oxic/anoxic, fresh/salt) biology and biogeochemistry. Vertical profiles of hydrostatic parameters in three inland Blue Holes were constructed from measurements of temperature, salinity and dissolved oxygen (DO), all assessed remotely using submersible probes. Hydrogen sulfide (H_2S) was measured by the colorimetric Cline Assay in water samples collected by Niskin bottle. Low DO values were confirmed by Winkler titration. The two deeper Blue Holes; Cousteau's (Max Z, 110m) and EW3 (Max Z, 18m) were salinity stratified with sharply defined pycnoclines at 18m and 13m respectively. In both systems DO declined rapidly with depth at the pycnocline and the water was anoxic and sulfidic immediately below. Anoxic, sulfidic, saline water occupies an 80m thick layer to the bottom of Cousteau's and a 5m thick layer in EW3. Gobio Lake (Max Z, 6.5m), where the bottom was covered with submerged aquatic vegetation, exhibited no pycnocline nor measureable pelagic H_2S , but was anoxic near the sediment water interface. These

data provide the background for continuing investigations of the microbial ecology of Blue Holes.

103

CARPENTER, THOMAS R., STEPHEN L. COPPS, JR., LUTHER P. BROWN, and ROBERT B. JONAS. George Mason University--Variation in bacterial abundance and biovolume in Bahamian Blue Holes.

Bacterial abundance and size distribution in three inland Bahamian Blue Holes on Andros Island were determined by direct fluorescence microscopy of acridine orange stained water samples. Hydrostatic water quality characteristics of these sites were measured at the time of sample collection (Copps, et al. this volume). Average water column abundance were highest (3×10^6 cells/ml) in Gobio Lake, intermediate (1×10^6 cells/ml) in EW3 and lowest ($< 0.5 \times 10^6$ cells/ml) in Cousteau's Blue Hole. In both Cousteau's and EW3 bacterial abundance (2.4×10^6 cells/ml, 2.1×10^6 cells/ml respectively) and biovolume (1.5×10^6 $\mu m^3/ml$, 2×10^6 $\mu m^3/ml$ respectively) reached maximum values in the midwater in association with the marked pycnoclines. In contrast maximum abundance (3.9×10^6 cells/ml) in EW3 occurred at 4m while biovolume (2.1×10^6 $\mu m^3/ml$) occurred at 0.5m. Gobio Lake (Secchi depth 4.5m) had abundant submerged and emergent macrophytes, while the principle plant communities of Cousteau's (Secchi depth 4.5m) and EW3 (Secchi depth 4.5m) were algal mats attached to the vertical walls. Cell morphology of the bacterial communities varied greatly with depth in the two density stratified systems, Cousteau's and EW3.

104

STEFFENS, THOMAS A., LUTHER P. BROWN AND ROBERT B. JONAS. George Mason University--Tarpon Blue Hole, Andros Island, Bahamas: Biogeochemical changes in an historically stable estuarine environment.

Bahamas estuarine and marine sink holes (Blue Holes) are foci of macro- and micro-biological activity. This intense activity may result from factors including energy subsidies related to tidally driven water movement, local high rates of primary production (anoxygenic bacterial photosynthesis in density stratified systems) or thermal inversions within the water column. Such a temperature (T) inversion was reported for Tarpon Blue Hole (Max Z = 7m) in summer 1982 when the T was 31°C near the surface and peaked at 38°C at 5m depth. Anecdotal reports by Bahamian fishermen indicate that this "hot" condition has been a long-term phenomenon at this site. In this investigation, vertical profiles of hydrostatic parameters were constructed from measurements of T, salinity (S) and dissolved oxygen (DO), all assessed remotely using submersible probes. In January 1990, the temperature inversion continued, 22.7°C at 0m and 26.3 °C at 1.5m,

in association with a rise in S of 2ppt and decline in DO from 80% to 20% saturation. Below 5m the water was anoxic, sulfidic and contained large populations of (morphologically) purple sulfur bacteria. However, in May 1992 there was no thermal inversion S change with depth was <1ppt and DO was at nearly 80% saturation throughout the water column. Causes for this change remain speculative, but it seems possible that reduced volume flow of high salinity water has massively altered this unique karst system.

105

HALPIN, T. R.,¹ GRAHAM, B.G.,¹ HEARD, R. W.,² and R. M. OVERSTREET.² Livingston University¹ and Gulf Coast Research Laboratory².--A Preliminary Faunal and Ecological Survey of an Inland Saline Environment.

Field work during the summer of 1992 revealed an unique estuarine-like environment approximately 160 km inland from the Gulf of Mexico. Located near Jackson, AL., this ecological anomaly was created by fresh water intrusions forced upward through the Klepac salt dome by hydrostatic pressure forming natural saltwater springs with salinities over 40 ppt. The wetland vegetation surrounding the springs included two tidal marsh species, Eleocharis parvula and Pluchea purpurens. Faunal collections were made in the immediate vicinity of the springs. Several species of macroinvertebrates and one fish, Gambusia affinis, were observed. The invertebrates collected included an oligochaete (Limnodrilus hoffmeisteri), a hydrobiid gastropod (Pyropophorus sp.), three crustaceans (Gammarus nr. tigrinis, Lirceus sp., and an unidentified poecocopid ostracod), and two larval dipterans (Goeldichironomus nr. carus and Aedes cf. taeniahychus). Most of the aquatic species from the study area appear to represent fresh water forms that have adapted to the saline condition of the spring run. This information provides baseline data for additional research into this unique ecosystem.

106

GLOVER, JAMES B. University of Louisville--Habitat and food selection of the caddisflies in the genus *Triaenodes* (Trichoptera: Leptoceridae).

The caddisfly genus *Triaenodes* is a shredder-herbivore which occurs in two basic habitats-aquatic macrophytes and the roots of terrestrial and aquatic plants. Although many species of *Triaenodes* are habitat specific some will occur both in macrophytes and roots in lentic and lotic habitats. *T. injustus* is one such species which has been collected in large numbers both in roots and macrophytes in streams and lakes. Specimens from the South Fork of the Shenandoah River in Page County Virginia were analyzed for habitat and food preference. *Triaenodes injustus* showed a strong preference for root mats over the aquatic macrophyte *Justicia americana*, although specimens were observed to feed actively on both choices. Gut analysis revealed large amounts of plant material but also diatoms and green algae. A theory on the evolution of aquatic macrophyte herbivory will be presented.

107

FISCHER, J. C.¹, J. L. FARRIS², R. J. NEVES¹ and D. S. CHERRY¹. Virginia Polytechnic Institute and State University¹ and Arkansas State University²--An examination of growth rates and age-class structure of freshwater mussels in the Clinch River, Virginia.

The Clinch River, Virginia to Tennessee, holds one of the most diverse mussel faunas in the world. Over the past century the mussel population in the Clinch River has shown a marked decline in density and diversity due to a number of anthropogenic impacts. In this study muskrat midden shells of *Lampsilis fasciola* were used to examine and compare growth rates and age-class structure between sites on the Clinch River, Virginia. Three sites were chosen based on availability of middens and longitudinal position on the river. Site 1 (CR1) was the most upstream site, site 2 (CR2) was the midstream site located 58 river miles downstream of CR1 and site 3 (CR3) was the farthest downstream site located 104 river miles downstream of CR1. Males and females of *L. fasciola* were considered separately and growth rates and age-class were examined for both at the three sites. The objective was to determine the condition of mussel populations based on the growth rates and level of recruitment of mussel species between different populations. At CR3 it was found that both males and females of *L. fasciola* exhibited a decrease in growth and an absence of recruitment compared with the upstream sites. Therefore, it is concluded that growth rates and levels of recruitment can be used to determine the differences in mussel populations which may be linked to anthropogenic impacts.

108

YEAGER, MARY M., DONALD S. CHERRY, and RICHARD NEVES. Virginia Polytechnic Institute and State University--Interstitial feeding behavior of juvenile unionid mussels, *Villosa iris*.

Declining unionid mussel populations have prompted research to develop better culturing techniques and to evaluate the effects of anthropogenic impacts on unionid mussels. These attempts have been hindered by the lack of information concerning the sensitive juvenile stages. This study was undertaken to characterize the relationship between juveniles and the sediment they inhabit, and to contribute dietary information to culturing studies by determining the feeding mechanism and principle food source of juvenile *Villosa iris*. Dye studies in a feeding chamber, observations of feeding using video tape and gut content analysis were used to determine mechanisms of feeding, the primary food source, and the origin of substances uptaken by the juveniles. It was found that although the juveniles burrow less than one centimeter into the sediment, their exposure to the overlying water is limited. Exposure to sediment comes not only through

direct contact, but also through filtration of interstitial water and sediment-associated fine particulate organic matter. The principle food source of the juveniles appears to be bacteria. Juveniles were also found to be feeding on green algae and diatoms which were associated with the sediment.

- 109 EMERY, ERICH, DAN CHAFIN, MARCIA HARRISON, DAN EVANS, and DONALD TARTER. Marshall University--Acute and chronic toxicity of ichtthyothereol, an ichtthyotoxin from Clibadium asperum (Aubl.) DC of (Asteraceae) of Amazonia, to the fathead minnow, Pimephales promelas (Rafinesque) and the central mudminnow, Umbra limi (Kirtland).
- Clibadium asperum, known locally as Masu, is used extensively by indigenous people of southeastern Ecuador to kill or stun fish. Upper leaves, flowers, and fruits from the low shrub are collected, crushed until moist and introduced into the stream or pool with the aid of a fiber basket passed back and forth in the water. Fish become disoriented in a few minutes and are easily caught and eaten without ill effects. The cyclic polyacetylene ichtthyothereol is the active component in C. asperum. During this experiment, a crude extract was made from leaves and stems (fresh and dry). Both acute (96 hrs) and chronic (7 days) static bioassays were set up in the laboratory and tests were conducted according to EPA protocols. Fry of the fathead minnow which were less than 14 days old were held at varying concentrations to determine the lethal dose for 50 percent of the test population. Once an effective concentration was established, a comparison was made between the fathead minnow and the central mudminnow, a more tolerant fish species.

- 110 HAYES, TIM P. and DONALD C. TARTER. Marshall University--Food habits of a disjunct population of the central mudminnow, Umbra limi (Kirtland), in relation to seasonal changes and age groups, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.

The central mudminnow, Umbra limi, is mentioned on the Vertebrate Species of Concern list in West Virginia. The only population of the central mudminnow in west Virginia is found in the 57 hectare wetland habitat of the Green Bottom Wildlife Management Area (ca. 378 ha) in Cabell County, West Virginia. This disjunct population is located 110 km from the nearest population in

Hocking County, Ohio, and provides a unique opportunity for a seasonal food habit study outside its normal range. This wetland area is also currently under expansion by the U. S. Army Corps of Engineers in a mitigation project. Data collected for this study will provide baseline information for seasonal food habits prior to habitat expansion. Mudminnows ($X = 60/$ season) were collected monthly from October 1989 to December 1992 by seining the vegetated, littoral zones of the marshland. In the laboratory, quality and quantity of the stomach contents were determined using the following calculations: 1) percent frequency of occurrence, 2) average of volume percentages, and 3) percent of total volume. These calculations were accomplished using the point system of Hynes. Comparison of types of food found (e.g. copepods, ostracods, odonates) as well as seasonal changes will be made with other food habit studies in the literature.

- 111 JONES, THOMAS G. and DONALD C. TARTER. Marshall University--Spring season foraging patterns of fishes in the Greenbottom Wildlife Management Area, West Virginia, in relationship to macrobenthos and plankton community structures.
- Spring food habits of fishes were compared to the benthic and planktonic community structures in Greenbottom Swamp from February to June, 1991. A total of 48 benthic and planktonic taxa was collected from the swamp. Thirty-nine taxa were consumed by the fishes. Dipterans, coleopterans, and odonates were representative insect orders in the diet. Shannon diversity was measured for two collecting methods, Hester-Dendy multiplates and a square meter kick method. The highest monthly diversity occurred in May according to both collecting techniques. The square meter kick method measured on average 1.0 magnitude higher diversity than the Hester-Dendy multiplates. The square meter kick method diversity was also compared to the diversity of the fish gut content. The comparisons were based on monthly averages for the fish gut content. A strong trend was indicated. A comparison between microhabitats was made for the two collection techniques. The shallow water areas with high density of aquatic vegetation were the most productive areas. The two techniques were also compared using a Chi-square test on average monthly density measures for several taxa. Ten taxa densities and gut frequencies were compared using linear regressions to correlate predation rates to densities. Seven of these taxa showed no correlation. Overall, the environmental diversity of prey items was tracked by the gut content diversity of the fish.

- 112 MOORE, EDWARD L., ERICH B. EMERY, and DONALD C. TARTER. Marshall University--Low pH tolerance under laboratory conditions of a larval population of the alderfly *Sialis hasta* Ross (Megaloptera: Sialidae).
- A larval population of the alderfly *Sialis hasta* was experimentally tested under static bioassay conditions to determine its tolerance to low pH. Larval alderflies were exposed to four pH values (1.5, 3.0, 4.5, 7.0) in the laboratory investigation. The straight-line graphical interpolation method along with a linear regression analysis were used to determine the pH value at which 50 percent of the larvae survived after 96 hours (median tolerance limit). Additionally, the survival rate was monitored after 24, 48, and 72 hours. Larval alderflies of the genus *Sialis* have a wide tolerance range for pH (2.3-8.3). Results from this investigation will be compared to other low pH tolerance studies of larval populations of *S. itasca* Ross and *S. joppa* Ross from good water quality streams and *S. aequalis* Banks from Camp Creek, an acid mine stream, and Flat-foot Creek, a good water quality stream.
- 113 DANIELS, KATIE L. and DONALD C. TARTER. Marshall University--Reproductive biology of the bowfin, *Amia calva* Linnaeus, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.
- The bowfin, *Amia calva*, is the only extant member of the family Amiidae. The Green Bottom Wildlife Management Area (GBWMA) is the location of the only reproducing bowfin population in West Virginia. The GBWMA (38° 35' 35"N, 82° 14' 55"W) is located along the Ohio River 26 km northeast of Huntington, West Virginia. The area (ca. 338 ha) contains a valuable wetland habitat (ca. 57 ha) in the southwestern portion of the State. A study of the reproductive biology of the bowfin became important when the U. S. Army Corps of Engineers proposed a habitat modification to add marshland by building dykes. Being the only reproducing population in the state also makes this population unique and in need of observation. The information from this study will establish a baseline for reproductive activities of the bowfin prior to habitat perturbation so that their adaptation to the new environment can be accurately determined. The bowfin (39) were collected seasonally (spring, summer, fall) by hoop nets, pillow traps, and seines. Attempts were made to determine the duration of the reproductive season by: (1) calculating the seasonal gonosomatic index (GSI), (2) observing spawning in field and laboratory, and (3) noting the appearance of newly hatched individuals. Observations were also made on spawning colors, fecundity, egg diameters, sex ratios, and sexual dimorphism (meristics and morphometrics).
- 114 FRITZ, J. DOUGLAS,¹ FRANK J. BULOW,¹ and STEPHEN E. MOORE.² Tennessee Technological University¹ and Great Smoky Mountains National Park²--Effects of trail-induced sediment loads on Great Smoky Mountains National Park high-gradient trout streams.
- Studies have indicated that increased sediment loads have negative effects on western salmonids. However, there is little documentation concerning sediment-induced damage to fish stocks in the high-gradient bedrock streams of the southern Appalachians. Sediment loads at seven sites in streams located within the Great Smoky Mountains National Park were measured using specially designed sediment traps. Two control sites were located away from heavily used trails and two other sites were located in streams that had trails running parallel to them. To measure additive effects, three additional sites were located downstream aside trails. Collected sediment was analyzed for total fines (<4.76 mm), organics, and benthic macroinvertebrate colonization. Brook trout, *Salvelinus fontinalis*, and rainbow trout, *Oncorhynchus mykiss*, density and biomass were evaluated in relation to location and sediment load. This study will contribute to the development of an effective technique to determine when fish populations located in higher gradient areas are susceptible to harm from increased sediment loads.
- 115 SAPP, KELLI K. and GERALD W. ESCH. Wake Forest University--The strength of spatial and temporal heterogeneity as structuring forces of the infra- and component communities in *Helisoma anceps* and *Physa gyrina*.
- Similarity in the infra- and component communities in *Helisoma anceps* and *Physa gyrina*, combined with differences in the snails life histories, provided an opportunity to compare the effects of various life history traits on the acquisition of larval trematodes in various microhabitats. In order to assess the effects of microhabitat partitioning on the infection status of the two snail species, bi-monthly collections were made from three separate localities in a local farm pond. Site location, water depth, snail depth, distance from shore, type of substrata, infection status, and host size were recorded for each snail. Manipulation of infracommunity structure, through the exclusion of parasites, allowed us to examine the influence of temporal heterogeneity, as compared to trematode antagonism, as a force in structuring the infra- and component communities. Snails were maintained in cages in the field. Enclosures were positioned a few inches above the substrata to prevent infection of the snails via egg ingestion, effectively eliminating the more prevalent parasite species from the pond by preventing parasite transmission to these snails. Preliminary data analysis suggests that certain microhabitat variables are more correlated with predicting infection status than others. Thus, elimination of the most prevalent parasites did not result in a change in the infracommunity structure within the snails through time.

- 116 KIGHTLINGER, LON K. and JOHN R. SEED. University of North Carolina at Chapel Hill--Intestinal nematodes, growth status, and immunity in children in the rain forest of Madagascar.

In a prospective parasitology and child health survey in several rural, traditional communities in the Ranomafana rain forest of SE Madagascar we studied the relationships of intestinal nematodes, growth status, and general cell mediated immunity. The three major intestinal helminths in 1292 children, birth-10 years old, had prevalence rates of 79% for *Ascaris lumbricoides*, *Trichuris trichiura* 38%, and *Necator americanus* 16%. Worm distribution was overdispersed in the child population with mean intensity levels for children, 4-10 years, of 19.2 *Ascaris* worms. Malnutrition was common with 69% of the children growth stunted and 11% wasted. The children, 4-10 years, were skin tested with three common antigens for delayed cutaneous hypersensitivity (DCH) reactions to evaluate the general cell mediated immunity, and 95% were able to respond to at least one of the antigens. We found decreased DCH responses in malnourished children, but little association between DCH and *Ascaris* burden. The association of nutritional status and *Ascaris* burden was very subtle with worm aggregation in the wasted children, but no correlation between the growth indices or growth velocity and the numbers of *Ascaris* at pretreatment levels and again after a 12 month reinfection period.

- 117 WETZEL, ERIC J. and GERALD W. ESCH. Wake Forest University--Ecological determinants of larval trematode infection in 3 species of odonate naiads.

The variation in life history traits among odonate intermediate hosts of larval trematodes may determine the apparent patterns of parasite infection for these host species. In the present study, naiads of 3 species of odonates, each representing a different life history pattern, were compared for the mean intensity and prevalence of infection by the metacercariae of 2 congeneric trematodes, *Haematoloechus longiplexus* and *H. complexus*. A total of 475 naiads was sampled over a period of 5 months (June-October) from 4 sites within Charlie's Pond, a 2 ha pond in the Piedmont area of North Carolina. The insects were brought to the lab, isolated in separate jars filled with pond water and subsequently necropsied. Since infection levels did not differ significantly between the 4 locations, results from individual sites were lumped. *Libellula cyanea* (a sprawler) had significantly greater mean intensities of both *H. longiplexus* and *H. complexus*, with the greatest intensities in August and July, respectively; *L. cyanea* had the highest prevalences of *H. longiplexus* and *H. complexus*, except in August when prevalence of *H. complexus* was highest in *Ischnura posita* (a climber). Based on the life history characteristics of the 3 odonate species, it is reasoned that *L. cyanea* should have the greatest likelihood of contacting motile cercariae because of its location in the aquatic microhabitat. The results suggest that subtle variations in life history traits are sufficient to influence the potential for larval odonates to serve as intermediate hosts, and require consideration when evaluating the transmission dynamics of digenetic trematodes.

- 118 MARS, CRYSTAL L. and WILLIAM F. FONT. Southeastern Louisiana University--Seasonal dynamics of the introduced Asian tapeworm *Bothriocephalus acheilognathi* in mosquitofish *Gambusia affinis* from Louisiana.

Prevalence and abundance of the Asian fish tapeworm *Bothriocephalus acheilognathi* Yamaguti, 1934 was studied in the mosquitofish *Gambusia affinis* from a man-made pond in Hammond, LA. Fish were separated by sex and size classes for seasonal sampling initially in January 1992 and then from May through October 1992. Tapeworms were assigned to one of five developmental stages: stage I (plerocercoid without bothria), II (plerocercoid with bothria), III (immature strobila), IV (mature), and V (gravid). Seasonal dynamics were monitored in the largest fish (old cohort: males > 29mm; females > 39mm). Lowest abundance occurred in January (males- 5.4 worms/fish; females- 6.5). By May, abundance for the largest females was 14.4 increasing in June to 25.4, followed by a decline in late summer (12.1). Abundance increased again in late fall to 20.9. Males were less heavily infected but showed a similar seasonal pattern of bimodal peaks of abundance. These peaks were associated with periods of recruitment (stage I worms) in spring and fall. Recruitment was followed by rapid maturation (stage V) in spring but not in fall. Abundance in the new fish cohort, which first appeared in June, remained low (< 1.3) throughout the summer but rapidly increased in fall to 11.9 concomitant with reoccurrence of recruitment in the older cohort.

- 119 TUTTLE, ROBERT H. and J.E. HALL. University of North Carolina at Chapel Hill--Short-term aromatic amino acid metabolism in a *Leishmania donovani*-infected human monocytic model system.

Leishmania promastigotes metabolize the aromatic amino acids tryptophan, phenylalanine, and tyrosine to their respective aromatic pyruvates and lactates. Although this pathway has quantitative significance *in vitro*, its importance to the host-parasite relationship is unknown. Several possibilities exist how these compounds might contribute to pathogenesis, but one key question is whether the intracellular amastigotes form the same metabolites as promastigotes. Focusing on tryptophan catabolism specifically, one hypothesis suggests that the parasite diverts this amino acid away from the kynurenic acid pathway of the host cell. Depleting the amount of tryptophan flow through this pathway reduces the availability of picolinic acid, a catabolite which has been shown to further activate stimulated macrophages to cytotoxic killing. We have developed an *in vitro* model system of *L. donovani*-infected human THP-1 monocytes and we have used GC and GC-MS techniques to assay the metabolic profile of the three aromatic amino acids. Preliminary results show that physiological picolinic acid concentrations of the THP-1 cells are below

the micromolar range. We also report the major short-term catabolites of tyrosine, phenylalanine and tryptophan when added to a simple buffer system containing the *Leishmania*-infected THP-1 cells. With these preliminary experiments we have seen host cell growth inhibition caused by specific catabolites. Thus, the metabolism of the aromatic amino acids might contribute directly to the pathogenesis seen in *Leishmania* infections.

120 STOVALL, CHRISTINA E., JOHN RICHARD SEED, and TEMITOPE O. KEKU. University of North Carolina at Chapel Hill--Increased virulence of Trypanosoma brucei rhodesiense maintained in vitro. Rapid phenotypic changes occurred in *Trypanosoma brucei rhodesiense* (LouTat.1) maintained *in vitro*. Following cultivation, transfer to C3H mice resulted in a decreased length of infection and a loss in the degree of pleomorphy, as compared to LouTat.1 maintained solely by passage through C3H mice. Even a single *in vitro* passage resulted in increased virulence, as did repeated passages. Transformation to the procyclic (insect) form also became more difficult with the number of *in vitro* passages, as would be expected with the loss of pleomorphy. This rapid increase in virulence demonstrates its remarkable capacity for change.

121 COLE, REBECCA A.,¹ DAVID S. LINDSAY,¹ J. P. DUBEY,² BYRON L. BLAGBURN,¹ AND DONALD C. SORJONEN.¹ Auburn University¹ and ARS, USDA, Beltsville, Maryland²--Transplacental transmission of Neospora caninum in bitches infected during early pregnancy.

Three mixed-breed bitches were infected subcutaneously with 5×10^6 cell culture maintained tachyzoites of *Neospora caninum* 21 days after insemination (a.i.). Bitch 1 aborted after day 28 a.i. At necropsy, 1 mummified pup and remains of 3 pups partially resorbed were recovered. Histological, immunohistochemical and cell culture assays of tissues from the bitch and pups were negative for *N. caninum*. Bitch 2 aborted between day 35 and 43 a.i. At necropsy, 1 macerated pup and 6 mummified pups were recovered. Cell culture assays of uterine tissues and immunohistochemical staining of tissues from the mummified pup were positive for *N. caninum*; all other tissues from the bitch were negative. Bitch 3 gave birth to 3 live pups 65 days a.i. *Neospora caninum* was isolated from the placental tissue. Pups showed slight signs of proprioception deficits and hind limb tonicities which began to subside by the time they were 30 days of age. The pup with the most severe clinical signs of disease was euthanized at 38 days of age in efforts to isolate *N. caninum*. All tissues examined were negative. Results indicate that *N. caninum* may be transmitted to pups when the

bitch is inoculated during early pregnancy. Results also suggest that infections of bitches may cause abortion and subsequent resorption of pups.

122 ASSADI-RAD, AMIR and SHARON PATTON. University of Tennessee College of Veterinary Medicine--The epidemiology of Toxoplasma gondii on swine farms in TN. Prevalence of toxoplasmosis on swine farms in TN was estimated from 2000 serum samples collected from sows on 252 farms in 1991, and 1876 samples from 89 farms in 1992. All samples were tested for antibodies against *Toxoplasma gondii* using a modified agglutination test (MAT). An additional 150 samples from 5 - 6 month old pigs from a UT finishing house, and 58 new born piglets from the UT farm were titered. Results were 740/2000 (37%) of the sows were positive for *T. gondii* antibodies in 1991; 403/1876 (22%) were positive in 1992. All of the pigs from the finishing house were negative as were the 58 new born piglets that were bled and titered prior to nursing. More sows had antibodies to *T. gondii* than younger animals. A questionnaire mailed to each farm was returned by 107 farmers. This provided information about the herds including size, management practices, health status, feeding practices, presence of cats on the farm, and the disposal of older pigs.

123 PINCKNEY, RHONDA D.,¹ DAVID S. LINDSAY,¹ J. P. DUBEY,² and BYRON L. BLAGBURN.¹ Auburn University¹ and USDA, Zoonotic Disease Laboratory²--Effects of inoculation of nursing pigs with a temperature-sensitive mutant of Toxoplasma gondii on subsequent oocyst challenge.

Toxoplasma gondii is a protozoan parasite of humans and other warm-blooded animals. Animals may be infected *in utero* by tachyzoites, by ingesting tissue cysts containing bradyzoites in infected meat, or by ingesting oocysts from cat feces. The present study was done to determine if subcutaneous (SC) or intravenous (IV) inoculation of 3 day-old nursing pigs with tachyzoites of the temperature-sensitive TS-4 mutant of *T. gondii* would protect against oral inoculation with oocysts of the GT-1 isolate of *T. gondii*. Two pigs were inoculated IV with Hanks balanced salt solution (HBSS) on day 0 and 14 postinoculation (PI) and served as controls (Group 1). Two pigs were inoculated IV with 3×10^5 TS-4 tachyzoites on day 0 and 14 PI (Group 2), and two pigs were inoculated SC with 3×10^5 TS-4 tachyzoites in the ear on day 0 and 14 PI (Group 3). All pigs were orally inoculated with 8×10^4 oocysts on day 30 PI. No clinical signs were associated with inoculation of tachyzoites. Mild diarrhea was observed in one pig in Group 1, 6 to 8 days after oocyst inoculation, all

other pigs remained normal. Pigs were killed 78 to 81 days PI and 25 gram portions of brain, heart, ham, and tongue were digested in acid-pepsin solution and inoculated SC in mice to detect tissue cysts. All mice (40 of 40) inoculated with tissues from pigs in Group 1 were positive, 98% (39 of 40) of mice inoculated with tissues from Group 2 pigs were positive, and 45% (18 of 40) mice inoculated with tissues from Group 3 pigs were positive.

124 DIDERRICH, VINA R. and SHARON PATTON. University of Tennessee College of Veterinary Medicine--Toxoplasma gondii and feline immunodeficiency virus infection in nondomestic felids.

Serum samples from 49 nondomestic felids were tested for antibodies to *Toxoplasma gondii* by a modified agglutination test (MAT) and for antibodies to feline immunodeficiency virus (FIV) by an ELISA test. Forty-four of the cats belonged to the Knoxville Zoological Park; 5 were privately owned. Serum samples were part of the serum bank of the UTCVM Clinical Parasitology Service. Species of nondomestic felids tested included: 18 African lions, 1 Asian lion, 10 Bengal tigers, 6 Siberian tigers, 5 black leopards, 1 snow leopard, 1 cheetah, 1 serval, 3 cougars, 2 lynx, and 1 bobcat. Thirty three cats (67%) had positive *I. gondii* titers greater than or equal to 32. One African lion also tested positive for FIV. Of the 16 cats that tested negative (33%) for *Toxoplasma*, one cat (cougar) tested positive for FIV. Recent research in domestic felids suggests that immunosuppression induced by FIV infections may be associated with active toxoplasmosis. The impact of concurrent infections on the health of captive exotic felids should be considered in the management of these endangered species.

125 KEKU, T.O. and J.R. SEED. University of North Carolina at Chapel Hill--Mechanisms of pathogenesis in African trypanosomiasis: identification of the trypanosome growth inhibitor.

In order to explore the mechanisms of pathogenesis in African trypanosomiasis, we examined the effect of *Trypanosoma brucei rhodesiense* (LouTat.1) on HL-60 growth and function. In previous studies we have shown that the trypanosome growth inhibitor (TGI) produced by *T. b. rhodesiense* inhibited the growth and functions associated with the mature HL-60 cells *in vitro*. More recently the trypanosome variant surface glycoprotein (VSG) coat has been identified as the active component of TGI. Examination of the trypanosome growth inhibitory supernatants and *T. b. rhodesiense* cell lysates by SDS-PAGE revealed that the VSG was common to both

preparations. The presence of LouTat.1 VSG in differentiated HL-60 cultures resulted in decreased phagocytosis and lysozyme activity. Acid phosphatase activity was increased in the VSG treated HL-60 cultures. The LouTat.1 VSG therefore mimicked all the inhibitory activities of the trypanosome growth inhibitor. The growth inhibitory activity of the VSG and TGI was reduced by the addition of anti VSG antibody. The results suggest that the trypanosome VSG is the only active growth inhibitory component in TGI.

126 Davis, Sara R., John C. Meade, and William B. Lushbaugh. University of Mississippi Medical Center--Hydrogen peroxide induced an oxidative stress response in *Trichomonas vaginalis*.

The oxidative stress response induced in *Trichomonas vaginalis* by exposure to various concentrations of hydrogen peroxide was traced by metabolic labeling and monitored by sodium dodecyl sulfate-polyacrylamide gel electrophoresis and fluorography of trichloroacetic acid precipitated proteins. Exposure to hydrogen peroxide above 450 μ M decreased incorporation of radiolabel into protein and altered protein synthesis resulting in a banding pattern similar to the heat shock protein profile. The proteins produced by oxidative stress included molecules with average molecular masses of 145-165, 92-84, 66, 43-46, and 35-36 kilodaltons. Full conversion to oxidative stress response occurred within 150-180 min after stress initiation. The oxidative stress responses of three freshly initiated strains were compared to the responses of the same strain cultured *in vitro* for several months (culture adapted). Culture adaptation did not modify the oxidative stress responses of the three strains tested; however, variations among the three strains occurred in the synthesis of the 74-75, 43, and 35-36 kilodalton molecules. Identification of the genes involved in these stress responses is under investigation.

127 FINLEY, R. L. and W. B. LUSHBAUGH. University of Mississippi Medical Center --Drug susceptibility testing of local *Trichomonas vaginalis* (Tv) isolates.

We recently carried out a double blind placebo-controlled trial of single dose intravaginal versus single dose oral metronidazole in patients with Tv vaginitis. Participants identified by a Tv positive wet mount or culture were treated with one of two drug regimens and cultured 3-5 days post-treatment. Half of the intravaginal treatment group and 88% of the orally treated group were microbiologically cured ($p=0.02$). Tv strains were axenically cultured from 75% of the study participants and from 44 others. Isolates were tested for susceptibility to metronidazole *in vitro* using an improved method of testing in 96 well plates. After a period of exposure to drug, cells were washed and re-suspended in drug-free medium to allow growth of remaining viable cells. After the second growth period, cells were 3 H-thymidine labeled, harvested onto glass fiber paper and counted by a gas ionization direct beta counter. This technique was sensitive in the range of 100 viable cells/ml and comparable to viability assessments using soft agar cloning. The mean concentration of metronidazole required to kill all Tv trophozoites (LD100) of 84 axenized Tv strains was 16 μ g/ml (median = 8 μ g/ml; range = 4-64 μ g/ml). The mean LD100 of the Tv isolates from clinical failures and from

clinical cures were identical. There was no correlation between clinical treatment failure of either vaginally or orally administered drug and the relative *in vitro* metronidazole resistance of the patients' axenically cultured Tv strains.

disjuncts were found, including Carex jorii, Platanthera cristata, P. integrilabia, Cratiola pilosa, Lobelia nuttallii, Quercus michauxii, Q. lyrata, and Toxicodendron vernix.

128

RAMSEY, GWYNN W.,¹ CHARLES H. LEYS,² ROBERT A. S. WRIGHT,³ DOUGLAS A. COLEMAN,⁴ AUBREY O. NEAS,⁵ and CHARLES E. STEVENS,⁶ Lynchburg College,¹ Lynchburg, VA.,² Central Virginia³ Biological Research Consortium,³ Wintergreen Resort,⁴ Mt. Rainier National Park,⁵ Charlottesville, VA.⁶ --- A Botanical Eden: The James River Gorge in the Central Blue Ridge Mountains of Virginia.

Over 15 seasons of field work reveal that the vascular flora of the James River Gorge Watersheds between Snowden and Glasgow, Va., including the James River Face Wilderness and portions of Amherst, Bedford and Rockbridge Counties, is superbly diverse. Herbarium voucher specimens document that the 3585 hectare research area supports a vascular flora of at least 964 species representing 471 genera in 119 plant families. The five largest families are: Asteraceae, 120 taxa; Poaceae, 93 taxa; Cyperaceae, 61 taxa; Fabaceae, 54 taxa; Rosaceae, 41 taxa. Non-native taxa, 203 species, comprise 21% of the total flora. Virginia Blue Ridge Records have been established for Azolla caroliniana, Carex grayi and Cyperus retrorsus. Styrax americana is recognized as a new mountain-coastal plain disjunct. Eight different habitat types existing in the gorge have been identified and eleven rare Virginia taxa discovered in the research area are considered.

129

JONES, RONALD L. Eastern Kentucky University--Wetland flora of the Cumberland Plateau in Kentucky.

From 1989-1992 a floristic survey was conducted of wetlands on the Cumberland Plateau of east-central Kentucky. The objectives of the study were to locate wetland sites, describe the communities, and document the vascular plant species. The majority of the study sites were located in McCreary, Whitley, Knox, Laurel, and Pulaski Counties. Habitats at the sites were classified into 4 categories: aquatic beds, emergent wetlands, shrub swamps, and forested wetlands. Najas minor, Potamogeton nodosus, P. diversifolius, Brasenia schreberi, and Utricularia gibba were typical of the aquatic beds. The emergent wetlands were dominated by various species of Carex, Juncus, Panicum, and Rhynchospora. Important species in shrub swamps were Cephalanthus occidentalis, Itea virginica, Vaccinium corymbosum, Cornus amomum, Rhododendron periclymenoides, and Lyonia ligustrina. Typical dominants of the forested wetlands were Acer rubrum, Nyssa sylvatica, and Liquidambar styraciflua. A number of state rarities and/or Coastal Plain

130

STALTER, RICHARD,¹ and E.E. LAMONT,² St. John's University¹ and The New York Botanical Garden²---The vascular flora of the Outer Banks of North Carolina.

The Outer Banks of North Carolina, located just off the mainland coast of North Carolina, is a series of narrow dynamic sandy barrier islands ranging in width 150 meters to over 3.5 kilometers. This dynamic barrier island chain is continually reshaped by winds, bayside flooding, ocean currents and overwash that affect changes in topography and migration of the dunes and barrier islands. Salt spray has a controlling influence on coastal vegetation and affects plant distribution and community development. Drought, fire, insect infestation (e.g. pine bark beetles), use of recreational vehicles, hurricanes, northeasters and tidal flooding also affect community development on the Outer Banks. The present study describes the vascular flora at the Outer Banks. Five hundred twelve taxa in one hundred eight families have been identified. The Poaceae (78 species) and Asteraceae (70 species) are the largest families of the flora. Other families with large number of species are: Cyperaceae (34 species) and Fabaceae (27 species). The rarest plant encountered was Amaranthus pumilus.

131

ANDERSON, LORAN C. Florida State University--Botanical richness of the western panhandle of Florida.

Florida is well known for its diverse flora. There are three areas of relatively high endemism in the state: the Miami Ridge pine rocklands, the Lake Wales Ridge of peninsular Florida, and the Apalachicola River system in the panhandle. Additionally, richness of the flora in the western panhandle is exemplified at Eglin Air Force Base. Recent surveys there have produced two state records--Luziola bahiensis and Lindera subcoriacea; specimens tentatively assigned to the latter have been found in peninsular Florida, but the Eglin plants represent the first unequivocal report for the state. Endemics in the western panhandle include Aristida simpliciflora, Baptisia calycosa var. villosa, Calamovilfa curtisii, Chrysopsis crulseana, C. godfreyi, Lilium tridollae, Lupinus westianus, Panicum nudicaule, Pinguicula primuliflora, Polygonella macrophylla, Potamogeton floridanus, and Tephrosia mohrii. The rare Linum westii is at Eglin as a disjunct from its major distribution

near the Apalachicola River. Streams in the area have massive floating populations of Sarracenia leucophylla, and the steepheads have Carex baltzwellii, Kalmia latifolia, Magnolia ashei, and Stewartia malacodendron.

132
JOYNER, JAMES and EDWARD W. CHESTER.
Austin Peay State University--The wetland vascular flora of Cross Creeks National Wildlife Refuge, Stewart County, Tennessee.

The refuge is a 3,566-ha, mostly wetland tract astride 10 river miles of the Cumberland River (Lake Barkley) between Dover and Cumberland City. The area has been owned and managed since 1962 by the U.S. Fish and Wildlife Service, primarily as a feeding and resting site for migrating waterfowl. Much of the refuge is river bottomland that was formerly agricultural. Present management practices include moist-soil crops for wildlife, some agricultural production (hay, soybeans, small grains), successional fields, and 16 managed pools where dams, levees, and floodgates allow for water level manipulation. The Cumberland River and its tributaries are permanently impounded with seasonal variations in pool levels. Various wetland habitat and community types occur, including marshes, swamps, dewatered zones, bottomland forests, and permanent deep water. This research involved a floristic survey of the area, excluding peripheral uplands. Specific objectives were to (1) qualitatively delineate community types, (2) determine their floristic composition, and (3) seek listed rare taxa. During 1990-1992, 77 collecting trips yielded 636 taxa (including seven rare elements) representing 367 genera and 116 families.

133
KENNEMORE, DOUGLAS E., BRENT S. LONG, and JOHN B. NELSON. University of South Carolina--Floristic survey and rare plants of Fort Jackson Army Installation, SC.

Entirely within Richland County, SC, Fort Jackson Army Installation contains about 55,000 acres, all more or less within the Fall Line Sandhills. The diversity of the natural and exotic flora of the Fort mirrors that of the encompassing county. Additionally, the flora of the Fort is relatively rich, due to the isolation from intensive urbanization it has enjoyed for nearly a century, and to the increase, in relation to surrounding landscape history, of fire, both natural and man-caused. A study of the vascular flora of Fort Jackson was begun in March 1990, concluding in September 1992. 118 families, 381 genera, and 759 species have been documented. A study of rare, threatened or endangered taxa was also undertaken, and a target list of 40 species was developed from the Federal Register of listed or candidate species, and from a list of tracked species maintained by the SC Nongame & Heritage Trust Program. Thirteen of these taxa are documented and mapped. Lysimachia asperulaefolia was located in one large population, reestablishing this plant as extant in SC.

134
SMALL, VIRGINIA L. AND B. E. WOFFORD.
University of Tennessee at Knoxville--Vascular flora of Pickett State Park and Forest, Pickett and Fentress counties, Tennessee.

Pickett State Park and Forest occupies 11,752 acres of the Cumberland Plateau in Pickett and Fentress counties. Specimens were collected during the past two and a half growing seasons. To date, a total of 539 species and lesser taxa in 319 genera and 106 families have been identified. The largest families are: Asteraceae, 73 species; Fabaceae, 38 species; Poaceae, 31 species and Cyperaceae, 27 species. Four hundred twenty-four county records and a state record have been established. Eight taxa are listed as Endangered or Threatened in Tennessee. Three taxa are either federally listed or under review for listing. Taxa totaling 10.2 percent of the flora are introduced reflecting the history of human disturbance. The results of this study provide the respective State agencies with information that could be useful in land management and public interpretation for both the Park and Forest.

135
WYRICK, DANIEL AND B. E. WOFFORD.
UNIVERSITY OF TENNESSEE, KNOXVILLE--Vascular flora of Gee Creek Wilderness, Tennessee

Gee Creek Wilderness is a narrow mountainous watershed positioned on the southwestern extreme of the Blue Ridge in Tennessee. Starr and Chestnut Mountains define the physical boundaries of the wilderness and create a narrow valley drained by Gee Creek. The wilderness lies within Cherokee National Forest in Polk and Monroe Counties. Human impact to the watershed prior to its wilderness designation involved limonite mining, prospecting, and logging. A floristic survey was conducted from June, 1991, through October, 1992. A total of 369 taxa representing 233 genera and 93 families have been documented. Forty-four taxa are county records. Nine species are listed in Tennessee as endangered, threatened, special concern, or endangered due to commercial exploitation. Less than 2% of the flora consists of introduced taxa. The flora generally typifies the southern Appalachians with a few exceptions. Notable collections have been made which represent range extensions and/or physiographic records. Examples are Polymnia laevigata Beadle, Hydrangea quercifolia Bartr., Calamagrostis porteri Gray, and Amelanchier sanguinea (Pursh) DC.

136
HYATT, PHILIP E. Sylamore Ranger District, Ozark National Forest--A survey of the vascular flora of Baxter County, Arkansas.

A list of vascular plant taxa from Baxter County, Arkansas, U.S.A., is reported. It is based upon field, herbarium, and literature surveys conducted from 1987 through 1992. One thousand and sixty-six vascular plant taxa are listed, including

five new state records. Thus, Baxter County is now floristically the fourth richest county known in Arkansas. Ecological data are given for each taxon, and historical, physiographical, climatic, and ecological data on Baxter County are presented.

137

Stark, T.J., and D.K. Evans.
Marshall University--The flora of Green Bottom Wildlife Management Area, middle Ohio River floodplain.

Green Bottom Wildlife Management Area (Cabell county, West Virginia) contains several hydrologically diverse habitats recognized by their plant species composition and gross physiography. Both forested and open canopy wetlands and riparian sand and mud flats are observed in several stages of succession. Species richness in these habitats often surpasses 20 species per lm^2 . The objective of this study was to produce a vouchered flora of the 338 hectare site, ignoring fields under cultivation. A single season taxonomic survey documented 330 species of vascular plants, including 63 obligate, and 217 facultative wetland species. Of these, 238 are native to West Virginia, 71 are exotic to North America, and the remainder are considered North American adventive. Six state endangered species (found in five or fewer locations statewide), and four state threatened species, were recorded. An examination of geographical affinities of the Green Bottom flora is included. Pertinent literature, concerned herbaria, and West Virginia State Natural Heritage Program records for Cabell county, are being searched and verified in order to construct as complete a vouchered flora as possible.

138

HARDIN, JAMES W. North Carolina State University--Foliar micro-morphology of the U. S. Sapotaceae.

The Sapotaceae characteristically have dolabriform (dolabrate, T-shaped, 2-armed, axe-shaped, Malpighiaceae) trichomes. These trichomes are single cells which are shaped like the head of a pickax, with two diverging arms attached at right angles to a short, erect, basal stalk. It may be symmetrical with both arms the same length (i.e., 1:1) or more or less asymmetrical (1:1.2--1:4). The kind and color of the foliar vestiture is helpful in delimiting the taxa; however, trichome micromorphology is of limited use. Species of *Bumelia* are all very similar with the dolabriform trichomes varying from 1:1--1:2 (rarely to 1:4) in symmetry, the two arms

straight, curly, or twisted and 0.1--1.2 mm long, and with a stalk 0.01--0.15 (rarely 0.2) mm. One species, *E. celastrina*, is unique in also having short subulate trichomes and sunken glands. *Pouteria campechiana* (*Lucuma nervosa*) is distinctive in having all very small dolabriform trichomes (0.1--0.12 mm long), straight, symmetrical, and appearing sessile (stalk ca. 5 μm). These are frequent, but inconspicuous, and the leaves have been incorrectly described as glabrous.

139

ANDERSON, LORAN C. Florida State University.--Are *Arnoglossum* and *Yermo* congeneric? Anatomical and morphological considerations.

The recently discovered and described *Yermo xanthocephalus* of Wyoming appears to be closely related to *Arnoglossum*, a genus of seven or eight species from the eastern United States. The latter have dull white to greenish or light purplish corollas and green or white involucre, whereas *Yermo* has bright yellow flowers and involucre. Some differences between the two groups in vegetative anatomy and morphology can be attributed to adaptation to their widely disparate environments. The winged phyllaries of *Yermo* are similar to those of *A. plantagineum* and *A. floridanum*. Floral morphology suggests the two genera are distinct.

140

Evans, D. K. and D. W. Chaffin.
Marshall University--Plants used as fish poisons by the Shuar and Achuar of southeastern Ecuador.

The Shuar and Achuar, formerly the Jivaro, of southeastern Ecuador, employ several plants that kill or stun fish. The most important are *Lonchocarpus nicou* (Aubl.) DC and varieties (*Fabaceae*), *Tephrosia sinapou* (Bucholz) A. Chev. (*Fabaceae*) and *Clibadium asperum* (Aubl.) DC (*Asteraceae*). All are woody plants, cultivated in gardens in or near villages and are harvested nondestructively. In the former two taxa roots sections are dug, pounded into shreds and introduced in the stream or pool with a vine basket or simply thrown into the water. In the latter, upper leaves and infructescences are collected, placed into a prepared hole in the ground and crushed into a wet pulp with blunt-ended poles. The material is then introduced into the water with a vine basket passed back and forth in the stream or impounded pool. In all cases fish become disoriented in a matter of minutes and are easily caught and eaten without ill effects. In both *Lonchocarpus* and *Tephrosia* the active compound is rotenone the action of which is well established. In *Clibadium asperum* the poisonous principle is ichthyothereol, a polyacetylenic compound which apparently acts as a neurotoxin. Laboratory studies of fish killing potency and mode of action of ichthyothereol are currently in progress.

141. RODGERS, JOHN C. III, Department of Botany, and SALLY P. HORN, Department of Geography, University of Tennessee, Knoxville--Modern pollen rain in Costa Rica.
Pollen spectra in lake and swamp sediments and surface soils are being studied to characterize modern pollen rain in different vegetation types of Costa Rica. The habitats under study include five major life zones from the Holdridge Life Zone system (Holdridge et al., 1967): tropical wet forest, tropical dry forest, premontane rain forest, montane rain forest, and sub-alpine paramo. Other vegetation types include mangroves, freshwater swamps, tropical savannas, and montane bogs. This is the first study of modern pollen rain in Costa Rica and will provide the basis for reconstructing past vegetation from pollen profiles in sediment cores.
142. Cody, Richard P. Museum of Natural Science, Louisiana State University--Behavioral ecology of the black caboso, *Mauligobius maderensis*.
The black caboso, *Mauligobius maderensis* is a common intertidal goby restricted in distribution to the island of Madeira and the archipelago comprising the Canary Islands in the eastern North Atlantic Ocean. A total of 267 intertidal pools were examined from 1990-92 during the months June-August to obtain information on habitat preference (spatial utilization) and associated intraspecific behavior. Variables including: elevation, volume, depth, surface area, substrate, shelter, and algal cover were examined in regression and principal components analyses. Although individuals from small size classes (<30mm SL) occurred in pools with larger fish, smaller individuals showed a preference for pools with less cover at high elevations. A sequence of behavioral components associated with territorial defense and spawning were identified from observations made of fish in tidepools and aquaria. In addition to reducing predation, differences in distribution of the size classes may provide juveniles with optimal conditions for fine-tuning behavioral interactions important for defense of a territory and ultimately, successful spawning.
143. HOLT, J.C., K.M. TOLSON, AND N.H. DOUGLAS. Northeast Louisiana University--Use of carapace dimensions in the alligator snapping turtle, *Macroclemys temminckii*, to project body weight.
The largest freshwater turtle in the United States, *Macroclemys temminckii*, is the subject of numerous investigations being conducted in the field and in the laboratory setting. Certain physical parameters are considered essential to any type of research, with weight of the subject being one of the most important variables. The difficulty encountered when handling alligator snapping turtles (sometimes even in a boat) has necessitated the search for procedures to reduce the amount of contact with each animal. Data have been compiled on over 250 alligator snapping turtles and the correlation between body weight and carapace length x carapace width has been calculated ($r = 0.99$). Further studies have allowed the extrapolation of weight from only the carapace length due to the correlation between carapace length and carapace width ($r = 0.99$).
144. SCHMITT, EMILY F. and BRIAN S. MASTERS. Towson State University-- Implementation of Random Amplification of Polymorphic DNA (RAPD) Technology in the Genetic Analysis of Yellow Perch (*Perca flavescens*) Populations in the Chesapeake Bay.
Molecular genetic analyses are important for the better understanding of behavioral ecology and population biology. As a result of recent developments in DNA technology, techniques are being developed that make DNA analysis more accessible to field studies. In this project one such recently developed DNA analysis technique termed Random Amplification of Polymorphic DNA (RAPD) was studied to determine those methods useful in the analysis of DNA obtained from yellow perch inhabiting various river systems associated with the Chesapeake Bay.
145. SLACK, WILLIAM T., STEPHEN T. ROSS and JAMES M. HUEBNER. University of Southern Mississippi--Floodplain use in a Mississippi low order blackwater stream.
In July 1991, we began investigating potential floodplain use by stream fishes in Beaverdam Creek, a 4th order tributary of Black Creek. The study area is a 2nd order site and includes a 450 m stream reach along with adjacent fringing floodplains. We are addressing three primary questions: 1) What fishes occur on the floodplains? 2) What are they doing in floodplain habitats? 3) How does their floodplain activity impact short and long-term population and assemblage success? We are using passive capture techniques (directional fyke nets and wire mesh minnow traps) to document floodplain occurrences, and floodplains are actively sampled by seine during floods. Eleven flooding events were sampled from January to November 1992. Thirty-one species have been documented from the immediate study area and 27 species have been found on the floodplain. Numerically dominant species on the floodplain are *Lythrurus roseipinnis*, *Cyprinella venusta*, *Fundulus olivaceus*, *Luxilus chrysocephalus* and *Etheostoma swaini*. Species numerically dominant in the

channel are *L. roseipinnis*, *E. swaini*, *F. olivaceus*, *Percina nigrofasciata* and *Noturus leptacanthus*. Only 3 channel species, *Notropis signipinnis*, *Hypentelium nigricans* and *E. stigmaeum*, have not been documented on the floodplain.

146

SCHWARTZ, F. J. Institute of Marine Sciences, University of North Carolina--External leech and monogenetic trematode parasites of some Elasmobranchs captured off North Carolina.

Seasonal abundance and external occurrences of the leech, *Stilarobdella macrothela*, and monogenetic trematode, *Benedeniella posterocolpa*, on three species of sharks, *Carcharhinus plumbeus*, *Rhizoprionodon terraenovae*, and *Sphyrna lewini*, and the cownose ray, *Rhinoptera bonasus*, captured during a 22-year period (1970-1992) off North Carolina are discussed. Sharks and the rays harbored the external parasites when frequenting saline waters of >30 ppt. The lowest salinity tolerated by the leech was 28 ppt on an Atlantic sharpnose shark captured in the estuarine waters of the Cape Fear River 3 May 1977. Sandbar sharks harbored leeches from June-August at densities 1-3/shark, the Atlantic sharpnose shark at densities 3/shark between May-November, and scalloped hammerheads at 5/25 sharks during June-September, where the largest leech was 165 mm total length. Northerly coastal migrating cownose rays harbored the monogenetic trematode, *Benedeniella*, at densities 1-20/10 rays from May-October while massive schools of southerly migrating rays or rays frequenting sounds or rivers were devoid of the trematode.

Occurrence studies of external parasites will be incomplete or biased unless parasitologists consider the environments frequented by the host.

147

BRENNEMAN, WILLIAM M. Indiana University of Pennsylvania--Larval abundance and reproductive timing in a south Mississippi headwater cyprinid assemblage.

As part of a larger study to determine differences in reproductive timing between upper and lower stream reach fishes, 4543 larval fishes, representing nine cyprinid species, were collected from weekly (for the most part) samples taken over a 16 month period in 1988 and 1989, from three headwater streams in the Lower Little Creek watershed (Pearl River drainage). Most specimens were collected with a 0.5 mm mesh dipnet, with effort standardized to 0.5 hr per sample; however, light traps fished overnight at each stream yielded some species (e.g., *Notropis*

volucellus) that were never collected by dipnetting. The headwater cyprinid assemblage was dominated by *Luxilus chrysocephalus* and *Lythrurus roseipinnis*, which, respectively, comprised 58 and 36 percent of the total specimens collected; the remaining seven species individually accounted for less than three percent of total specimens. *Luxilus chrysocephalus* and *Lythrurus roseipinnis* had protracted reproductive periods lasting from April - October, with peak abundances in late spring or early summer for striped shiner larvae, and in late summer of early fall for cherryfin shiner larvae. These protracted reproductive periods were associated with headwater stream environments where water levels fluctuated greatly in response to precipitation.

148

SETTLE, LAWRENCE R. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Beaufort Laboratory--Spatial and temporal variability in the distribution and abundance of juvenile fishes associated with pelagic Sargassum.

A survey of the early life history stages of fishes associated with the pelagic sargassum habitat off North Carolina was conducted from July 1991 through October 1992. Fishes from 67 taxa have been identified. Juvenile reef fishes, coastal demersals, coastal pelagics, and epipelagic species are represented. The families with the highest frequency of occurrence and greatest biomass are Balistidae, Carangidae, and Antennariidae. Species composition and abundance vary with respect to season and distance from shore. Peak abundance and greatest diversity occurs during the spring and declines to a low in winter. Abundance also declines from inshore to offshore.

149

MILLS, GLENN R. and THOMAS K. PAULEY. Marshall University--Seasonal analyses of stream substrate utilization and prey selection of *Desmognathus quadramaculatus* (Holbrook) in the northern most periphery of its range.

Seasonal analyses of *Desmognathus quadramaculatus* activities were observed in monthly visits to a stream in Fayette County, West Virginia. Salamander movements were found to be related to relative humidity near the surface of the stream. Seasonal changes of relative humidity influenced stream substrate utilization and prey selection. The stream is shaded by a dense deciduous canopy from late spring to early fall, which allows relative humidity to remain high and fairly constant. At this time, salamanders were observed on top of streamside substrate foraging for terrestrial and aerial prey. Late fall, winter, and early spring when relative humidity reaches an ambient low, the salamanders were found foraging under the surface of

the water. In this same time period, when relative humidity was increased near the surface of the stream (via rainfall), salamanders were observed on top of streamside substrate.

- 150 MCGUIRE, WILLIAM R., WILLIAM S. WOOLCOTT and EUGENE G. MAURAKIS. University of Richmond--Relation of epidermal morphology to breeding behavior in cyprinid fishes.

The objective of this study was to determine the relation of epidermal morphology to reproductive behavior in cyprinid fishes (nest-builders, *Exoglossum maxillingua*, *Nocomis leptocephalus*, and *Semotilus atromaculatus*; and non nest-builders, *Camptostoma anomalum* and *Clinostomus funduloides*). Epidermal morphology and keratin distribution of skins from the snout, cheek, mandible, pectoral fin, anterior dorso-lateral trunk, and caudal peduncle of breeding nest-building males, compared with those of non nest-building cyprinid species, were examined with light and scanning electron microscopy. Frame-by-frame analysis of videotapes, and literature accounts were used to identify and describe breeding behaviors. The locations and structures of keratinized regions in the epidermis of these fishes are species-specific. The distribution of keratin and the form in which it occurs in each species correlate with four primary aspects of reproduction: substrate modification (nest-building or pit digging), spawning, agonistic behaviors (combat and/or aggressive displays), and ornamentation (species and sex recognition).

- 151 NOWLIN, M K. and GILLIAM, F S. Marshall University--Effects of wildfire on the herbaceous layer of a southwestern West Virginia mixed hardwood forest

The effects of fire on the mixed hardwood forests in West Virginia have long been of interest both biologically and economically. This study examined the effects of a Fall, 1991 wildfire in Wayne County, West Virginia on soil fertility and herbaceous layer response. Study plots were established in areas representing fires of high, moderate and low intensities with a control established in an adjacent unburned area of similar aspect and elevation. Composite soil samples were taken from each site. Soil fertility response was evaluated with a plant bioassay experiment, using *Poa pratensis* (Kentucky bluegrass) grown in soil from each burn type and amended with a variety of nutrient solutions. Herbaceous layer and canopy cover measurements were made at each site during the spring, summer and fall of 1992. A seedbank study was performed to further assess potential herb layer recovery. Replicate sections of forest floor and

surface soil were taken from each burn type and allowed to develop in the greenhouse with only periodic watering. The plant bioassay suggested that soil fertility was increased by fire at all three burn intensities. There was a generally negative correlation exist between herbaceous cover and canopy opening. This was significant on the high and moderate burned plots. Herbaceous cover was highest on high burned plots and lowest on unburned plots. Species which developed in the seedbank study were generally well-represented in the field plots during the course of this study.

- 152 NASH, D R., NOWLIN, M.K., VANNATTER, C., and GILLIAM, F.S. Marshall University--Bryophyte response to wildfire in a southwestern West Virginia mixed hardwood forest

Bryophytes play a significant part in recovery from disturbance in many terrestrial ecosystems, having particularly critical roles in nutrient cycling and water relations of plant communities. The purpose of this study was to quantify bryophyte response to fire in a hardwood forest. A section of upland mixed hardwood forest in Wayne County, West Virginia, which burned from a wildfire in November 1991, was divided into four fire intensity types based on the amount of overstory stem charring, survival of understorey stems, and removal of litter layer. These types were high intensity burn (HB), medium intensity burn (MB), low intensity burn (LB), and unburned (UB). Three plots were randomly located in each of the four burn types and five 1-m² subplots were established in each plot by stratified random placement. All 60 subplots were measured in May, July and September for amount of bryophyte cover (%), herb layer cover (%) and overstorey canopy closure. Bryophyte cover was greatest at the HB site (24.7%) and lowest at the UB site (3.7%) but did not correlate significantly with canopy closure at any. Patterns of bryophyte recovery over time varied substantially with burn type. Bryophyte cover appeared to be more sensitive to herb layer development (closure) than to overstorey canopy closure. These results suggest that bryophyte response to wildfire in this hardwood forest is mediated greatly by an interaction of substrate availability (e.g., exposed soil) and the microclimatic conditions created by herbaceous layer cover.

- 153 AULICK, S D,¹ F S GILLIAM,¹ D K. EVANS,¹ and M B ADAMS,² Marshall University¹ and Fernow Experimental Forest². Factors influencing herbaceous layer communities in a central Appalachian mixed hardwood forest
Herbaceous layer communities respond to a variety of environmental variables in forest ecosystems. The objective of this study was to examine stand and soil variables and their influence on herbaceous communities of the Fernow Experimental Forest, Parsons, WV. Watersheds were selected on the bases of stand age and history (WS3 ~20 yr, select cut, WS4 >80 yr, control, and WS7 ~20 yr, clearcut and herbicide). Each watershed was sampled floristically

with transects four times from May through August. The voucher specimens collected from this sampling method were used to create a species list for all three watersheds. In addition, the herb layer was sampled within 15 0.04-ha circular sample plots per watershed. All vascular plants ≤ 1 m in height within 10 1-m² subplots per plot were identified to species and estimated for cover (%). The floristic study identified 231 species on all three watersheds combined. The largest family represented was Cyperaceae. Plot data revealed relationships between herb layer species diversity and soil variables for neither WS3 nor WS4. However, on WS7 there was a significant negative correlation between species diversity and soil variables, including clay content and cation exchange capacity. No correlations were found for any of the watersheds for stand variables and diversity or richness. Principle component analysis identified several potential herb communities. These communities appeared to be determined in part by similarities among herb layer species for resource requirements.

154 TURRILL, N.L.,¹ F.S. GILLIAM,¹ and M.B. ADAMS.² Marshall University¹ and Fernow Experimental Forest²-- Autogenic and allogenic controls of herb cover in mature and young stands of a central Appalachian hardwood forest. Herbs of montane forests respond to a variety of environmental gradients. The objective of this study was to determine how herb cover varies with stand and soil characteristics and how these effects change with stand age. Fifteen 0.04-ha circular plots were established in each of four watersheds of the Fernow Experimental Forest, Parsons, WV [WS4 control, >80yrs; WS13 select cut, >65yrs; WS3 clearcut, ~20yrs; WS7 clearcut/herbicide, ~20yrs]. Cover (%) was measured for all species (≤ 1 m in height) within 10 1-m² subplots in each plot and the two subplots with greatest cover per plot were harvested for biomass. Regressions of cover and biomass were used to estimate biomass for nonharvested subplots, cover was significantly correlated with biomass ($r^2=0.62$). Harvested tissue was analyzed for nutrient concentrations. One 10-cm soil sample was taken from each harvested subplot. All living woody stems ≥ 2.5 cm diameter at breast height (dbh) were categorized as overstory (>10 cm dbh) or understorey. Herb cover was significantly higher on WS7 (37.5%) due to an abundance of *Dryopteris marginalis* and *Polystichum acrostichoides*. Herb cover on WS4, WS3, and WS13 was 26.4, 19.3, and 17.9%, respectively. These watersheds were dominated by *Laportea canadensis* and *Acer pensylvanicum*. Soils of all watersheds were acidic sandy loams of similar fertility. Herbaceous species were higher in N, K, and Mg than woody seedlings. Canonical discriminant analysis of mean plot values separated watersheds along an age gradient based on stem density. The watersheds also were separated by clay content and soil NO₃ concentrations on an elevational gradient. Principle component analysis of individual watershed data (correlating cover to each axis) revealed that herb cover was negatively correlated with canopy characteristics (e.g. density) on WS4 and WS13 and positively correlated with soil nutrients on WS3 and WS7. These data suggest that early in succession, light availability is relatively high and uniform and herb layer development is nutrient-limited. Later in succession, canopy stratification and closure increase and the herb layer becomes limited by light availability.

155 GILLIAM, F.S.,¹ TURRILL, N.L.,¹ and M.B. ADAMS.² Marshall University¹ and Fernow Experimental Forest²-- Species composition of young vs. mature montane hardwood forests of West Virginia. Secondary successional sequences in forest ecosystems can be very site-specific, especially in high-elevation hardwood forests.

This study compared tree species composition among four watersheds of the Fernow Experimental Forest, Parsons, WV: two young (WS3 and WS7, both ~20 yr old) and two mature (WS13, >65 yr, WS4, >80 yr) watersheds. All trees ≥ 2.5 cm diameter at breast height (DBH) were tallied and measured for DBH within 15 0.04-ha circular plots per watershed. Multivariate statistical analyses [canonical discriminant analysis (CDA) and principle components analysis (PCA)] were performed on ln-transformed importance values based on the sum of relative density and relative basal area per plot. For both CDA and PCA, axis scores were compared to ln-transformed environmental variables (e.g., elevation, soil nutrients, soil organic matter) to determine possible relationships of species composition and successional change to these variables. Watersheds varied greatly with respect to stand age (young vs. mature, respectively) for density (1278 vs. 465 stems/ha), basal area (22.5 vs. 42.8 m²/ha), and species richness (17 vs. 20 species/watershed). Several important tree species were common to all four watersheds, including *Acer saccharum*, *Quercus rubra*, *Prunus serotina*, and *Liriodendron tulipifera*. Species composition and dominance, however, varied greatly between watersheds. CDA separated the watersheds along a stand age gradient from mature to young stands, with *Acer saccharum* and *Quercus rubra* loading negatively and *Prunus serotina* and *Liriodendron tulipifera* loading positively on the first axis. PCA indicated that tree species composition within each watershed responded substantially to a variety of soil variables (including nutrients and texture) and elevation. These data suggest a species sequence for this central Appalachian hardwood forest from *Prunus serotina* and *Liriodendron tulipifera* dominating early in succession and being replaced by *Acer saccharum* and *Quercus rubra* later in succession.

156 BARDEN, LAWRENCE S. University of North Carolina at Charlotte-- Differential plant productivity under equal cumulative light on the east and west sides of a forest canopy gap. Recently, several computer models have been constructed to predict light levels (PAR) beneath a forest canopy gap. These models predict symmetrically equal PAR on the east and west sides of a gap, which might suggest that plant growth would be equal on east and west sides of a gap, given equal cumulative PAR. To test this null hypothesis, I grew *Microstegium vimineum* in fertilized soil in 25 small phytometers placed at 1 m intervals across a forest canopy gap. The five pots at each end of the line were in the "extended gap" with canopy overhead. All pots were kept well-watered throughout the growing season. Cumulative PAR was measured at each pot with quantum sensors. The results contradicted the null hypothesis. Productivity on the west side of the extended gap was approximately 25-30% greater than that on the east side of the extended gap. The difference in growth is attributed to the relatively greater water stress on the east side of the gap where plants received most light during the warmer afternoon hours, in contrast to the west side where plants received most light during the cooler morning hours. However, in the open gap with sky vertically overhead, there was no significant difference in plant productivity on

the east and west sides of the gap. This study was supported by a grant from the UNCC Foundation.

- 157 COLLINS, B. and G. WEIN. Memphis State University and Savannah River Ecology Lab--Oldfield community responses to frequency and intensity of clipping.

Frequency and intensity of disturbance can influence community structure and dynamics. For example, species diversity is expected to be highest at intermediate disturbance levels if greater frequency/intensity decreases the pool of species that can survive and competitive exclusion occurs at low levels. Oldfields dominated by herbaceous perennials are a mixture of short- and long-lived, ruderal and competitive species. We varied frequency (0, 2x/yr, 1x/yr, 1x/2yr) and intensity (no clipping, dominants or total above-ground biomass removed) of clipping to determine their effects on community structure and dynamics in 2x3 m plots arrayed in a randomized block design. After 2 yr, plots totally clipped 2x/yr had no litter layer, little vertical stratification, and were dominated by annual foxtail grasses. All other treatments did not differ from the control in species dominance or diversity, vertical stratification, cover, and nearest neighbor identity or distance. Plots were dominated by perennial bunch grasses and forbs. We conclude that only the most intense/frequent clipping influences structure of this oldfield after 2 yr.

- 158 Schildt, Amy and James Fralish. Southern Illinois University, Carbondale--A study of presettlement forest in the Southern Coastal Plain Region of Illinois.

Witness tree data from the 1806-7 original land survey records are being used to reconstruct forest community patterns in the Gulf Coastal Plain region which extends approximately 35 Km into the southern tip of Illinois. Using topographic maps, section and quarter-section corners are being categorized as upland or bottomland. Upland corners are being further classified by aspect and slope position. Species importance values (relative basal area), and stand density and basal area are being calculated for each site type (ridgetop, high south slope, low south slope, etc.). *Quercus alba*, *Quercus velutina* and *Carya* spp. were the major species of most upland

sites but a few mesophytic species occurred on low and north-facing sites. Bottomland sites are being delineated by elevation, distance from the Ohio River, distance from the nearest permanent stream and soil type. *Fraxinus*, *Ulmus*, *Liquidambar* and *Quercus* (lowland species) occur on well-drained bottomlands while *Taxodium* appears in some areas.

- 159 Snyder, Pam and James Fralish. Southern Illinois University, Carbondale--A study of oak re-establishment in clearcut forest at Land Between The Lakes, KY and TN.

Research on oak re-establishment after timber harvesting at LBL is being conducted under the auspices of the Center for Field Biology, Austin Peay State University, Clarksville, TN, and the Department of Forestry, SIU. During the summer of 1992, sapling and seedling data were collected from 50 0.006 and 0.003 ha plots, respectively. These plots were located in eight areas of oak dominated forest clearcut between 1978 and 1980. After initial harvesting had been completed, all remaining stems between 2.5 and 12 cm DBH were cut. On the drier ridgetops and south slopes, regrowth appears to be similar in composition to the original overstory. On dry ridges where a soil fragipan is present, *Quercus stellata* and *Q. prinus* are major species in the new forest, while on south slopes, *Q. alba*, *Q. velutina*, and *Carya* dominate the sapling strata. Low east and north slopes presently support a community of *Acer saccharum* and associated species indicating an immediate conversion to mesophytes in the absence of preharvest fire or other operations to eliminate *Acer*.

- 160 Strazzante, Lisa and James Fralish. Southern Illinois University, Carbondale--Encroachment of *Acer saccharum* into the oak communities of the Ozark Hills region of Illinois.

Research is being conducted on the rate of invasion of *Acer saccharum* (sugar maple) into mature undisturbed oak-hickory forests of the Illinois Ozark Hills region. Tree, sapling and seedling data are being collected from 46 permanent nested plots of 0.04, 0.006, and 0.003 ha,

respectively, located in the Ozark Hills Nature Preserve. These plots, first measured in 1986, are being relocated and resampled. Data from the two measurement times are being analyzed to study the rate of composition change. Data from an additional 48 plots randomly located throughout the Ozark Hills region also are being analyzed. For all 94 plots, a compositional index [CI = sum of (Species Importance value x Adaptation value)] is being developed for each stratum, and differences between overstory and understory compared to examine successional trends on several site types. Results from a stand table projection procedure will be compared with a forest growth simulator model (JABOWA) also will be used to investigate long term change in forest composition. Early results indicate that *Acer saccharum* is rapidly replacing oak on most site types.

161 FRANKLIN, SCOTT B.,¹ PHILIP A. ROBERTSON,¹ JAMES S. FRALISH¹ AND STEPHAN M. KETTLER.² Southern Illinois University, Carbondale and Colorado Natural Heritage Program, Boulder--Stratum analysis for separating successional from compositionally-stable stands.

Woody species from 137 stands sampled at Land Between The Lakes (LBL), Kentucky and Tennessee, were used to analyze successional dynamics. Stratum continuum index and percent similarity were used to identify 64 compositionally-stable and 73 successional stands. Overstory and understory successional stand data were ordinated using DECORANA and vectors were drawn between overstory and respective understory points in ordination space. Mean first axis ordination scores for overstory and understory stands were 201.6 and 257.4, respectively, indicating a significant shift in vegetation to a more mesophytic condition. The successional trajectories revealed two major successional trends; *Pinus echinata* stands succeeding to *Quercus* dominance and *Quercus alba* stands succeeding to mesophytic dominance. Discriminant Analysis between successional dominance types and their expected climax dominance types supported the ordination results. The successional *P. echinata* type and *Q. alba* type showed no significant environmental difference from their expected climax dominance types. Comparison of compositionally-stable and successional coenoclines show a substantial shift in species composition with forest succession at LBL.

162 PHILIPPI, THOMAS E.¹, ROBERT K. PEET¹, and NORMAN L. CHRISTENSEN².

¹ University of North Carolina, Chapel Hill, NC 27599-3280 USA, and ² Duke University, Durham, NC, 27706 USA. -- Tree seedling demography in old-field *Pinus taeda* and mature mixed hardwood stands in a Piedmont forest.

Seedling interactions and demography are potentially important factors in forest succession, but remain little known and largely unstudied. We report age- and size- specific survivorship and growth rates for 14 species over a 12-year period from transitional-stage (60-80 yr) *Pinus taeda* stands and from uneven-aged mixed hardwood stands. With the exception of first-year seedlings (which may be growing from their seed reserves), for all species, relative growth rate (RGR) measured as (HT2-HT1)/HT1 is relatively independent of both seedling age and size. Surprisingly, RGR is not positively correlated among seedlings from one year to the next: fast-growing seedlings in one year are not more likely to be fast growing in the following year. The probability of surviving to the following year was an increasing function of both age and size. For most species, RGR from the previous year is not predictive of survivorship to the following year. The probabilities of seedlings surviving to 50 and 100 cm were estimated with simulations based on size-specific survivorship probabilities and distributions of growth rates. Among species, survival to 1m varied from .20 for white oak in pine stands to .0001 for *Ostrya* in hardwood stands. While *Quercus* and *Carya* species did much better in transitional pine stands than in hardwood stands, *Acer* and *Nyssa* seedlings had higher survivorship to 1m in hardwood stands than in pine stands.

163 LITTLE, JACKIE A. and JOHN RENNIE.

University of Tennessee--Impact of Hurricane Donna (1960) on the mangrove forest, Shark River, Everglades National Park.

Mangrove productivity and succession is characterized as cyclic, with the cycles being reset by hurricanes every 15-20 years in the Caribbean region. This speculation is intuitively appealing, but the role of hurricane disturbance on mangrove productivity and succession has not been quantified. Our research objective is to develop hypotheses regarding hurricane impact for subsequent testing in a simulation model and in the field. The research site is along the Shark River. Our approach is to estimate mortality from standing dead trees and to recreate succession from size class distribution. In March 1992, we sampled forest structure, species distribution, regeneration, mortality, and light extinction through the canopy. Results indicate that mortality was selective spatially, by species (black and white mangrove), and concentrated in the larger diameter classes (30-90cm dbh). 50% of the regeneration was by stump sprout. The sapling size class was dominated by white mangrove, the seedling class was dominated by red mangrove.

164

NEUFELD, HOWARD S. Appalachian State University--
Modern Instrumentation for the Teaching of Plant
Ecophysiology.

Plant ecophysiology has undergone a revolution in terms of the instrumentation available for research and teaching. The goal of this workshop is to show how some of these instruments can be used to develop new instructional laboratories in traditional physiology courses, and to demonstrate several new techniques of use for both research and teaching purposes. Some of the exercises require fairly expensive instrumentation, while others can be done for very modest expenditures. Traditionally, gas exchange measurements (photosynthesis and stomatal conductance) and water relations have dominated modern day plant ecophysiology. Photosynthesis has most commonly been demonstrated in university labs using *Elodea* sprigs, and rates of photosynthesis have been estimated from amounts of oxygen evolved per unit time. I show how, with a simple gas exchange system, one can generate sophisticated light, temperature and CO₂ curves for whole leaves. One can also construct lowcost, homemade light and humidity sensors of high accuracy. In addition, water relations of plants can be studied with a modest investment of resources. As an example, I will demonstrate how to measure hydraulic conductances in stems with a simple pressure apparatus. Finally, I will discuss the practical utility of hands-on experience with scientific instrumentation and its benefit to the student.

165

EL SAWALHY, AHMED A., JAMES E.
HALL, and J. RICHARD SEED. University of North Carolina-Chapel Hill--
In-vivo catabolism of aromatic
amino acids by Trypanosoma brucei
evansi.

Aromatic amino acids catabolism by *Trypanosoma brucei evansi* was investigated in vivo using C3H mice. The urine samples were collected before the infection, at different stages of parasitaemia, as well as after treatment with suramin (40 mg/kg I.P.). The catabolites were converted to the tert-butyltrimethylsilyl derivatives, then analyzed and quantified by capillary gas liquid chromatography and their structure confirmed by gas chromatography-mass spectroscopy. The major catabolites detected in the urines of infected animals were phenylpyruvic acid, 4-hydroxyphenylpyruvic acid, and indole-3-pyruvic acid. Significant decreases in these catabolites were observed one day after suramin treatment, and had returned to normal levels by the third day. In addition indole-3-acetic acid, indole-3-lactic acid, and 4-hydroxyphenylacetic acid were also detected in infected urines by GC-MS. The quantities of these catabolites were too small to be detected by GC alone, and therefore could not be quantified. Phenylacetic acid, phenylacetic acid, 4-hydroxyphenylacetic acid, indole-3-ethanol, phenylethanol, and hydroxyphenyl ethyl alcohol were not detected by GC-MS.

166

JOHNSON, SANDRA S. and GEORGE A.
CONDER. Upjohn Laboratories, Kalamazoo,
MI--Development and use of a novel
anthelmintic assay utilizing jirds (*Meriones
unguiculatus*) infected with the ruminant
nematode *Haemonchus contortus*.

Despite great efforts in pharmaceutical companies, government laboratories, and academic institutions, there are only 3 classes of broad-spectrum anthelmintics available today and the newest of these, the avermectins/milbemycins, was discovered some 20 years ago. Unfortunately, resistance to each of these classes is evident in the field, and resistance is a particular problem in sheep/goats and horses. A novel class of anthelmintic, working through a unique mode of action, could provide a valuable tool for combating resistant parasites and for extending the life of existing anthelmintics through rotational strategies. Toward this end, we are actively pursuing the discovery of new anthelmintics. An important component of our discovery effort is a rodent model utilizing target parasites. In this model, immunosuppressed jirds (*Meriones unguiculatus*) are infected with the important ruminant nematode *Haemonchus contortus*. We have demonstrated that this parasite infects jirds in a site anatomically similar to its predilection site in ruminants, grows, and develops from third-stage larvae through the immature fifth-stage. An assay scheme has been developed, based on the biology of the parasite in the jird, which is predictive for anthelmintic activity in ruminants and which requires only 1-10 mg of test material. By adding other parasite species to the model, initial indications of anthelmintic spectrum can be achieved. Resistant strains of parasites can be used in the model to examine mode-of-action and cross-resistance. Use of this jird model greatly reduces the need for studies in ruminants, speeds the discovery process, and significantly reduces the cost of finding useful new anthelmintics.

167

OLIVER, JAMES H., JR., FRANCIS W.
CHANDLER, AND M. PAGE LUTTRELL.
Georgia Southern University, Medical College of
Georgia, and University of Georgia--First
isolation and transmission of the Lyme disease
spirochete from southeastern United States.

The first isolation of the Lyme disease spirochete *Borrelia burgdorferi* from the southeastern United States is reported from Sapelo Island, Georgia. Three isolates, two from cotton mice (*Peromyscus gossypinus*) and one from the black-legged tick (*Ixodes scapularis*), were recovered in July and September, 1991. They were characterized immunologically by indirect fluorescent antibody (IFA) assay with a battery of five monoclonal antibodies, by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) of whole cell lysates, and by the polymerase chain reaction (PCR) assay using primers for three DNA target sequences found in *B. burgdorferi* reference strain B-31. Transmission experiments indicate that the three Georgia isolates can infect experimentally inoculated hamsters and mice. Tick transmission of one of the isolates has been attempted so far; *I. scapularis* transmitted isolate

SI-1 from hamsters to mice, but the lone star tick, *Amblyomma americanum*, did not. Supported by NIAID AI24899 and CDC U50/CCU406614-01.

- 168 BULTS, JEFFREY A., VANYA M. GREENE, and ELIZABETH B. HARRIS. Appalachian State University--Prevalence of *Dirofilaria immitis* in Adjacent Counties in Northwestern North Carolina.

While Wilkes and Watauga Counties are adjacent, Wilkes County is in the Piedmont Province and Watauga County is in the Mountain Province. In the summer of 1990 a study was undertaken to determine prevalence of *Dirofilaria immitis* in these two counties. Stray dogs scheduled for euthanasia at the county animal shelters were tested for microfilariae of *D. immitis* using the Knott's technique. The prevalence of *D. immitis* was 11.3% in Wilkes County but was only 6% in adjacent Watauga County. Elevation effects are hypothesized to account for the difference in prevalence rates.

- 169 Allman, C., B. DOWELL, and J. JOY. Marshall University--Mosquitoes of Western West Virginia.

Eleven species of larval mosquitoes were collected from 87 different sites in 14 western West Virginia counties from April through October 1992. *Aedes triseriatus*, *Anopheles punctipennis*, and *Culex restuans* were the most frequently encountered species. Although not new to the state, *Orthopodomyia signifera*, and *Toxorhynchites rutilus*, are reported for the first time from one or more of these western West Virginia counties. *Culex apicalis* is reported for the first time from West Virginia. Mosquito larvae are also assigned to specific habitat categories.

- 170 DUOBINIS-GRAY, LEON F., SHEILA WITT, and EDMUND ZIMMERER. Murray State University--Detection of the causative agent of Lyme disease, *Borrelia burgdorferi*, in various tick hosts from mammals in western Kentucky utilizing the polymerase chain reaction technique.

During the Summer and Fall of 1992, a total of 418 ticks of various species from western Kentucky was examined for the presence of *Borrelia burgdorferi*, the causative bacterial agent of Lyme disease.

The polymerase chain reaction technique (PCR) was employed to test an area of the bacterial genome which codes for outer surface protein A (OspA). Four tick species were examined: *Amblyomma americanum*, *Dermacentor albipictus*, *D. variabilis*, and *Haemaphysalis leporispalustris*. All ticks were removed from mammals suspected as potential reservoir hosts for the bacterium and analyzed in pooled samples consisting of multiples within tick species. Mammalian hosts included whitetail deer, *Odocoileus virginianus*, racoon, *Procyon lotor*, and eastern cottontail rabbit, *Sylvilagus floridanus*. Of the pooled tick samples, 29 were positive for *B. burgdorferi*. Based upon pooled samples, the minimum prevalence of *B. burgdorferi* in tick hosts was 7%. All tick species examined were positive by PCR testing. These results indicate that multiple tick species may be potential vectors of Lyme disease in the southeastern U.S.

- 171 RIBEIRO-RODRIGUES, R., B. J. BOGITSH, and C. E. CARTER. Vanderbilt University--An ultrastructural study of *Trypanosoma cruzi* reservosomes during in vitro metacyclogenesis.

Horseradish peroxidase (HRP) was used as a tracer enzyme to study the fate of reservosomes during *in vitro* metacyclogenesis of *Trypanosoma cruzi* epimastigotes (Y strain) to trypomastigotes. Epimastigotes in mid-log phase of growth in LIT culture medium were exposed to HRP (250 µg/ml) for 30 minutes, washed, and transferred to a protein-free, chemically defined simple culture medium (TAU3AAG) for 96 hours with aliquots removed every 24 hours for microscopic analysis. The number of reservosomes/cell diminished as a function of time as did the number of cells possessing reservosomes. At 96 hours, approximately 60% of the epimastigotes had transformed to trypomastigotes, and fewer than 5% of the cells displayed reservosomes. The morphology of the reservosomes also changed as a function of time. At 24 hours, HRP reaction product in the matrix of the reservosomes lessened; concomitantly, electron-lucid vesicles in the reservosomes enlarged. From 48 to 72 hours, the reservosomes became progressively smaller with some blebbing of the reservosome membrane. In some cases, electron dense granules fused with the reservosome membrane. These results affirm the hypothesis that the contents of reservosomes may serve as energy sources during the transformation of epimastigotes to trypomastigotes in the insect vector's gut. This work was supported in part by NRC-CNPq-Brazil grant 201536/91-9 (RRR) and NIH grant AI26505 (CEC).

- 172 DOWELL, B. and J. JOY. Marshall University--A Preliminary Report of *Glythelmins quieta* (Trematoda: Digenea) from the Spring Peeper, *Pseudacris crucifer*, in Western West Virginia.

Glythelmins quieta Stafford, 1905 was recovered from the intestinal tracts of 24 of 46 (52.2%) *Pseudacris crucifer* individuals examined in the spring of 1992. Intensity of infection ranged from 1 to 21 trematodes with a mean of 9.2 ± 6.5 (1 std. dev.). We found a decrease in the mean lengths of trematode individuals as the number of trematodes in a given host increased. This negative correlation (of mean length versus total number of trematode individuals present) could be expressed as: $y = 2.97 + (-0.067)x$; $r = -0.733$.

- 173 TILAHUN, GETACHEW¹ and SHARON PATTON². Addis Ababa University, Ethiopia¹ and University of Tennessee College of Veterinary Medicine²--Serological studies on *Dictyocaulus filaria* vaccine.

The humoral antibody response to vaccination with an irradiated *Dictyocaulus filaria* larval vaccine was assessed by an indirect fluorescent antibody test (IFAT). Frozen histological sections of adult *D. filaria* were used as antigen. Pooled sera from 80 vaccinated and non-vaccinated lambs were used in this trial. Antibody titers in the vaccinated lambs ranged from 1:160 to 1:1280, whereas titers in the non-vaccinated lambs ranged from 1:10 to 1:40. No significant serological cross reaction was observed between *D. filaria* and other lungworms of sheep indicating good specificity of the test.

- 174 JOY, J., E. MADAN, and J. HARMON. Marshall University--*Potamilus alatus* (Mollusca: Unionidae) glochidia-induced histopathology in freshwater drum, *Aplodinotus grunniens*, from the Kanawha River, West Virginia.

The gills of 37 of 173 freshwater drum, *Aplodinotus grunniens* Rafinesque, taken from two locations on the Kanawha River, West Virginia, were found infected with glochidia of the freshwater mussel, *Potamilus alatus* Lea. All infections were recorded between May 25th and June 21st. No glochidia were recovered from hosts in monthly collections taken between the 22nd of June through mid-October. Infections gave rise to granulomas that caused a distal "clubbing" of the parasitized gill filaments. The resulting lymphohistocytic response was comparable to a type IV hypersensitive reaction seen in human tissues. Increased vascularization within the granuloma was not observed. Glochidial development of the

definitive and larval mantles, and the gut and digestive glands corroborated findings of previous investigators. The transitory larval adductor, pedal retractors, heart, and gill buds were prominent as well, but the number of glochidia at the necessary stages (ages?) of development was insufficient to adequately describe the origin and subsequent development of those structures.

- 175 FAULKNER, CHARLES T. and SHARON PATTON. University of Tennessee--College of Veterinary Medicine--Parasitic infections of Mexican Indians and domesticated livestock in the State of Nayarit, Mexico: A preliminary study.

Fecal samples obtained from Mexican Indians and their domesticated livestock were examined for endoparasitic helminth eggs and larvae, intestinal protozoan cysts and oocysts. *Ascaris suum*, *Trichuris suis*, and eggs identified to the order Strongyloidea were present in samples (5/7) from domesticated swine. All samples from horses and donkeys (n=6) were positive for Strongyloidea eggs, and *Dictyocaulus arnfieldi* L. larvae were also found in one of the horse samples. Trichostrongyloidea eggs, and *Eimeria* sp. oocysts were found in 2 fecal samples from a calf and a goat, respectively. Fecal samples from humans (n=28) represented 9 households. *Hymenolepis nana* eggs were present in 8 samples, and 4 cases occurred within a single household. Other parasite products in the samples are *Enterobius vermicularis* (3/28) and *Trichuris trichiura* (2/28) eggs, and *Giardia lamblia* (3/28) cysts. The distribution of these infections in the human population does not appear to be associated with gender, age, or household membership. This research was undertaken in cooperation with the Remote Area Medical Foundation Inc., Knoxville TN.

- 176 PATTON, SHARON, CLARK S. PATTON, STEWART POWELL, and R. L. GLENN. University of Tennessee College of Veterinary Medicine and Pellissippi Animal Hospital -- *Trichinella spiralis* in domestic dogs.
- Trichinella spiralis* cysts were seen in a biopsy taken from the nasal area of a 5 year old beagle mixed-breed dog from east TN that was presented for treatment of a dermatitis. The Veterinary Medical Database at Purdue University was searched for other reports of trichinosis in dogs from cases seen at the veterinary colleges in the

United States and Canada. The search included data from 1964 - 1992 for 23 veterinary colleges. Trichinosis was the primary or secondary diagnosis in dogs in 17 cases which were reported from 7 different veterinary colleges. Two cases were reported in the 60's, 10 in the 70's, and 5 in the 80's. Other reports suggest that the prevalence of infection with *T. spiralis* in dogs is decreasing. The prevalence and epidemiology of *T. spiralis* in dogs today is not well understood. Many cases probably go undiagnosed.

177

BLAGBURN, BYRON L., DAVID S. LINDSAY, LISA C. PARSONS, and NATASHA S. RIPPEY. Auburn University--Diclazuril inhibits development of *Cryptosporidium parvum* in Hsd:(ICR)BR Swiss and BALB/c mice.

Cryptosporidium parvum is an enteric protozoan parasite of many species of mammals including humans. It is particularly important as a cause of persistent diarrhea in HIV-infected humans with AIDS. At present, there is no drug with confirmed, consistent efficacy against AIDS-associated cryptosporidiosis. Diclazuril is a new, potent benzeneacetone nitrile anticoccidial with efficacy against several eimeriid coccidia. We evaluated the cryptosporidicidal effects of diclazuril at a dosage of 1 mg/kg using our established suckling murine assay. A mixture of suckling BALB/c and outbred Swiss mice were each infected with 10^5 oocysts of *C. parvum* by esophageal intubation on day 0. One group (n=9 mice) was treated with diclazuril at a dosage of 1 mg/kg. Diclazuril was solubilized in 25% v/v dimethylsulfoxide (DMSO) in RPMI 1640 media with 10% fetal calf serum. A second group (n=9 mice) was treated with a similar amount of RPMI 1640 without diclazuril. Treatments were administered daily beginning on day 0 and continuing through day 3. All mice were necropsied on day 6. The terminal ileum and cecum of each mouse was removed and ground in 2.5% v/v potassium dichromate solution at high speed to free oocysts from the tissues. An aliquot of the homogenate from each mouse was counted with the aid of a hemacytometer. Mean numbers of oocysts recovered from the treated and control mice were compared using the nonparametric Mann Whitney U test. The mean raw hemacytometer count for treated mice (39.56 ± 8.18) was significantly less (74% reduction; $P=0.002$) than that of the control mice (153.11 ± 36.32). No evidence of toxicity was observed following treatment with diclazuril or diluent. Supported in part by Grant AI33363 from NIAID.

178

LINDSAY, DAVID S., PAUL C. SMITH, FREDERIC J. HOERR, and BYRON L. BLAGBURN. Auburn University--Prevalence of encysted *Toxoplasma gondii* in wild turkeys and raptors from Alabama.

Little is known about the prevalence of encysted *Toxoplasma gondii* in wild birds. We examined the

hearts from 11 wild turkeys, and heart and breast muscles from 93 raptors for encysted *T. gondii*. Wild turkeys were hunter killed and raptors were birds that had been submitted for necropsy examination at the C. S. Roberts State Veterinary Diagnostic Laboratory, Auburn, Alabama. Tissues were digested in acid-pepsin solution and subcutaneously inoculated into groups of 4 or 5 mice. Four to 5 weeks postinoculation, serum was collected from each mouse and examined at dilutions of 1:50 and 1:100 in an IFA test for antibodies to *T. gondii*. In addition, smears were made from the brain of each mouse and examined for *T. gondii* tissue cysts. *Toxoplasma gondii* was isolated from 6 of 11 (55%) wild turkeys and 26 of 93 (28%) raptors as follows: 8 of 11 (73%) red-shouldered hawks, 12 of 25 (48%) red-tailed hawks, 1 of 2 (50%) sparrow hawks, 1 of 5 (20%) great horned owls, 3 of 14 (21%) barred owls, 1 of 4 (25%) Cooper's hawks, 0 of 4 ospreys, 0 of 4 turkey vultures, 0 of 1 black vultures, 0 of 6 barn owls, 0 of 9 screech owls, 0 of 2 golden eagles, 0 of 2 sharp-shinned hawks, 0 of 1 Mississippi Kites, and 0 of 3 broad winged hawks. Five of the six isolates from wild turkeys produced fatal infections in mice on primary isolation. One *T. gondii* isolate from red-tailed hawks and one isolate from red-shouldered hawks produced fatal infections in mice on primary isolation; the other *T. gondii* isolates from raptors were nonpathogenic on primary isolation.

179

FORESTER, DON C. AND ROBERT W. MILLER. Towson State University--Distribution of the gray tree frogs, *Hyla chrysoscelis* and *Hyla versicolor* in Maryland.

The diploid gray tree frog, *Hyla chrysoscelis*, and its tetraploid congener, *Hyla versicolor*, are sibling species which are widely distributed in eastern and central North America. Phenotypically identical, these sister taxa may be distinguished in the field based on parameters of the male advertisement call. Between 1986 and 1992, we mapped the distribution of these species in Maryland. *Hyla chrysoscelis* is largely a species of the Coastal Plain and lower Piedmont in Maryland, although we did record a single male from the Allegheny Plateau in the westernmost county of the state. This individual may represent a recent eastward expansion of the diploid species from adjacent West Virginia, or an indigenous population which became disjunct from eastern *H. chrysoscelis* due to the expansion of *H. versicolor* westward into the mountains. Today, *Hyla versicolor* is largely an upland species, exhibiting extended allopatry on the Allegheny Plateau eastward through the Valley and Ridge Province well into the central Piedmont. A broad, complex band of sympatry occurs through central Maryland adjacent to the Fall Line. A narrow band of sympatry also exists on the upper Delmarva Peninsula. During the survey, we analyzed the calls of 239 *H. chrysoscelis* and 109 *H. versicolor* from 79 localities across the state. Of these, 37 sites were allopatric for *H. chrysoscelis*, 28 were allopatric for *H. versicolor* and 14 were syntopic (both species breeding at the same site). We measured body length (SVL) as well four parameters of the call (pitch, length, pulses, pulses/second) for each male. Pitch, length and pulses/second were significantly influenced by temperature, but we were unable to confirm character displacement for the calls of either species.

180

BAUGH, JULIA R. Towson State University --
Territorial prior residence effect in the dart-poison
 frog, *Dendrobates pumilio*.

Each of 32 male, *Dendrobates pumilio* (red phase) were allowed to establish a territory in one half of a ten gallon aquarium. Each territory contained a substrate of Sphagnum, a potted plant, and a water dish. Males occupying the same aquarium were prevented from seeing one another by an opaque barrier. In the first experiment, residents were presented with a conspecific intruder matched for size and color. Based on a numerical index of aggression, territorial residents were consistently dominant over intruders. When reciprocal trials were conducted the results were reversed (i.e., residents were dominant over males to which they previously had been subordinate). The success of resident males was not influenced by the size of conspecific intruders. Residents were generally unsuccessful in defending their territories against conspecific males representing a yellow color morph, but consistently dominated a sympatric confamilial intruder (*Phyllobates lugubris*). Removal experiments revealed that resident males recognize and defend their territories after 3, and to a lesser degree, 6 days of isolation. I also examined the effect of territorial markers on the prior residence effect by stepwise removal of the plant and *Sphagnum*. Residents aggressively defended territories in both experiments. When *Sphagnum* was removed from the residents' territories, and placed in previously unused aquaria, 7 of 10 males exhibited dominance over conspecific intruders.

181

PARKINSON, CHRISTOPHER L. University of
 Louisville--A Thermal Denaturation Study of
 Genomic DNAs of *Coluber Constrictor*.

To estimate the degree of gross genomic change that has accompanied subspecific differentiation and evolution, the nuclear DNAs from most of the subspecies of the Racer, *Coluber constrictor*, were isolated and thermally denatured. Melting profiles were generated by measuring the change in absorbance (A_{260}) that accompanies denaturation of the DNA molecule. The fifth derivatives of the melting profiles were calculated and compared; these are used in a phylogenetic analysis. Percent GC content, compositional heterogeneity, and presence of discrete shoulders on the melting profile were also identified for each taxon. Percent GC content for the subspecies was quite similar (34-39.5%). Their melting profiles exhibit discrete shoulders at similar temperatures. Comparison of the *Coluber* melting profiles with those of its putative sister taxon, *Masticophis flagellum*, indicates a high degree of homology.

182

DODD, C. KENNETH, JR. National
 Ecology Research Center USFWS--
Population structure of eastern
 narrow-mouthed toads during a
 prolonged drought.

The eastern narrow-mouthed toad, *Gastrophryne carolinensis*, is a common inhabitant of sandhill uplands in north-central Florida. From 1986-1990, I monitored a population of this species at a temporary wetland in Putnam Co., Florida. The pond held water only 14 mo during the 60 mo study. A drift fence-pitfall trap system

encircled the pond basin to capture toads as they entered and exited. 5740 eastern narrow-mouthed toads were captured despite a severe drought during the latter years of the study. In 1986 and 1988, approximately 900 eastern narrow-mouthed toads entered the pond. Few multi-year recaptures were recorded. The adult population size-class structure remained consistent throughout the study although the population size decreased. The sex ratio was male-biased in all years except 1990. Males were smaller than females in both snout-urostyle length (SUL) and weight, and differences were significant among years and between sexes. Drought eliminated reproduction for 5 years and seemed to reduce overall population size, but direct correlations between drought effects and stochastic variation are not possible. My data suggest that *G. carolinensis* survives long-term droughts because of its large population size scattered in a variety of habitats.

183

MAURAKIS, EUGENE and WILLIAM
 WOOLCOTT. University of Richmond
 --Agonistic behavior in *Nocomis*
 species: A test of the dear enemy
 phenomenon and cooperative
 defense coalitions.

The "dear enemy phenomenon" is reduced aggression among established neighbors at mutually recognized territorial boundaries. Neighbors, not only display reduced aggression among themselves, but reciprocate by exhibiting more aggression to intruders, forming the basis for cooperative defense coalitions. For the first time, observations, and frame by frame analyses of videotapes made under natural conditions in the field were used to qualify six agonistic behaviors, and quantify the numbers of interactions between males for each behavior that occurred over spawning nests of *Nocomis leptocephalus* and *Nocomis micropogon*. Analysis of interactions between male *N. leptocephalus*, using paired t-test, support the hypotheses that dear enemies exhibit reduced aggression, and reciprocation forms the basis for cooperative defense coalitions. Interactions between male *N. micropogon* do not support either hypothesis. We propose that the occurrences of the dear enemy phenomenon and the cooperative defense coalition theory in *N. leptocephalus*, and their absences in *N. micropogon* are related to differences in the evolutionary strategies (aspects of nest construction, spawning, and habitat) of the two species.

- 184 BAILEY, JEFFREY E. and THOMAS K. PAULEY. Marshall University--Aspects of the natural history of the Cumberland Plateau salamander, *Plethodon kentucki*, in West Virginia.
- A population of *Plethodon kentucki* in southwestern West Virginia was studied for 15 months (June 1990 through August 1991) to determine aspects of the natural history such as surface densities by season, diel activities, movement patterns, cover object preferences, and aspect with the greatest salamander density. *Plethodon kentucki* reached the greatest surface density in March and April with 70% of all salamanders observed occurring during these two months. A few adults were observed on the surface in May and June after the vertical migration in March and April and in February prior to the vertical movement. Surface density was significantly correlated with soil moisture but was not significantly correlated with soil temperature, air temperature, air relative humidity, and soil pH. In terms of diel activity, *Plethodon kentucki* first appeared on the forest surface at 7:00 pm and reached the greatest surface density between 9:00 and 10:00 pm. Only 4 marked individuals were recaptured. Of these, two adult females were recaptured in the same locations, one adult female moved 1.8 meters, and one juvenile moved 1.3 meters. Rocks were the major cover objects followed by roots, leaves, and logs. The greatest density of salamanders occurred on west-facing slopes compared to southwest and northwest slopes.
- 185 PAULEY, THOMAS K., JEFFREY E. BAILEY, and JAMES KOCHENDERFER. Marshall University and Fernow Experimental Forest--Impacts of herbicides and timbering operations on *Plethodon cinereus* (redback salamander) in northcentral West Virginia.
- Five watersheds with different stand ages in the Fernow Experimental Forest in northcentral West Virginia were monitored for two years (1989 and 1990) to determine the impacts of herbicides and timbercuttings on the redback salamander, *Plethodon cinereus*. Salamander populations on each watershed were examined for surface density, snout-vent lengths, food items, percentages of fat in tails and carcasses, and ovarian egg sizes, volumes, and numbers. Watershed timbercuttings and treatments are as follows: one watershed was clearcut 84 years ago and not treated; one watershed had a light selection cut 29 years ago and not treated; one watershed was clearcut 35 years ago and treated with urea in 1971 and diflubenzuron in 1986; one watershed was clearcut 19 years ago and undesirable stems treated with herbicides; and one was clearcut 22 years ago and maintained barren with herbicides from February 1968 to October 1969. There was no significance difference in the surface density of *P. cinereus* among the watersheds. There were no significant differences in ovarian egg numbers, sizes, and volumes, percentages
- of fat, snout-vent lengths, or food items in specimens collected from different watersheds. Based on these data, *Plethodon cinereus* populations in the northcentral West Virginia recover in clearcut areas within 20 years.
- 186 ORDIWAY, LINDA D. and THOMAS K. PAULEY. Marshall University--A study of habitat selection between two salamanders: *Desmognathus ochrophaeus* and *Plethodon cinereus*.
- One watershed within the Fernow Experimental Forest in Tucker County, West Virginia was studied from April through November to determine habitat selection between *P. cinereus* and *D. ochrophaeus*. Two vertical transects were established upslope from a permanent creek to the ridge, one was along an intermittent creek for the first 107 meters. A third transect was positioned to bisect the vertical transects. *Desmognathus ochrophaeus* was the dominant species along the transect adjacent to the intermittent creek. *Plethodon cinereus* was the dominant species in the top 64 meters of this transect, i.e., near the ridge. In the area between the lower and upper sections of the transect (43 meters), the two species were equally distributed. In the second vertical transect, both species were found throughout the transect. However, *D. ochrophaeus* was more prevalent near the permanent creek and *P. cinereus* was more common at the upper end of the transect. The two species were equally distributed along the horizontal transect (43 meters). *Desmognathus ochrophaeus* was the dominant species in lower, more moist areas, and *P. cinereus* was the dominant species in the higher, drier sites.
- 187 CASCHETTA, ABBY R. and JAMES H. HOWARD. Frostburg State University--Silvicultural effects on herpetile abundance and diversity in western Maryland.
- To investigate the effects of timber harvesting practices on habitat utilization by forest floor herptiles, nine sites in western Maryland were selected. Three of the selected sites represented areas clearcut within the last three years. The remaining six sites represented forested sites: three pole stands aged 10-20 years and three mature stands aged 60-90 years. All sites were chosen to decrease variance resulting from differences due to aspect and slope. Sites were sampled using funnel trap, drift fence, and pitfall arrays. Collections were made for three six week intervals during the spring, summer, and fall of 1992. Analysis of variance indicated significant differences among treatment types with respect to abundance ($p < 0.05$). Ducau's multiple range test indicates that clearcuts have significantly fewer herptiles than either the pole or mature stands ($p < 0.05$). Ducau's multiple range test was used to examine differences in Shannon-Weiner diversity estimates among treatment groups. There

were significant differences in the diversity estimates between clearcut and mature stands with clearcuts having significantly higher diversity ($p < 0.05$).

188

SCHMITT EMILY F. and VIRGINIA C. LESLIE. Towson State University and Rice University--A Comparison of Video Versus Visual Sampling Techniques to Assess the Abundance of Snappers (Family Lutjanidae) and Groupers (Family Serranidae) on Shallow Water Reefs.

Data collected using visual and video sampling techniques of coral reef fishes were compared at two different shallow water reef sites in the Turks and Caicos Islands, B.W.I. Transects of the coral reef were swum at both sites by two divers on SCUBA. Data were collected simultaneously using both the video and visual sampling methods. The densities of all fish species present, as well as the densities of snappers (Family Lutjanidae) and groupers (Family Serranidae) along each transect were recorded. Our analysis revealed that the visual method consistently yields a higher density of fishes than the video method on the same transect. Since the video method has rigid bounds set for its field of view, the area being sampled can be standardized. Sampling by the video method also provides a permanent record of the transect being sampled for comparison with future transects. We found that there was no significant difference in the density of Lutjanids present at each site although there was a significant difference in the density of Serranids present at each site. We suggest that the use of video sampling facilitates quantification of species density and should prove valuable to future population management of the commercial fisheries off South Caicos Island.

189

BURKE, VINCENT J. Savannah River Ecology Laboratory--The extended nesting phenomenon of common mud turtles, Kinosternon subrubrum.

For more than two decades, turtles inhabiting Ellenton Bay on the Savannah River Site near Aiken, SC have been studied to determine numerous life history characteristics. All turtles exiting and entering the water were examined at a drift fence that completely encircled the bay. During the course of this research, it was discovered that gravid female mud turtles leaving the bay to nest took several days to complete the nesting event. To understand why the turtles require so much time to nest, 25 turtles were equipped with radio transmitters and their nesting behavior was observed. Gravid female mud turtles were found to bury themselves after exiting the bay. The turtles remained buried until a rainstorm occurred. During the rainstorm, the turtles nested. After nesting, the turtles again buried themselves. The turtles then waited for another rainstorm before returning to the bay. The amount of time between rains determined the amount of time the turtles took to nest. It is suggested that nesting during rainstorms may reduce nest predation by mammals.

190

KOONS, JOHN and A. FLOYD SCOTT. Jackson State Community College and Austin Peay State University--Summer Movements of Native and Introduced Alligator Snapping Turtles, *Macrochelys temminckii*, in Kentucky Lake.

Movements of seven Alligator Snapping Turtles (two natives and five aliens) were monitored in Kentucky Lake (river miles 54 to 59) during July, August, and September 1992. Study animals were relocated by radio telemetry an average of 14.3 times each (range 5 to 23) over periods ranging from 3 to 69 days per individual. The average time between relocations was 1.9 days (range 0.6 to 32). Comparisons of pooled data for native versus alien individuals revealed significant differences ($P < 0.05$) between distances measured from relocation points to shore and depths of relocation points. No significant differences were detected between distances traveled or habitats frequented by the two groups. A typical habitat was one near shore in shallow water with a rocky and/or gravelly substrate and some type of underwater structure or cover (e.g. tree trunks, tops of fallen trees, entrances to bank burrows of muskrats or beavers, and patches of aquatic plants). Funding for this project was provided by The Center for Field Biology, Austin Peay State University.

191

ROTHERFORD, NICOLLE R. Coastal Carolina College--Effects of nest relocation and beach microenvironment on loggerhead turtle nesting success.

Since loggerhead turtles (*Caretta caretta*) are an endangered species, there is public and private interest in facilitating the natural reproduction of loggerhead turtles. The effects of nest relocation and the beach microenvironment on nest choice, nest viability, and hatching success were studied at Yawkey Wildlife Center in Georgetown County, SC. It was found that relocation did not significantly inhibit hatching success. In addition, of the eggs in an average single nest, 71% hatched successfully, 27% died early in development, 1.7% died late in development, and 0.3% died during hatching. The environmental factors causing false crawls are complex, however, the number of false crawls was greatest in washover areas of the beach.

192

WEST, TRAYCIE, H.G. MARSHALL and P.A. TESTER. Old Dominion Univ. and NOAA, Southeast Fisheries Sciences Center, Beaufort, N.C.--Phytoplankton assemblages associated with a bloom of *Ptychodiscus brevis* (*Gymnodinium breve*) off the North Carolina coast.

In late October 1987, a red tide bloom was reported off the coast of North Carolina caused by *Ptychodiscus brevis*. The bloom persisted until late February 1988, resulting in economic losses of over \$24 million. The affect of these blooms to natural phytoplankton

populations was investigated. Within the barrier islands, assemblages during peak bloom periods were dominated by small (<20 μ) diatoms. When no *P. brevis* cells were present, larger diatoms (>20 μ) were dominant. In off shore waters lacking *P. brevis*, assemblages consisted of mostly larger diatoms and cyanobacteria. As *P. brevis* numbers increased, diatoms still persisted, by the cyanobacteria declined in abundance. The nanoplankton components were numerous at all stations, and did not appear to be effected by the bloom concentrations. Silicoflagellates and coccolithophores were recorded at low, but consistent levels throughout the study.

- 193 SEABORN, DAVID, KAREN SOUCEK and H.G. MARSHALL. Old Dominion University--Phytoplankton composition and concentrations in the Pagan River, Virginia: Preliminary results.

The Pagan River is a tidal stream and tributary to the James River and has been exposed to excessive amounts of nutrients over the past several decades, with sources from agriculture, sewage and a meat packing plant. Common levels for total nitrogen and total phosphorous were noted in excess of 2.0 mg/l and 0.5-0.9 mg/l respectively. Initial collections began in fall 1992, with diatoms (e.g. *Leptocylindrus minimus*) and cyanobacteria (e.g. *Microcystis incerta*) dominating the samples. Total cell counts reached fall maxima of 2×10^8 cells/l. Separate examination of autotrophic picoplankters with epifluorescence microscopy indicated fall counts of 10^7 cells/l. With both categories, cell abundance increased upstream.

- 194 DILLARD, GARY E. and NANCY S. DAWSON. Western Kentucky University--Stephanosphaera pluvialis Cohn (Chlorophyceae:Volvocales) from Kentucky.

Stephanosphaera pluvialis, an infrequently encountered planktonic alga, was described from water-containing shallow depressions in granite outcrops in Germany by F. Cohn in 1852. It has subsequently been reported from granite or sandstone outcrops in Czechoslovakia, Russia, several additional locales in Germany and California, Massachusetts, Michigan, North Carolina and Virginia. The unique morphology of the organism and its reproductive adaptation to its habitat will be discussed.

195

- BEARD, CHARLES E. and THOMAS M. MCINNIS, JR. Clemson University--Amino acids and sugar alcohols as osmotica in the salt tolerant fungus, *Lagenidium callinectes* Couch

The mechanism by which the marine Oomycete *Lagenidium callinectes* Couch tolerates high salinity is being investigated. Many fungi use amino acids or sugar alcohols as osmotica to balance a low water potential. Quantification and identification of some of these substances was undertaken to determine if any are osmotically active in this species. Cultures were grown to late log phase (20 days) in different salinities (0‰ to 50‰) and soluble components were extracted after drying. Quantification of amino acids was carried out using reversed phase HPLC of PTC derivatives. The major amino acids quantified were hydroxyproline, proline, alanine, threonine, valine, tyrosine. In all cases the highest ratio of these amino acids occurred at 20‰ salinity which also corresponds with the highest dry weights. Lower and higher salinities were correlated to lower amounts of these amino acids. Sugar alcohols were analyzed using Ca^{++} ligand exchange HPLC. No significant variations with salinity were seen for sorbitol, glycerol, erythritol, mannitol, ribitol or arabitol. These data indicate that none of the compounds tested were used by the fungus as osmotica under these growth conditions. Other mechanisms of salinity tolerance being investigated include: the use of inorganic ions and other organic molecules as osmotica.

196

- Chaffin, D.W.,¹ D.K. Evans,¹ R. Deal,² and M.A. Harrison.¹ Marshall University¹ and Shawnee State University²--Internal secretory anatomy in leaves and involucre bracts of *Clibadium asperum* (Aubl.) DC. (Asteraceae). Secretory reservoirs lined with a uniseriate epithelium are present in close association with the vasculature in stems, leaves and involucre bracts of *Clibadium asperum*. Upper leaves and infructescences of this shrub are utilized as a source of piscicide by native people of Ecuador. The cyclic polyacetylene ichthyotoxerol, and its acetate, are the agents responsible for fish poisoning activity of the plant. The presence of polyacetylenes, produced and stored in reservoirs, is suggested by fluorescent action and methods of colometric detection on nitrocellulose prints. In general, reservoirs of varying length are located abaxially in relation to lower veins and variable to higher vein orders. Involucre bracts possess reservoirs of larger diameter as compared to those of leaves. Certain developmental aspects, as well as possible function of leaf and bract reservoirs, will also be presented.

197

MUSSELMAN, LYTTON J.¹ and DAVID A.² KNEPPER. Old Dominion University, Department of Biological Sciences¹ and U.S. Army Corps of Engineers, Norfolk District² -- Apogamy in Isoetes.

Apogamy is well studied in ferns but little is known about apogamous behavior in the genus *Isoetes* although the literature suggests that apogamy might be operative in some species and species groups. We report the development of sporophytes from the megaspores of an undescribed species of *Isoetes* from North Carolina. Megaspores were removed from sporangia under aseptic conditions and placed on glass fiber filter paper in an incubator at 20 C for 14 days. Gametangial development appeared normal. Young sporophytes developed from the layer of cells beneath the spore coat and resembled sexually produced sporplings in every way. In addition to the North Carolina plant, several other species, including hybrids, were studied for apogamy.

198

KNEPPER, DAVID A.¹ and LYTTON J. MUSSELMAN². U.S. Army Corps of Engineers, Norfolk District¹ and Old Dominion University, Department of Biological Sciences² -- The quillworts (*Isoetes*) of Virginia.

Based on field work, herbarium research, SEM studies of megaspores and microspores, chromosome counts and spore sizes we recognize five sexual species and two hybrids of *Isoetes* in Virginia: *I. engelmannii* (widespread in freshwater), *I. riparia* (tidal and non-tidal rivers of the coastal plain), *I. caroliniana* (Appalachian endemic), *I. melanopoda* (= *I. virginica*, triassic sandstones), *I. macrospora* (= *I. lacustris*, a single station in the Shenandoah Mountains); and the hybrid *I. X brittonii* (= *I. engelmannii* x *I. riparia*, frequent where both parents occur). For a previously undescribed hybrid between *I. macrospora* and *I. caroliniana* we propose the name *I. X harvillii*. The status of *I. piedmontana* will be discussed. Determination of species is almost totally dependent upon spore characters, especially when working with herbarium specimens but some species are readily determined in the field using habitat, leaf shape, sporophyll position, and color. The *Isoetes* collections of M. L. Fernald from southeastern Virginia in the 1930's and 40's are of historical value in documenting the decline of *I. riparia* and the frequency of hybrids.

199

MICKLE, JAMES E. North Carolina State University--Fossil fertile marattialean fern foliage from the Wolfcampian of Texas. Fertile frond segments on a single matrix surface from the Lower Permian (Wolfcampian age) of Jack

Co. (north-central) Texas are described. The specimen was obtained by loan from the Texas Memorial Museum, Austin. Fossils are preserved as coalified compressions and were viewed with light microscopy and SEM. The larger of the two fertile frond segments is 95 mm long. The central rachis is 4 mm wide and possesses ten alternately attached pinnae. The smaller segment is 52 mm long with a rachis 2 mm wide and four alternately attached pinnae. Pinna laminae of both specimens are incompletely preserved with positions of pinnae shown by numerous syngangia lateral to a central rachis 0.6 mm wide. Pinnae are up to 28 mm long and 7 mm wide. Syngangia consist of 5 radially-arranged, basally-fused sporangia about 1.5 mm long and are borne on the abaxial pinna surface. Sporangial dehiscence occurs through a longitudinal slit to the inside of the syngangium. No spores or cuticle were recovered. Sterile pinnatifid pinnae with venation similar to fertile segments are found on the same matrix face. Sterile segments are up to 32 mm long and 10 mm wide and have a rachis 1 mm wide. Venation is open dichotomous. Fertile specimens are similar to the marattialean fossil genera *Scolecopteris* Zenker and *Asterotheca* Presl. Sterile specimens are referable to *Pecopteris* Sternberg.

200

FREDERICK, LAFAYETTE. Howard University. An interesting Enteridium and some other myxomycetes from bark of Taxodium.

Bark samples removed from several medium-size trees of *Taxodium* sp., growing in a park across from Union Station in St. Louis, Mo., were placed in moist chamber culture and periodically examined for the development of myxomycete sporocarps. Among the forms that appeared over a six-week period were four small round, flattened grey-olivaceous aethalia. When first noticed they appeared to be round, lead gray droplets of slime that had accumulated on the surface of the wet bark. Later the bark samples that contained the droplets were removed from moist chamber culture and allowed to dry. The bodies persisted and an initial examination of the structures revealed them to be small (less than 1 mm) flattened, disc-like aethalia with a dark-brown, ring-like hypothallus. Light and scanning electron microscopy examinations have shown that the aethalia have a thin translucent peridium with a smooth outer surface and a minutely warted inner surface; globose, commonly clustered, warted spores that are 9 - 11 μm in diameter; and sparse, solid, occasionally branched filaments with a roughened surface, occasional nodelike expansions, and frayed ends. The filaments are considered to be pseudocapillitia. These characteristics along with the absence of dictydine granules suggest that this myxomycete is a species of *Enteridium* (formerly *Reticularia*). Aethalia of the species currently recognized in the genus are much larger than the specimens described here and have different color and pseudocapillitial characteristics. These specimens probably represent a new taxon. Other myxomycetes that appeared on the bark samples were *Clastoderma debaryanum*, two species of *Comatricha*, and *Licea operculata*.

- 201 SUMMERS, JEVENE M., DAVID S. HOCKEY and ROBERT B. JONAS. George Mason University--Analysis of thymidine incorporation in estimating bacterial production. Bacterioplankton are an integral part of the complex web of biological and biochemical processes which sustain life in aquatic ecosystems. One of the most commonly used methods for estimating rates of bacterial production is based on tritiated methyl-thymidine (TMT) incorporation into macromolecules. There is continuing uncertainty about the specificity with which TMT labels DNA. This work examined macromolecular TMT labeling by digestion with specific enzymes. Surface samples, collected from the lower Potomac River (Salinity 8ppt), were incubated with TMT for 0.25-0.5h and then rapidly frozen at -70°C to stop uptake. Thawed samples were sonicated to release macromolecules and treated with DNase, RNase or protease. Although there was some variation in individual sample results, on average, DNase solubilized nearly 60% of particle associated radioactivity. Neither RNase or protease removed significant radioactivity. Since efficiency of cell cleavage was about 50%, these results are consistent with the hypothesis that TMT labeled DNA and not RNA or protein.
- 203 MCKENNA, MARY A. and NATAMA N. SUMMERS. Howard University--Effects of simulated acid rain on growth and reproduction in alpine plant communities. In previous studies to examine the effects of acid rain on vegetative and reproductive processes in natural populations of alpine plants in the Snowy Mts of Wyoming, we found reduced pollen growth, seed set and vegetative growth in Aquilegia plants exposed to simulated acid rain, yet reproduction in Erythronium appeared to be more tolerant to low pH. In the present study we further investigated the effects of simulated acid rain on Aquilegia and Erythronium. We also explored the extent of variation in pollen response to low pH within 3 species of Pedicularis and in populations of Penstemon whippleanus at 3 elevations. Pollen growth in vitro was observed in medias ranging from pH 2.5 to 7.5, and field studies were performed to measure vegetative growth and reproduction in response to simulated acid rain. As in earlier studies, Aquilegia showed reduced growth and reproduction in plants exposed to simulated acid rain. In Erythronium however, these studies revealed reduced pollen tube growth below pH 4.5 despite relatively high germination at these pH levels. Erythronium flowers pollinated 24 hrs after spraying with acid rain simulat also yielded significantly fewer seeds than flowers sprayed with an ambient rain simulat. Both Penstemon and Pedicularis pollen showed reduced growth below pH 4.5; in Pedicularis a species-specific pattern of pollen response to pH was also observed.
- 204 HILL, SUZANNE M. Virginia Polytechnic Institute and state University--The heat tolerance response of the shale barren endemic Eriogonum allenii. Eriogonum allenii is a plant endemic to the shale barrens of southwestern Virginia. These barrens are characterized as having a southwest facing slope, sparse vegetation, a rocky soil surface, and elevated temperatures relative to the surrounding deciduous forest. It was expected that E. allenii is capable of adapting to high heat environments, therefore potential heat tolerance mechanisms were examined in the laboratory. Plants were maintained in two growth chambers set at (37°C day / 25°C night), and (25°C day / 18°C night) respectively. Since membrane stability and photosynthesis are essential for plants to survive, electrolyte leakage and total lipid concentrations at the cellular level, and temperature response curves of photosynthesis at the whole plant level, were determined for plants from each growth chamber. Results of the electrolyte leakage study did not reveal appreciable differences between plants from different growth chambers. Plants from each treatment experienced membrane leakage within 57-60°C. Results of the lipid study and temperature response curves will be presented.
- 204 ALDEN, RAYMOND W. III. Applied Marine Research Laboratory, Old Dominion University, Norfolk, VA--Long-term trends in the lower Chesapeake Bay: statistical approaches for water quality and biological monitoring assessments. Long-term water quality and biological monitoring programs have been established in the Virginian waters of the Chesapeake Bay. Over 7 years of data have been collected and analyzed in order to determine spatial and temporal ecological patterns. This talk provides an overview of the statistical approaches employed in the water quality and biological investigations which will be summarized in the following four presentations. The statistical protocols have been designed to: 1) characterize spatial and temporal patterns; 2) detect long-term trends; and 3) determine the power and robustness of the program in detecting ecologically significant trends and in meeting the needs of environmental managers. The spatio-temporal patterns were delineated by a series of multivariate techniques including a simultaneous spatial and temporal cluster analysis, multivariate analysis of variance, non-linear regression analysis, and discriminant analysis. The

long-term trends were evaluated by a series of non-parametric trend analyses. An empirically-based simulation technique termed the *Data Fitting Method* was developed to provide assessments of the power and robustness of the monitoring regime and the statistical protocols. In addition, an approach termed *Minimum Detectable Impact* analysis was employed to determine the relation between program duration and sensitivity. Examples will be provided to demonstrate the application and interpretation of the statistical approaches.

- 205 ALDEN, RAYMOND W. III, R. MICHAEL EWING, AND STEVEN W. SOKOLOWSKI. Applied Marine Research Laboratory, Old Dominion University, Norfolk, VA--Long-term trends in the lower Chesapeake Bay: water quality.

A long-term water quality monitoring program has been established at 28 stations in the Virginian waters of the Chesapeake Bay. A series of statistical protocols (described in previous presentation) have determined spatiotemporal patterns and trends in the 7-year data base. Spatial and temporal factors accounted for approximately equal portions of the "explained" variance in the water quality data set. Statistically determined site-groups displayed geographic continuity, with water quality differing between up-Bay and more seaward regions; and shallow segments differing from deeper ones. Distinct seasonal patterns were identified for most parameters. A number of long-term trends in water quality were observed: phosphorus-based nutrients decreased; many nitrogen-containing compounds also decreased, but total nitrogen increased in certain regions; total organic carbon increased; a shallow western embayment displayed trends indicative of increasing eutrophication; water temperatures tended to increase; and dissolved oxygen concentrations decreased near the mouth of the Bay. Reasons for and implications of these trends will be discussed. Simulation assessments indicated that the trend analyses tended to be liberal for the data sets analyzed, but that the Type I error generally could be maintained below 0.05 by adopting a test criteria of $\alpha=0.001$. The power of the tests for most water quality parameters was good, with only a 10-20% change being required for detection.

- 206 DAUER, DANIEL M. Old Dominion University--Long-term trends in the lower Chesapeake Bay: Benthos.

Long-term monitoring of the macrobenthic communities of the lower Chesapeake Bay has been conducted quarterly since March 1985. A non-parametric trend analysis procedure was applied to five parameters characterizing macrobenthic community structure: community abundance, community biomass, species diversity, relative abundance of opportunistic species and relative abundance of equilibrium species. Analysis of the macrobenthic

communities of the lower Chesapeake Bay showed: (1) a total of 38 trends were detected, (2) all trends in biomass (5 trends), species diversity (6 trends) and abundance of individuals (17 trends) had positive slopes, (3) six trends were detected in opportunistic species biomass with negative slopes in tidal freshwater regions and positive slopes at hypoxic affected regions, and (4) four trends in equilibrium species biomass with three positive slopes in the tributaries and one negative slope in the mainstem of the Bay. The ecological significance of these trends is interpreted with respect to an expected pattern of decreasing eutrophication of the Bay.

- 207 BIRDSONG, R.S. and R.W. ALDEN III. Old Dominion University--Long term trends in the lower Chesapeake Bay: mesozooplankton.

Seven stations in the Virginia waters of the Chesapeake bay mainstem were monitored monthly for mesozooplankton from July 1985. These data through December 1991 were analyzed using a series of powerful and robust nonparametric trend tests. Trend analyses were performed on the following zooplankton community variables: biomass, diversity, total abundance, abundance of *Acartia tonsa*, all *Acartia*, all calanoid copepods, all cyclopoid copepods, *Callinectes sapidus* larvae, all fish eggs and larvae and the ratio of calanoid to cyclopoid copepods. The following seasonally limited trends across all stations were significant at the 0.01 level: increasing trends- total abundance in January and February; fish eggs and larvae in May; decreasing trends- zooplankton diversity and fish eggs and larvae in August; biomass in October and November; total abundance and *Acartia* abundance in November; and zooplankton diversity and *Acartia* abundance in December.

- 208 MARSHALL, H.G. and R.W. ALDEN. Old Dominion University--Long term trends in the lower Chesapeake Bay: Phytoplankton.

Over the 1985-1991 time period, established statistical trend analyses were applied to a 6 year data set from 7 stations in the Chesapeake Bay. The results indicated modest, but significant seasonal trends of reduced phytoplankton concentrations occurred and these were most developed from March through June. Overall positive trends were also indicated for dinoflagellate abundance and increased cell biomass in July, November and December, which were associated with a similar positive growth pattern for diatoms and dinoflagellates. Decreasing trends for diatoms coincided with the March-June decline of total cell abundance. In comparison to other trends noted during this period, the overall reduction in phytoplankton abundance was associated with a reduced

nutrient concentrations and the possibility for increased predation pressure. In addition, there were trends of increased temperatures and total suspended solids (increased turbidity) during the summer months, which would have influenced different algal responses and a possible shift in phytoplankton composition. These phytoplankton populations are able to respond to both major and the more subtle changes in water quality that may favor certain species (or categories) over others. These changes may initiate short (or long) term trends that may include population shifts of dominance. Supported by the Virginia State Water Control Board.

- 209 MADDEN, JEFFREY, KAREN SOUCEK and H.G. MARSHALL. Old Dominion University--The comparison of seasonal phytoplankton populations in the lower Chesapeake Bay: 1990-1992.

Interannual and seasonal differences in abundance and development of various phytoplankton components are identified for the Chesapeake Bay. An earlier spring bloom development and higher seasonal concentrations occurred in 1990 compared to 1991 for spring, summer and fall. Diatoms predominated throughout the year, and specially along the western margin of the bay. The diatoms with dinoflagellates dominated the eastern bay region, composed of neritic and estuarine species. The central bay region had multiple seasonal dominants including diatoms, dinoflagellates, cryptomonads, cyanobacteria and chlorophytes. Greatest abundance (10^7 cells/liter) was at river entrance sites, and in the river plumes. Reduced cell concentrations and biovolume occurred moving north to south in the lower bay, with decreasing cell concentrations from west to east. The more productive and dynamic bay regions were those associated within the western region of the bay. These are also the sites most susceptible to algal bloom development. Dominant species included the diatoms Asterionella glacialis, Skeletonema costatum, Cyclotella caspia, Leptocylindrus danicus, L. minimus, and the dinoflagellates Heterocapsa triquetra and Katodinium rotundatum. Supported by the Virginia State Water Control Board.

- 210 WEINSTEIN, MOLLIE, JEFFREY MADDEN and H.G. MARSHALL. Old Dominion University--Seasonal autotrophic picoplankton concentrations in the lower Chesapeake Bay: 1990-1991. Autotrophic picoplankton concentrations were recorded at

seven stations in the lower Chesapeake Bay during 1990-1991, using epifluorescence microscopy to identify these cells. During each year, a single seasonal maximum occurred from June through August, both above and below the pycnocline, although higher concentrations were generally recorded above the pycnocline. A marked difference in abundance occurred in the summer maxima between the two years, with higher levels in 1990 ($1.1-4.5 \times 10^9$ cells/l) compared to 1991 ($0.4-3.0 \times 10^9$ cells/l) above the pycnocline. Below the pycnocline, concentrations in 1990 were also greater ($0.6-8.0 \times 10^9$ cells/l) than in 1991 ($0.3-1.5 \times 10^9$ cells/l). Higher cell concentrations were noted in the north central Bay and lowest along the eastern Bay region. Supported by the Virginia State Water Control Board.

- 211 NESIUS, KNEELAND K. and HAROLD G. MARSHALL. Old Dominion University--Seasonal Productivity Study in three Estuarine River Systems of the Lower Chesapeake Bay.

Primary productivity rates varied seasonally, consisting of three major periods of production (early spring, mid-summer and fall). Average annual production was greatest on the James ($408.6 \text{ gC m}^{-2}\text{y}^{-1}$) followed by the York ($213.8 \text{ gC m}^{-2}\text{y}^{-1}$) and Rappahannock ($199.4 \text{ gC m}^{-2}\text{y}^{-1}$) rivers. Seasonal distinct productivity patterns were more prominent at the tidal fresh and oligohaline stations of each tributary. Annual productivity rates were highest at the mouth (polyhaline) of each tributary. Specific phytoplankton assemblages were associated with the seasonal ^{14}C production pulses.

- 212 WENDKER, S.M. and MARSHALL, H.G. Old Dominion University--Primary production of microalgal communities on mudflats in the lower Chesapeake Bay: Preliminary results.

Mudflats are found throughout the Chesapeake Bay, most extensively within inlets and at the mouths of the tributaries. This study included five sites within the lower Chesapeake Bay. These were located within the Lynnhaven Inlet in the southernmost part of the Bay, close to the mouths of the York- and Rappahannock-River on the western shore, and near the towns of Cape Charles and Onancock on the Eastern Shore. Salinity ranged from 15-26 ppt. Sampling was carried out monthly at low tide between April 1992 and October 1992. The

radiocarbon method was used to measure primary production. Primary production was highest in August with mean values from 17-90 mgC m²hr⁻¹ depending on the site. In April primary production ranged between 1 and 19 mgC m²hr⁻¹, in October values from 3-50 mgC m²hr⁻¹ were found. Cell counts were also highest in August with 1.3-7.8*10⁶ cells/cm². The sites at the Lynnhaven Inlet and at Cape Charles contained the most productive mudflats. The microalgal communities were dominated by diatoms, with species of the genera Gyrosigma, Navicula, and Amphiprora most common. Cyanophytes were also abundant, having higher concentrations during the summer months.

- 213 MARSHALL, H.G. and KAREN SOUCEK. Old Dominion University--Red tide blooms in the lower Chesapeake Bay: September 1992. During the 1992 summer, the lower Chesapeake Bay experienced several algal blooms that included an extensive September development of Cochlodinium heterolobatum. Initially, Ceratium furca produced a July bloom along the western Bay region. This diminished in early August. C. heterolobatum was a localized bloom in the York River in early August, spreading within the river and with the river plume into the Chesapeake Bay. By early September, C. heterolobatum had spread throughout the central and western lower Chesapeake Bay, with concentrations at tidal fronts at 3.2 x 10⁶ cells/liter. At other isolated regions in the lower bay, the dinoflagellates Gymnodinium splendens, Noctiluca scintillans, Gyrodinium aureolum, and the euglenoid Euglena sp. also reached bloom concentrations. The Chesapeake plume also contained high concentrations of C. heterolobatum and carried these cells southward along the Virginia and North Carolina coast. No incidents of major fish kills accompanied these bloom, although short periods of hypoxic waters were noted within several inlets.

- 214 PARK, GYUNG-SOO and H.G. MARSHALL. Old Dominion University--Microzooplankton representation within the lower Chesapeake Bay and in three tidal rivers: Preliminary results. Summer and fall (1992) microzooplankton (<150 microns) collections were been made in the lower Chesapeake Bay and the tidal waters of the James, York and Elizabeth Rivers. The most common categories were ciliates (with and

without a lorica), nauplii rotifers, cladocerans, polychete larvae and a miscellaneous grouping. The summer collections in the rivers were dominated by ciliates and rotifers, with fall collections containing an assortment of ciliates, rotifers, nauplii and cladocerans. Non-loricated ciliates reached counts of 19,472/liter in the Elizabeth River. In contrast, the lower Chesapeake Bay was dominated by ciliates and nauplii throughout the summer and fall, with a major increase in polychete larvae in fall. Supported by the Virginia State Water Control Board.

- 215 MILLS, EDWARD and JAMES W. HALL. Wingate College--An acid rain model for the biology laboratory. A working model for observing and learning about the formation and effects of acid rain in the general biology laboratory can be easily constructed and safely operated. When bituminous coal is burned at high temperatures, heavy smoke is released containing both SO₂ and SO₃. When bubbled through water (and positive air flow design to prevent accidents) sulfuric and sulfurous acids are formed. Students calculate pH by NaOH titration or pH paper. Experimental applications are numerous. We have explored plant growth (root and shoot length of radish plants) with this acid solution added to potting soil, and have examined germination of seeds exposed to the heavy gases collected from the burning coal with a large syringe.
- 216 NUSSBAUM, FRANCIS E. Kent State University: Tuscarawas Campus--Another look at undergraduate writing assignments. Expanding upon his article pertaining to introductory library writing assignments for undergraduate biology students which appeared in the May '91 American Biology Teacher, the author offers additional insights on the merits of having students critique professional journal articles. The assignment's success depends on the students' selection of articles that are appropriate to their academic background. Citations are efficiently given in Vancouver style. Grading is weighted to favor quality of original input in the student's response to an article's main premise. In addition to practical improvements in student scholarship such as habitual use of library resources, gaining familiarity with professional journals, indices, and databases, improving organization in written communication and noting the use of the scientific method in research, students also experience the

gamut of Bloom's hierarchy of learning and thinking from exposure and basic comprehension of knowledge through subsequent analysis, synthesis and evaluation.

217

LYKINS, KATHRYN V. Shorter College--
The "musical" method of teaching classification.

It is often difficult for teachers to engage student interest in the topic of biological classification; yet, it is an important topic. Those of us who teach biology want our students to understand that classification is a means of grouping organisms by shared characteristics, that classification involves a hierarchical structuring of the living world, and that classification serves distinct purposes. An activity that has always worked well for me is to introduce students to biological classification by having them classify music. I believe other teachers will find that a discussion of musical classification will have all students on task and will help them see the need for biological classification and even appreciate why phyla need to be further divided into classes, classes into orders, and so on. Methods for initiating and guiding the activity will be discussed, as will means of linking this activity to other learning experiences, such as use of a dichotomous key.

218

WEISS, EDWARD and CONES, HAROLD.
Christoohr Newoort University--Taking Biology Beyond: A Multidisciplinary Field Exoerience.

An extended biology camping trip encompassing 2400 miles between Virginia and Maine stimulates students to view and interpret natural and human-created environments with an emphasis on the conflict between managed and unmanaged. Natural history instruction is supplemented by Humanities faculty who encourage students to express their feelings through such creative outlets as writing and art. Structured and informal activities force students to evaluate their environmental values and their interactive role in the world in which they live. An instructor-written interdisciplinary manual emphasizes the history, cultural diversity, and geological and biological diversity of the varied geograohic regions visited. The presentation will discuss the value to students and faculty of this experiential learning activity. Guidance in creative methodology and in the oractical asoects of scheduling, financing, logistics, and execution will be discussed. Samole manual text and planning handouts will be provided.

219

BAKER, S.C., M.E.B. CARTER, H.F. SHARP, JR. and T.R. WADE. Oxford College, Emory University--Improving ecology in education: a teacher enhancement workshop.

In 1992 the Biology Department at Oxford College of Emory University initiated a

pilot program for K-12 educators, the Oxford Institute for Environmental Education, with two primary objectives: to provide knowledge of the fundamentals of ecology and to apply these concepts to field experience in local ecosystems. The two week workshop was held at the Oxhouse Field Station, near campus, with participants from surrounding counties, representing public and private schools. Following an introduction to ecosystems, participants investigated clean and polluted streams, lakes, wetlands and forests, used basic sampling techniques, identified organisms, analyzed results of their investigations, and developed a personal collection of representative organisms. Finally, the teachers sketched their own school yards and developed plans for using their knowledge in developing field experiences for their students. At a follow-up workshop in September, participants described their implementation of the workshop into their curriculum. We are convinced that improving the ecological knowledge and experience of precollege teachers will result in improving the education of a generation of students and citizens.

220

SEMONES, SHAWN W., DAVID L. ERICKSON, DONALD R. YOUNG. Virginia Commonwealth University--Salinity, water relations and zonation of three common barrier island shrubs.

A combined field and greenhouse study examined the effect of salinity upon the apparent zonation of Myrica cerifera, Iva frutescens, and Baccharis halimifolia, three shrubs that are common in South-eastern coastal environments. Seasonal variations in soil and groundwater salinities, water relations and precipitation data were compared among shrubs growing on Hog Island within the Virginia barrier system. Soil chloride concentrations were lowest for M. cerifera (0-500 ppm), intermediate for B. halimifolia (0-4800 ppm), and highest for I. frutescens (101- 5000 ppm). Groundwater salinities followed the same pattern: M. cerifera (1-3 ppt), the B. halimifolia (6-11 ppt), and I. frutescens (2-18 ppt). Although stomatal conductances were similar for the three species, seasonal xylem pressure potentials reflected differences in salinities among the three shrubs. Pre-dawn xylem pressure potentials were highest for M. cerifera (-0.8 MPa), followed by B. halimifolia (-0.9 MPa), and I. frutescens (-1.3 MPa). Salinity, especially as influenced by extreme flood tides, and precipitation explained the water relations and zonation of these common coastal shrubs.

- 221 ERICKSON, DAVID L. and DONALD R. YOUNG. Virginia Commonwealth University--Oceanic transport and barrier island colonization by *Strophostyles umbelata*.

The potential for ocean transport of viable seeds was examined for *Strophostyles umbelata*, an herbaceous, trailing vine common in strand communities of the Virginia barrier island system. Laboratory experiments showed that seeds of *S. umbelata*, which were not scarified, withstood exposure to high salinity (30 ppt) for 14 days without a decrease in viability. Non-scarified seeds did not imbibe during exposure. However, seeds which were scarified prior to exposure to 30 ppt salinity did imbibe, which contributed to a decrease in viability. Additional experiments related the decrease in viability for scarified seeds to salinity concentration and length of exposure. Scarified seed germination remained near 100% up to 20 ppt salinity, above which no germination occurred. In contrast, glasshouse experiments revealed a low tolerance to salinity for seedlings (< 10 ppt). These data indicate island colonization via oceanic transport is possible for *S. umbelata*, provided seeds are not scarified prior to exposure to salt water and that salinity levels are quickly reduced after germination.

- 222 YOUNG, DONALD R. Virginia Commonwealth University--Spatial and temporal growth dynamics of *Myrica* shrub thickets on Virginia barrier islands. *Myrica cerifera* is the dominant woody species on many of the Southeastern U.S.A. barrier islands. On five of the fourteen islands within the Virginia barrier system, *Myrica* shrub thickets cover 15% of the area above the fringe marshes. In particular, 22% of Hog Island (181 ha) is covered by *Myrica*. However, shrub growth has increased dramatically over the past 30 years. Thicket growth characteristics are related to exposure to the ocean and thicket age. The highest annual production was measured on the accreting, ocean side of the island where thickets are developing (86 g branch⁻¹). Thickets in the island interior were intermediate in production (63 g branch⁻¹), followed by the oldest thickets on the bay side of the island (46 g branch⁻¹). Recruitment of new stems followed the same pattern. A high net photosynthetic rate (37 $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), photosynthetic bark and fruit, an evergreen leaf habit and nitrogen fixation through a symbiotic association with the bacterium, *Frankia*, enable rapid expansion of thickets. However, expansion and production may be controlled by

salinity intolerance, thicket aging, and competition with other woody species, as well as changes in patterns of island erosion and accretion.

- 223 CONN THOMAS, CHRISTINE E. AND FRANK P. DAY. Old Dominion University--Environmental influences on belowground decomposition rates along a barrier island chronosequence of ridge and swale formations. The interaction between landform age, topographic position and environmental regime was used to study environmental controls on belowground decomposition rates. A standard litter type was employed as the decomposition substrate to reduce variation from litter quality differences. Mean water table position dropped from younger to older sites and was higher in swales (4.8 cm aboveground to 14.7 cm belowground) than in ridges (91.2 cm to 116.5 cm belowground). Mean soil redox levels decreased with depth, exhibited no differences between ridges (423 to 573 mV) and were lower in swales (-35 to 239 mV). Older swales had higher soil redox levels. Mean soil pH was similar in all sites, but declined with depth. Mean soil temperatures were higher in ridges (16.9 to 23.7 C) than in swales (13.4 to 17.1 C). Mean soil water salinity was negligible in ridges (<1 ppt) and slightly higher in swales (1-6.4 ppt). Root litter on ridges had less percent mass remaining (40.8-57.5%) than swales (74.2-86.3%). Losses were greater in older sites. Decomposition increased with increased depth in ridges and decreased in swales. Multiple regression analysis demonstrated hydrology and soil redox were strongly intercorrelated and explained approximately 65% of the variation in decomposition rates.

- 224 STEVENSON, MARK AND FRANK P. DAY. Old Dominion University--Fine root production along a chronosequence of barrier island communities. Fine root production was quantified by an ingrowth core method along a chronosequence of dune communities on Hog Island, a Virginia Coast Reserve LTER site. The dune communities are dominated by *Ammophila breviligulata*, *Spartina patens*, and *Aristida tuberculosa*. Production estimates for fine roots ($\leq 2\text{mm}$) were estimated using biomass ingrowth into root-free soil volumes for one growing season. Fine root production was greater in N-fertilized plots than nonfertilized plots. The younger dune community (R24) had higher production rates in nonfertilized and N-fertilized plots than the older dune communities (R36 and R120). These biomass

production patterns may be attributed to the moisture levels in the dunes as well as microenvironmental factors.

- 225 LAKSHMI, BHARATHA and FRANK P. DAY. Old Dominion University--
Soil nitrogen levels and mineralization along a community chronosequence on a coastal barrier island.

Soil nitrogen (ammonium and nitrate-N), N-mineralization rates and the influence of urea fertilization were determined over one year along a community chronosequence on Hog Island, part of the Virginia Coast Reserve LTER Site. Nitrogen concentrations increased from younger to older dunes (0.015-0.038 g/m²) and swales (0.016-0.052 g/m²) on the island. Most nitrogen was in the form of ammonium. Older swales had higher concentrations than the adjacent dunes. Fertilization of the dunes resulted in a 10-13 fold increase in nitrogen with the highest accumulation in the oldest dune (0.501 g/m²). Net annual N-mineralization was highest (0.053 mg kg⁻¹ day⁻¹) in the youngest dune and fertilization increased this rate to 0.356 mg kg⁻¹ day⁻¹. Fertilization had a marked effect in the younger dune (16-fold increase) but a minimal effect in the oldest dune. Swales showed either equal or higher mineralization rates compared with the associated dunes, except in the oldest dune-swale association. The low rates in the oldest fertilized dune and its associated swale was due to lowered concentrations of ammonium-N after soil incubations in spring and fall. Site, age, hydrologic regime, season and vegetation seem to determine mineralization rates on Hog Island.

- 226 WEBER, EVERETT P. and FRANK P. DAY. Old Dominion University.--
The effect of nitrogen fertilization on the phenology of roots in a barrier island dune ecosystem: a minirhizotron analysis.

Little work has been done on the phenology of root growth and senescence largely due to methodological difficulties. The application of minirhizotron technology has enabled the tracking of individual roots through an entire growing season. As a result, direct measures of turnover, root growth, and senescence are possible. Small plots on a 36 year old dune on Hog Island, a barrier island in the Virginia Coast Reserve Long Term Ecological Research Site, were fertilized with nitrogen. Minirhizotron tubes were installed in each fertilized and control plot. Each tube was sampled monthly for nine months, March through November. Preliminary results showed an increase in root density from March to April with the fertilized plots showing a higher root

density than the unfertilized plots for both March (256% greater) and April (140% greater). Only 4% of the roots sampled in April were present in the March sampling. The minirhizotron method allows a high resolution perspective of the belowground environment and direct monitoring of phenomena which previously were obtainable only through indirect measures.

- 227 IMM, DONALD W. and KENNETH W. MCLEOD. Savannah River Ecology Laboratory, University of Georgia--Patterns of plant diversity and community structure in an upper coastal plain forest.

Community structure and diversity are dependent upon land use as well as edaphic patterning. Uneven-aged stands tend to have higher spatial and temporal diversities. On the Savannah River Site (Aiken, SC), we sampled a timber compartment (532 ha) using a grid of 137 equidistant points. This area is currently managed for a variety of uses and provides a mosaic of vegetation types (planted pine, pine-hardwood, hardwood slope, riparian). Ground, shrub/sapling, and canopy vegetation were sampled using four sets of nested plots (4-1m², 4-16m², 400m²) per point. Topographic, soil, and light conditions were also sampled for each plot. Our results indicate that plot diversity is strongly associated with soil moisture (+) and light levels (+). Based on covariate analysis, diversities for planted pine and hardwood plots under edaphically similar conditions do not differ significantly, but have lower species turnover rates and gamma diversity levels. In planted pine stands, seedling and herb diversities are strongly linked to light levels(+), stand age (+), and distance from nearby stands (-). Based on canonical correspondence analysis (CCA), forest composition is strongly related to edaphic features, such as soil moisture and texture, light, topography, and fertility.

- 228 MCLEOD, KENNETH W. Savannah River Ecology Laboratory, University of Georgia--Bottomland forest restoration.

A current trend, to mitigate for the loss of wetlands, is to restore impacted or degraded wetlands. Restoration of herbaceous wetland communities has been attempted for numerous years, with varying degrees of success. These communities can "migrate" in response to inundation due their clonal growth form. Species of the bottomland forest face a different challenge, both temporally and spatially. For the successful species in this restoration must tolerate variable inundation, along with other climatic

variations and biotic interactions. Thus, species selection will be critical to ensure successful restoration. Over the past 3 years, numerous species trials have been conducted at the SRS to determine the most appropriate mid to late successional species for reintroduction into bottomland sites, which were destroyed by chronic thermal effluent. These experiments have indicated the habitat is stratified by potential inundation depth and soil stability. Since inundation poses the greatest threat to survival, species with the greatest flood tolerance have shown the maximum ability to survive. Beaver herbivory of plantings in standing water can be substantial but partially controlled by use of tree shelters. In drier habitats, several oak species can be used, but are at greater risk in wetter years. Successful restoration of the bottomland habitat will not succeed by planting of single species, but will require differential selection of species depending on potential inundation depth and soil stability.

surface mining for coal has converted many mountain slopes in Appalachia to vertical "high walls" and fairly flat "benches." Wetland hydrology was established in many depressions in benches, leading to colonization by hydrophytic vegetation, and finally hydric soils. Many of the resultant "accidental" wetlands, particularly those with good water quality, have provided habitat for many species of wetland plants and animals. But following SMCRA, surface mining practices had the effect of eliminating standing water over most reclamation sites. The purpose of this study was to characterize accidental wetland ecology in order to provide design criteria so that wetlands can be included as a component of several compatible post-mining land uses. Accidental wetlands (25) with good water quality were studied at four sites in Wise County, Virginia. Parameters included hydrology, soil chemistry, water chemistry, microbial composition, and vegetation and wildlife diversity and abundance. Hydrophytic plant species numbered approximately 80, and use of wetlands by herpetofauna, avifauna, and small mammals was documented. Wetlands are currently being constructed to validate design specifications.

- 229 HUPP, CLIFF R.,¹ THOMAS M. YANOSKY,¹ and COURTNEY T. HACKNEY.² U.S. Geological Survey¹ and University of North Carolina at Wilmington²--Estuarine saltwater intrusion estimated from chloride in growth rings of bald cypress, *Taxodium distichum* (L.) Rich., in coastal wetlands.

The prospect of a global rise in sea level has focused attention on potentially large losses of coastal forested wetlands. A sea-level rise of 1-2.3m by 2100, for example, would increase salinities and hydroperiods of thousands of square kilometres of forested coastal wetlands, particularly in southeastern United States. We used proton induced x-ray emission (PIXE) spectroscopy to study element concentrations in individual growth rings of bald cypress (*Taxodium distichum* (L.) Rich.) growing along a salinity gradient in the Cape Fear River estuary, North Carolina. Chloride concentrations in rings nearest the cambium (as high as 12,000 mg/g) coincide with salinity in swamp soils. Additionally, chloride concentrations within the heartwood rings provide a means to estimate the timing of saltwater intrusion. Temporal analyses of cypress growth rings at 5 sites strongly suggest that saltwater intrusion is a relatively recent occurrence, moving up the estuary, and may be accelerating. The absolute and relative concentrations of chloride and possibly other elements in trees will aid in early assessments of forests subjected to rapid rises in sea level, and thus in predictions of forested wetland losses.

- 131 SHAFFER, GARY P.,¹ DANIEL W. LLEWELLYN,¹ NANCY JO CRAIG,² LISA A. CREASMAN,² DAVID PASHLEY,² and MARK SWAN.² Southeastern Louisiana University¹ and The Nature Conservancy, LA²--Restoration of the Mississippi River Alluvial Floodplain as a network of functional ecosystems.

This study was undertaken to determine (1) the present and current extent of forested wetlands in the lower Mississippi River Alluvial Plain (MSRAP), (2) detailed land conversion statistics for one watershed (Tensas, LA), and (3) build a prototype modeling routine that would serve as a semi-objective means of developing a plan to restore the MSRAP as a network of functional ecosystems. The approximately 8,620,258 ha (21,119,633 acres) of presettlement forested wetlands have been reduced to about 1,872,000 ha, or 22% of the original forested floodplain. The vast majority (95.7%) of these floodplain forests occur in Louisiana, Arkansas, and Mississippi. For the Tensas basin in northeast Louisiana, between 1979 and 1987, about 73,000 ha of forested wetlands were converted to other uses, a rate of clearing equivalent to that of the previous two decades. From the mid-80s to 1990, the trend was reversed with approximately 30,000 ha of small isolated patches taken out of agricultural production. A Geographic Information System was built using the following logic to prioritize existing wetland forest patches and potential forested corridors: (1) to maximize forest interior and minimize forest edge, top priority for reforestation was given to islands of cleared forest within wetland forest, (2) to optimize the services that forested wetlands provide, corridors were placed along streams and marginal agriculture land, (3) priority was given to perennial streams over intermittent streams, (4) priority was given to streams that were not in close proximity with roads (within 50 m), or where a bridge crossing a stream was large enough to allow for passage of biota, or where high potential existed for a forested wetland ecotourism project, (5) streams meeting the above criteria were ranked according to the size of the aggregate area of wetland forest created, with priority given to aggregates in close proximity to other aggregates or where a connection between wetland forest and upland forest could be established. This example demonstrates that semi-objective restoration plans are attainable through computer modeling.

- 230 ATKINSON, ROBERT B., DAVID JONES, and JOHN CAIRNS, JR. Virginia Polytechnic Institute and State University--Ecology of accidental wetlands and implications for wetland creation on surface-mined lands. Prior to enactment of the Surface Mining Control and Reclamation Act of 1977 (SMCRA),

232

SCHMALZER, PAUL A. The Bionetics Corporation, NASA, Biomedical Operations and Research Office, John F. Kennedy Space Center--Composition and structure of long unburned oak-saw palmetto scrub.

Oak-saw palmetto scrub is a shrub community that historically burned frequently enough to prevent scrub oaks from reaching tree size. With landscape fragmentation and fire suppression scrub shrubs can reach size and structure that make reintroduction of fire difficult. This is a problem for land managers because unburned scrub eventually becomes unsuitable as habitat for the threatened Florida scrub jay (*Aphelocoma coerulescens coerulescens*) and other species of conservation concern. In this study, I sampled scrub stands in two areas of Kennedy Space Center using permanent 15 m transects. Vegetation data were recorded from the >0.5 m and <0.5 m height layers. Stands had not burned for >25 years or in some areas fires that occurred did not kill standing scrub oaks as indicated by fire scars. I dated stands by ring counts of harvested oaks. Scrub oaks (*Quercus myrtifolia*, *Q. geminata*, *Q. chapmanii*), saw palmetto (*Serenoa repens*), and ericaceous shrubs (e.g., *Lyonia ferruginea*) were dominant throughout. Scrub hickory (*Carya floridana*) and wild olive (*Osmanthus americana*) were important in some sites. Few herbs occurred except where there had been mechanical disturbance. Vegetation was dense with cover > 0.5 m exceeding 100% and little or no open space except where disturbed. Shrub height exceeded 2 m in most transects and reached 5-6 m in some. Species composition of these stands remains that characteristic of oak-saw palmetto scrub. Structural characteristics and the resistance of large scrub oaks to fire suggest that these communities would develop into xeric hammocks eventually. Mechanical treatment and prescribed burning are being used to restore these sites.

233

BARRY, RONALD E. Frostburg State University--Synchronous parturition of two syntopic species of hyrax in the Matobo National Park, Zimbabwe.

The demographics of syntopic populations of the rock hyrax, *Procavia capensis*, and yellow-spotted hyrax, *Heterohyrax brucei*, were studied from October, 1991 - May, 1992 in the Matobo National Park, Zimbabwe. Populations of these two species were composed of less than 4% juveniles (less than 12 months old) prior to a synchronous March-April, 1992 birth event, after which juveniles comprised more than 27% of the populations. During this year of severe drought, the breeding season coincided with the historical peak period of annual rainfall and flush of vegetation. Synchronous parturition late in the rainy season is an adaptation for the production of young when food and water are most plentiful. Any disadvantage associated with interspecific competition for nursery sites may be offset by an increase in the efficiency of vigilance in heterospecific groups in the face of extreme predation pressure.

234

KLENZENDORF, SYBILLE, LUTHER BROWN, and BRIAN HOLMES. George Mason University and National Park Service--Bear-human interactions in Katmai National Park.

The goal of brown bear management in national parks is to preserve natural bear populations while providing a safe viewing environment. This requires an understanding of interactions between bears and humans. Such interactions were studied in Katmai National Park, Alaska, during the summer of 1992. A total of 137 encounters were observed. Of these, 41% involved a bear trespassing through a camp, 31% involved dominance interactions and less than 15% were due to surprise encounters, food, or other causes. A small group of subadult siblings were involved in the majority of cases, regardless of the cause. Encounters occurred every day of the 51-day study (mean=2.7, S=3.4) and were clumped in time (coefficient of dispersion=1.25), clustering about the peak of salmon availability, which was also the peak of visitation. The effectiveness of various responses to bears, ranging from clapping to firing rubber bullets was evaluated. The results suggest that bears maturing with constant human contact habituate to humans the most, and therefore interact with tourists the most. Increased visitation to the park means increased interactions with bears, especially during the salmon run.

235

HILBURN, ROBERT L. Coker College--Differences in pre-nesting activities of subadult and adult males of orchard orioles, *Icterus spurius*.

A time allocation study was conducted on a free ranging population of pre-nesting orchard orioles, *Icterus spurius*. The purpose of this research was to test predictions of subadult versus adult activity patterns. Observations were made by random focal sampling at the Carolina Sandhills National Wildlife Refuge near McBee, S.C. Differences in activities between subadult and adult males were predicted to be the criteria that attracts females to the subadults. Major differences in activities by subadults and adults were observed in the categories of singing and sitting. Subadult males were found to be singing 10% more of their total time budget and for longer durations. Equal percentages of both types of males actively sang. Adult males were found to be sitting 9% more of their total time budget. The results indicate that subadult males allocate more time than adult males to activities directed towards attracting mates. These differences in activity may account for the selection of subadult males by females.

236

BRITSON, CAROL A.¹ and ROBERT E. KISSELL, JR.² Memphis State University¹ and Montana State University²--Effects of food type on developmental characteristics of an ephemeral pond-breeding anuran, *Pseudacris triseriata feriarum*.

For some anurans, the benefit of laying eggs in relatively predator-free temporary ponds must be weighed not only against the likelihood that the pond is temporally stable enough for metamorphosis to occur but can nutritionally support tadpoles as well. In Tennessee, the breeding season of the upland chorus frog (*Pseudacris triseriata feriarum*) coincides with the pollination of shortleaf pine (*Pinus echinata*) and southern red oak (*Quercus falcata*), both of which produce relatively nutritious pollen. Pine and oak pollen, algae, and a control were fed *ad libitum* to chorus frog tadpoles from 14 March to 20 April 1992 to determine the effects of (1) a single food type and (2) sequential presentation of different foods on tadpole growth and development. Using a repeated measures design, tadpole body length, mass and developmental stage were measured at the start of the experiment and every nine days thereafter. Consistently, tadpoles fed pine pollen at any point in the experiment were significantly smaller after each nine-day period than tadpoles receiving other foods. Additionally, significantly more tadpoles fed pine or oak pollen at any time failed to metamorphose by the end of the experiment as compared to tadpoles from any other treatment. Thus, while pollens may be ingested as part of the diet of suspension-feeding tadpoles, exclusive feeding, either purposely or accidentally, on these foods is detrimental to normal development.

237

YEOMANS, S. REBECCA. University of Georgia/Savannah River Ecology Laboratory--Turtle orientation: field tests of a water-finding ability in adult aquatic turtles.

Aquatic turtles live in a variety of habitats with fluctuating water levels. Turtles are long-lived and individuals repeatedly face the problem of surviving forced emigrations that result from droughts. I tested the hypothesis that adult aquatic turtles have a water-finding ability that allows orientation to aquatic habitats. During the summer of 1992, 110 adult yellow-bellied pond sliders (*Trachemys scripta*) were trapped and moved beyond their home ranges to an unfamiliar terrestrial habitat which had a single source of standing water nearby. After an acclimation period, groups of 10 turtles were released approximately 300 meters from the water's edge and out of sight of the water. After one hour a mean direction for each turtle was calculated. The released turtles oriented significantly in the direction of the nearest water, suggesting that pond sliders have a special water-finding ability. Turtles with the ability to move to another aquatic habitat in a direct, efficient manner should have a selective advantage because reduced exposure to predators, reduced water stress, and reduced time away from feeding would lower the cost of overland travel.

238

APPELGET, JEANNE, and WAYNE VAN DEVENDER. Appalachian State University--Distribution of Small Mammal Communities in northwestern North Carolina and effectiveness of sampling procedures. Mammal habitats are highly fragmented in the northwestern North Carolina mountains with some fragments occurring naturally (mountain wetlands, spruce-fir forests, etc), while others are man-made (road construction, agricultural disturbance, development, etc). Several small mammals, including rare and threatened species, are reported to be restricted to these habitat islands. It is valuable to determine effectiveness of several sampling procedures. Four long term (28 days) trapping sessions were conducted in spruce-fir forest, mountain wetland, old apple orchard and deciduous forest. Six short term (4 - 7 days) trapping sessions were conducted in moist deciduous forest, boulder garden, tobacco field, deciduous forest near agriculture, white pine stand and old field. Factors analyzed included: duration of trapping, trap and bait type, and habitat and elevation. Bottles, pitfalls, and Sherman live traps were baited with either peanut butter and rolled oats or sunflower seeds. Data were analyzed with Schnabel's population estimate and Simpson's, Shannon's and Pielou's diversity estimates. Populations, techniques, and estimates were compared by ANOVA. During 154 trapping nights, 202 animals were captured 402 times. Species found include several *Sorex* sp., *Peromyscus* sp., *Sigmodon hispidus*, *Clethrionomys gapperi*, *Napeozeugus insignis*, *Neotoma floridana* and *Mustela frenata*. Since new species entered traps after seven days and as late as the fourth week of long term sites, trapping periods less than fourteen days underestimated diversity in most areas. More animals were captured with Sherman traps than pitfalls. Only insectivores and juveniles of rodent species were captured more frequently in pitfalls and bottles. Bait type had no apparent effect on capture success.

239

GREENBERG, CATHRYN H., DANIEL G. NEARY, and LARRY D. HARRIS. USDA Forest Service and University of Florida, Gainesville, FL 32611, USA--A comparison of herpetofaunal communities in catastrophically burned, clearcut, and mature sand pine scrub.

Herpetofaunal communities in sand pine scrub were sampled for 14 months using drift fences, pitfall, and funnel traps in replicated 5- to 7-year-old treatments that were either: (1) catastrophically burned, salvage logged, and naturally regenerated (CB); (2) clearcut, roller-drum chopped, broadcast seeded (RC); (3) clearcut, bracke seeded (BK) or; (4) control [mature natural forest (MF)]. Seventeen reptile and four amphibian species were captured; species richness ranged from 11 (BK) to 18 (CB) among treatments. Proportion of individuals captured (25%, 30%, 29%, and 16% for CB, RC, BK, and MF, respectively), and species composition (especially lizards and skinks) differed most notably between MF and other treatments, probably due to physical features of the forest (microsites). Amphibian distribution appeared to be related more closely with proximity to water than to treatment.

- 240 WILSON, R. GAYLE,¹ WADE B. WORTHEN,² and SARA MAYROSE.² Erskine College¹ and Furman University²--The effects of ant predation, larval density, and soil moisture on the survival of *Drosophila tripunctata* larvae. Mushrooms are used as a larval food resource by several *Drosophila* species. Previous research has shown that both predation by ants and larval competition can reduce larval survival. In this experiment, we measured the effects of these factors over a gradient of increasing soil moisture. First instar larvae of a brown-eyed *Drosophila tripunctata* mutant were added to mushrooms at densities of 10, 20 or 40 larvae/mushroom. These mushrooms were placed in ant-access and ant-exclusion treatment cups, on dry, moist, or wet soil. The cups were placed in a woodland for 5 days, and the percentage of brown-eyed flies surviving to metamorphosis were analyzed (ANOVA). Ants visited wet soils most frequently and exerted a disproportionate negative effect on larval survival in these micro-environments. Larval density had no effect on survivorship, but survivorship did increase with increasing soil moisture. However, in rainy weeks, survivorship was greatest from dry soil cups. These results demonstrate that microclimate interacts with predation and macroclimate in complex ways to affect larval survivorship.
- 241 MAYROSE, SARA,¹ WADE B. WORTHEN,¹ and R. GAYLE WILSON.² Furman University¹ and Erskine College²--The effects of ant predation, larval density, and soil moisture on the structure of mycophagous fly communities. Mycophagous fly communities are unusually diverse. In this experiment, we studied how biotic and abiotic factors influence this diversity. First instar larvae of a brown-eyed *Drosophila tripunctata* mutant were added to mushrooms at densities of 10, 20 or 40 larvae/mushroom. The mushrooms were placed in ant-access and ant-exclusion treatment cups, on dry, moist, or wet soil. The cups were placed in a woodland for 5 days where they were available to native flies for oviposition. The number and diversity of native metamorphs emerging from mushrooms were analyzed with ANOVA and MANOVA. Predation significantly reduced metamorph abundance but had no effect on community structure. Larval density had no effect on either abundance or diversity. Community composition changed with soil moisture; a phorid dominated the dry soil mushrooms,
- whereas drosophilids were more abundant on moist and wet soils. Abundance and diversity increased with increasing mushroom mass. The effects of soil moisture and mushroom mass suggest that recruitment and the independent physiological tolerances among the species, not interspecific interactions, may determine community structure.
- 242 WINSTEAD, JOE E. and KEVIN PEVELER. Western Kentucky University--Insects, seral stages, elemental analysis and caloric value patterns in terrestrial ecosystems of Kentucky and Tennessee. In 12 years of comparing an early successional stage of fescue and clover growth to an oak-hickory forest in central Tennessee with respect to caloric values of Arthropods of the systems, higher energy values were always found in the insects of the field. Caloric values (n=80) of the younger system insects ranged from 222 to 832 gm cal/gm dry wt. higher over a collective mean of 4.855 Kcal/gm dry wt. (n = 35) of the insects from the forest system. Comparisons of Orthoptera from early seral stages in Warren County, Kentucky to bottomland and older habitat members of that order indicates consistent energy values of 5.1 Kcal/gm dry wt. and lower levels of K and P in body tissue than those from the older system where they had an average energy content of 4.5 Kcal/gm dry wt. and higher percentages of K and P. Differences in caloric values of Arthropods of young and older systems in south central Kentucky also tend to match the patterns seen in the Tennessee study site.
- 243 MILLER, KIMRAN E. and HAROLD GOUZOULES. Emory University--Skeptical responding in rhesus macaques (*Macaca mulatta*). Rhesus macaques vocalize alarm calls when threatened; however, vocal deception has rarely been observed. The aim of this study was to determine why deception in non-human primates is so rare. We predicted that for calls in which information of individual identity is included, the groups of monkeys would habituate at a slower rate to high-ranking deceptive alarm calls than to low-ranking deceptive alarm calls. Receivers should be more skeptical of a low-ranking caller because that individual would have more to gain by vocalizing infrequent deceptive alarm calls. The subjects of the study were groups of rhesus macaques from Yerkes Regional Primate Research Center Field Station in Atlanta, Georgia. Alarm calls alternating from high- vs. low-ranking individuals were played to the group of monkeys while they were feeding. The number of individuals responding to each set of high- and low-ranking calls was compared. Responses to high-ranking

deceptive alarm calls outnumbered responses to low-ranking deceptive alarm calls. Habituation to high-ranking alarm calls was found to occur at a slower rate than habituation to low-ranking calls, implying skeptical responding in a false context.

244

BLAYLOCK, ROBERT A. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory -- National Marine Fisheries Service Marine Mammal Research in the Southeastern United States and the Southeast Marine Mammal Stranding Network.

The Southeast Fisheries Science Center (SEFSC) is responsible for scientific research of the National Marine Fisheries Service on marine mammals in the southeastern United States. In addition to its own research, the SEFSC sponsors research by independent laboratories and universities. Currently, SEFSC-sponsored research is being conducted along the Texas coast and the central west Florida coast on bottlenose dolphin population biology. The SEFSC's own research program concentrates on marine mammal population assessment by conducting extensive aerial and shipboard surveys throughout southern U.S. Atlantic and Gulf of Mexico coastal and offshore waters. In addition, the SEFSC, in 1992, initiated an intensive study to monitor the health of wild dolphins in a portion of the Texas coast. We are strongly committed to the Southeast U.S. Marine Mammal Stranding Network, providing administrative and logistic support, and training. Network volunteers investigate marine mammal strandings, examine and identify specimens, conduct necropsies, and collect samples. Thus, the network provides an excellent opportunity for students to obtain practical experience in cetacean anatomy and biology. Individuals interested in volunteering assistance with the network are encouraged to contact participating institutions. Academic and research institutions situated in coastal areas are especially invited to participate in this unique educational opportunity.

245

LYNCH, TRACY K. Savannah River Ecology Laboratory--Ecology of ground skinks (*Scincella lateralis*) in South Carolina.

Though the ground skink, *Scincella lateralis*, is prevalent throughout the Southeast, often in dense populations, their ecology remains poorly known. Using coverboard arrays, intensive mark-recapture studies were undertaken on these small, secretive lizards in South Carolina pine stands. These skinks exhibit small home ranges, low body temperatures (about 28°C) when active, sexual size dimorphism, and clutch size variation with body size and season. Ecological and environmental variables of thinned and unthinned pine stands inhabited by *S. lateralis* were compared. The thinned stand had less litter, higher temperatures, lower

humidity, and fewer arthropods - all of which may limit resource budgets and alter phenotypes. Skinks in the thinned stand were smaller and thinner than those in the unthinned stand. The results suggest that *S. lateralis* can be used to understand bioenergetics and responses to environmental variation.

246

ULREY, CHRIS J. and DONALD E. MCLEOD. Mars Hill College--Vegetation Patterns and Diversity along Environmental Gradients of the Craggy Mountains of Western North Carolina.

The Craggy Mountains of Western North Carolina are rich and diverse in community types and plant species. Seventy seven 0.1 hectare plots were sampled using both random grid placement and stratified-topographic techniques. Eight community types were classified using DECORANA and TWINSPLAN, they are: 1) Mesic-Mixed Oak, 2) Chestnut Oak, 3) Red Oak, 4) Cove forests, 5) Canadian Hemlock, 6) Red Spruce, 7) Beech, 8) Beech-Yellow Birch. Elevation, solar radiation and soil nutrients were identified as the major environmental gradients using Spearman Rank Correlation analysis. These gradients were found to be responsible for the distribution of communities. Species richness was negatively correlated with elevation and positively correlated with soil nutrients. An abstract model was generated displaying community distribution along major environmental gradients. We found no correlation between rare and endangered species and environmental gradients.

247

SMITH, GERALD L.¹, D. BRENT JOYE,¹ and WALTER S. FLORY.² High Point University¹ and Wake Forest University²--Studies on *Hymenocallis occidentalis* (Le Conte) Kunth.

Hymenocallis occidentalis is the most widely distributed species of Traub's Caroliniana alliance. Herbarium studies have shown it extends from southwestern North Carolina to the hammocks of the Florida panhandle, westward to eastern Texas and northward to southern Missouri and Illinois. Unlike other southeastern spider-lilies, it may be found inhabiting mesic wooded hillsides and meadows as well as the wetter habitats of floodplain forests and streambanks. Distinguishing field features include the numerous, glaucous, shallowly channeled, oblanceolate leaves and showy inflorescences of typically six to nine white flowers each with funnelform staminal cup and long green perianth tube. *Hymenocallis occidentalis* may also be distinguished by its somatic chromosome number of 2n=54. It has also been shown to hybridize in the greenhouse with *H. coronaria*, and the hybrids as expected are 2n=49.

248

MCLEOD, DONALD E. and CHRIS J. ULREY. Mars Hill College--Attributes of Old Growth Mixed Mesophytic Forests of the Southern Appalachians

Fifty seven 0.1 hectare plots were sampled during the growing season of 1992. An attempt was made to include a range of mesic forest types under various environmental conditions. Several categories believed to be important in defining old growth forests were selected. These include the following: age structure, size structure, canopy and stand structure, canopy gaps, tree density, tree basal area, standing snags, species richness, tree regeneration, vascular plant species composition, amount of coarse woody debris, forest floor/soil characteristics, possible indicator species and stand history. Results indicate that old growth mixed mesophytic forest can be best defined by a combination of the following attributes:

1) a number of canopy trees over 150 years old, 2) a number of large canopy trees, 3) large volume of coarse woody debris over a range of decomposition classes, 4) numerous standing snags over a range of decomposition classes, 5) many shade tolerant trees in the canopy as well as understory shade tolerant species of trees and herbs, 6) high basal area for trees, 7) undisturbed soil with deep organic horizon, 8) multi-age structure of the arborescent layers, 9) complex stratification of the vegetation.

249

STEWART, C. NEAL, JR. Virginia Polytechnic Institute & State University--Phylogeny of cranberry (*Vaccinium macrocarpon*) populations from random amplified polymorphic DNA (RAPD) data.

Cranberry is a dominant, evergreen, dwarf shrub in bogs from New England to Wisconsin. Peripheral populations are found in the mid-to-southern Appalachians and the North Carolina coast. These southern populations are hypothesized to have been refugia for this and other northern bog species during Pleistocene glaciation. Therefore, current

populations may be descendants from those refugia populations. Populations may be founded by few seeds and subsequently sites are colonized by vegetative spread. RAPD analysis was used to construct a phylogenetic hypothesis comparing 28 cranberry populations, including commercial cultivars that are natural isolates (1/2 being peripheral). Single arbitrary primers were used to prime the PCR reactions. RAPD products were electrophoresed on agarose-based gels and fragments were visualized with ethidium bromide staining. Of the 40 primers tested, 18 disclosed polymorphisms among populations. Ten of these were chosen to generate characters used in parsimony, cluster analysis, and analysis of molecular variance (AMOVA) procedures. Populations from climatically similar sites were genetically similar, with some notable exceptions. For example, a montane Tennessee site was most similar to a coastal North Carolina site.

250

ABBOTT, J. RICHARD and RALPH L. THOMPSON. Berea College--A relict colony of coastal plain species on the eastern Mississippian Plateau in Pulaski County, Kentucky.

A rare assemblage of more than twenty species considered to be typical for the Coastal Plain Province of the eastern United States was studied on a small wet upland flat from 1991-1992. The three basic communities were: contiguous, seasonally wet mesophytic woods; a successional grass-sedge meadow; and a sundew wet meadow. A total of 245 taxa from 77 families and 168 genera was documented. These taxa consisted of 12 Pteridophyta, 2 Pinophyta, and 231 Magnoliophyta. Only two exotic taxa were present. The five largest families in species were the Poaceae (29), Cyperaceae (28), Asteraceae (19), Rosaceae (11), and Orchidaceae (10). The largest genera were *Carex* (20), *Panicum* (10), *Juncus* and *Quercus* (7), *Eupatorium* (6), and *Hypericum* (5). This is the only known site for *Dioscorea brevifolia*, *Gymnopogon brevifolius*, and *Ludwigia bidella* in Kentucky. *Hypericum sians*, *Calamagrostis cinnoides*, *Lycopodium appressum*, *Rhynchospora globularis*, and *Mecardonia acuminata* are also listed as endangered, threatened, or rare by the Kentucky Nature Preserves Commission. The rarity of many of the species, the importance of the entire area as a relict coastal plain community, and the qualification of the area as a wetland all make the site worthy of protection and preservation.

REVIEWS

Hardin, James W. 1992. **Foliar Morphology of the Common Trees of North Carolina and Adjacent States.** Technical Bulletin 298, North Carolina Agricultural Research Service, North Carolina State University, Raleigh, NC 27695. \$10.00. 135 pp.

This treatise is a compilation of many years of careful and unique work by Dr. Hardin on the leaf surface micro-morphology of woody plants in the Southeast. That is, it contains Scanning Electron Micrographs of leaf surface structures that are not only beautiful of themselves, but are diverse enough to allow taxonomic differentiation of genera and species. These structures consist of cuticles, waxes, scales, hairs, and glands that cannot be appreciated, much less utilized, without the aid of high resolution magnification.

Included in the treatment are 155 species (or infraspecific taxa) of trees in 65 genera and 38 families, or 62% of the tree species in North America north of Mexico. The broad range of habitats in North Carolina accounts for this high diversity.

The foremost objective of this work, as stated, is to present detailed descriptions of the macro- and micro-morphology of tree leaves using consistent terminology, a practice that apparently has not been followed in the literature. Standardization of terms and presentation of newer terminology are important technical aspects of this text. Unfortunately, a glossary is not provided, which means many of the terms are found only when they are used; though the all-important cuticular patterns and trichome types are listed and described separately.

A secondary objective "is to establish an up-to-date classification and nomenclature for North Carolina trees." While no detailed discussion of rationale is given, the trees are listed in a linear sequence by Division, Class, and Subclass according to the Cronquist phylogenetic system. The text is arranged by family, with listings of each species that includes descriptions of general leaf macro-morphology followed by micro-morphology. Since the book does not appear to be cramped for space, I think it would have been great to include some of Dr. Hardin's recent keys to difficult genera, such as *Quercus* and *Carya*, based on leaf and bud characteristics. Each species is illustrated by a line drawing of at least one leaf, and many species are additionally represented by Scanning Electron Micrographs. The purpose of the micrographs is to show every variation of trichome type and surface structure; therefore, it is not necessary to have a micrograph of every species. Some of the SEM's show incredible patterns (*Pawlowntia*, for example) that should not go unnoticed. Simply as a gallery of botanical art, the book is worth the price.

Apparently there is no other work quite like this one, bringing together such complete illustrations of so many species. It is pointed out that such a work can be valuable not only to botanists and foresters, but also for any profession that deals with detailed identification of foliar parts. The list would include such specialists as allergists, entomologists, plant chemists, plant pathologists, veterinarians, and forensic detectives.

One very useful aspect of this "atlas-like" compilation is the list of recent references relevant to surface features. Literature is also referred to in the text for explanations of taxonomic decisions, though occasionally this is less than satisfying. For example, Hardin places *Nyssa* in the Cornaceae, and makes references to Harlow's Textbook of Dendrology (1991). Presumably one would expect to find the reason given in this latter work, but there the reader is simply directed to an earlier work by Eyde.

After considering various possibilities, I have decided the purpose of a pattern in reviews is to allow the reviewer to show off what he was able to find wrong, or arguable, with the work, which is, after all, more fun than simply going on about the good points that would be obvious to any knowledgeable buyer. To this end, the review becomes something of a literary piece in its own right, and should be read for immediate enlightenment and entertainment as well as to get some feeling for the content, format and usefulness of a particular work. It also helps in these cases to have unlimited space for the review so that one can elaborate on certain points. I am going to show off in this review, since space is available, and I have enjoyed perusing the book at great length. In this instance, the review should not be taken as a personal attack on the work or Dr. Hardin, whom I admire greatly. After

all, each book that comes to press is the result of compromises among deadlines, editorial policies, desires to rewrite for perfection and tendencies to keep gathering data to make the work more complete.

The line drawings are mostly taken, with permission, from an earlier work on North Carolina trees by E. C. Cocke; and while convenient and useful, I find these drawings a bit unrefined when juxtaposed with the high-resolution SEM's.

Given the author's usual editorial attention to detail, I was surprised to read on page 16 that the "Taxodiaceae is now included . . ." and "Taxodiaceae does not form a natural group. . ." Family names are to be treated as plural.

This work is definitely not for use by beginners or specialists unfamiliar with technical morphological terms. A general glossary would have been helpful, as would diagrams to remind us what craspedodromous and brochidodromous venation means, for example. I do not think the line drawings are clear enough to indicate such patterns in every case. And I wish the SEM's could have been simply referred to as "upper" and "lower" surface, rather than the very similar looking "adaxial" and "abaxial" (did I get them right here; I'll bet you have to go and look them up!). Usually there are two adjacent SEM's on each page, and they may both be adaxial, or both abaxial, views. But often there is one SEM of each view. Since there is no consistent placement of abaxial always on the left, when both views are shown, I constantly wondered if I was interpreting the views correctly since the words are so similar. I also wondered if there was the slightest chance of a typo or misplacement of these two similar terms. It is unfortunate when technical terms get in the way of practicality.

It was difficult for me to understand why, at the beginning of each family treatment, an indication was given simply as to the number of species in North America without listing them. We are told, for example, that there are three genera and 31 tree species of Fagaceae in South Carolina, 30 in North Carolina, 27 in Virginia, and 25 in Tennessee. There are 30 species treated in this book. So, does this include all the ones in Tennessee? How useful is this enumeration of distributions?

Finally, in order to help those familiar with the trees but not their adaxial leaf morphology, and especially for workers in the peripheral fields of interest, it would have been helpful to have keys or tables of micro-morphological features to help separate similar species (or genera) for which there are good differences. Otherwise, one must read and compare the detailed, and often similar, descriptions.

While I have seemingly gone on and on, my criticisms are certainly not enough to detract from the solid contribution of this work. I very much enjoyed looking at the intricate patterns of the surface structures and relating them to species I have felt. As Dr. Hardin would say, the view from "down under" presented in this book is certainly eye-opening. At the very reasonable price, it should be handily available to every botanist, dendrology course and graduate student who deals with trees. Someday you will need to refer to it.

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Moseley, Charles J. (ed.). 1992. The Official World Wildlife Fund Guide to Endangered Species of North America. Beacham Publishing Inc., Washington, DC. Volume 3. \$75.00. 467 pp.

This is the companion volume to the two-volume set on endangered species of North America that I earlier reviewed in the *ASB Bulletin* (38: 180-181, 1991). It continues in the tradition of the first two books with 1-3 pages of information on the behavior, ecology, status, and recovery plans for an additional 92 plant and 40 animal species listed by the U.S. Fish and Wildlife Service (USFWS) through October 1991.

The Foreword to this volume is by John C. Sawhill, who extols the conservation measures taken by The Nature Conservancy, especially its Last Great Places initiative. A chapter by Michael J. Bean of the Environmental Defense Fund follows with a description of some of the opposition to the reauthorization to the Endangered Species Act. The book's pagination picks up where Volume 2 left off, with page 1181. In addition to the 132 species accounts written in the same tradition of the first volumes, there is a ready reference index and a state by state occurrence for species in Volume 3, a list of species proposed for listing, a list of all Category 1 species, and a list of the recovery status (e.g. declining, stable) for all threatened and endangered species based on a 1990 report to Congress. The most useful and innovative research tool in this book is the *Photo Locator*. This is a list by species of the people and agencies that have photographs of the species illustrated in the three volumes. Because many species have been illustrated for the first time in these books and because finding

photographs for rare species is sometimes difficult, this directory is a particularly valuable resource. Each species is illustrated in black and white in the species accounts and 40 of them are included in a signature of color plates.

I detected few mistakes and problems in this new volume. The spelling of "*Plethodon*" and *Plethodon*, a genus of terrestrial salamanders, occurs in the species account and index. However, the correct spelling occurs in the ready reference in the front of the book and in the state-by-state list. The black-and-white photographs did not fare well in production, as many lack detail and some are out of focus. Compare the color photograph of the Roan Mountain bluet with its black-and-white counterpart on page 1261, and that of the Shenandoah salamander with its black-and-white photo on page 1405, to name only two. I know that better black-and-white photographs can be made from color slides, whose reproduction fared much better.

With the appearance of the third volume, this series becomes an even more valuable resource for conservation biology educators than I extolled in my review of the first two volumes. These handsome and easy-to-read books should be on the shelves of every library in the country.

I hope the publisher will continue to produce periodic updates so that the American public can keep abreast of new listings. Educators have been using the first two volumes to make students of all ages more environmentally aware. The third volume is an important additional resource.

The Endangered Species Act will probably be reauthorized. In what form is the only question. Every biologist should be interested in its passage and help to insure that it stays intact. The number of species covered in these volumes (657) attests to the decline of North American native plants and animals. That alone should tell us that unless we protect these and other species in trouble, we will certainly have fewer organisms to study in the next century.

JOSEPH C. MITCHELL, *Department of Biology, University of Richmond, Richmond, VA 23173.*

NEWS OF BIOLOGY IN THE SOUTHEAST

Jon R. Fortman—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

ALABAMA

University of North Alabama, Department of Biology. Dr. Terry Richardson, Assistant Professor of Biology, has been awarded a grant by TVA for a project entitled "Colonization of Tennessee River bivalves by the invading zebra mussel (*Dreissena polymorpha*).” The objective is to monitor the progress and success of the invading zebra mussel in native bivalve assemblages in mussel refuges and commercially important beds in the southernmost reaches of the Tennessee River.

GEORGIA

Georgia Southern University, Department of Biology. The Fall Seminar Series included: Dr. Ramona Beshear from the Georgia Experiment Station, Department of Entomology; Dr. John Brower, U.S. Department of Agriculture-ARS; Dr. H. Stephen Hale, Georgia Southern, Department of Sociology and Anthropology; Dr. Hugh M. Turner, Department of Biological and Environmental Sciences, McNeese State University; Dr. Lance Durden, Institute of Arthropodology and Parasitology, Georgia Southern University. New faculty include Dr. Jonathan Copeland, Associate Professor (Ph.D., SUNY Stony Brook, Cellular/Behavioral Physiology), Dr. Becky A. Moulton, Assistant Professor (Ph.D., Texas Tech University, Behavioral Neurobiology), Dr. John W. Parrish, Professor and Department Chair (Ph.D., Bowling Green State University, Vertebrate Physiology), and Dr. Oscar J. Pung, Assistant Professor (Ph.D., University of North Carolina, Immunology/Parasitology). Other new faculty are Dr. Ann E. Pratt, Assistant Professor (Ph.D., University of Florida, Vertebrate Paleobiology), Dr. Stephen P. Vives, Assistant Professor (Ph.D., University of Wisconsin, Behavioral Ecology/Ichthyology), and Dr. Lisa K. Wagner, Assistant Professor (Ph.D., University of California at Berkeley, Plant Ecology). In the medical area, new faculty include Dr. William S. Irby, Assistant Professor (Ph.D., North Carolina State University, Medical-Veterinary Entomology) and Dr. James E. Keirans, Curator, U.S. National Museum Tick Collection (Ph.D., University of New Hampshire, Medical-Veterinary Acarology). The world's largest tick collection, representing 90% of all known tick species, has been established in a new home at Georgia Southern University. Through a \$1,153,458 grant awarded by the National Institute of Allergy and Infectious Diseases, the collection has come under the purview of Dr. James H. Oliver, Jr., head of the Institute of Arthropodology and Parasitology. The present curator, Dr. James E. Keirans, considered by many to be the world's foremost authority on tick classification, has joined the faculty and continues in his role as curator. The Georgia Southern facility formally opened in the fall of 1990. Over 300 type specimens are available for study there, in a setting that includes laboratories, a tick library and conference room, preparation rooms, and staff offices. Not only will the collection be more accessible to researchers, it can now involve live specimens in addition to the preserved materials. Dr. Oliver refers to the collection as a "national treasure." Dr. James H. Oliver, Jr., Fuller E. Callaway Professor of Biology is the only American to receive honorary membership in the Entomological Society of China and the Honorary Gold Medal of Achievement from the Warsaw Agricultural University of Poland.

Georgia Southwestern College, Department of Biology. Dr. Alicia Lesnikowska has joined the department as an Assistant Professor. She comes from a postdoctoral position at the McGregor Herbarium, at The University of Kansas. Her Ph.D. was earned at the University of Illinois, Urbana-Champaign.

ILLINOIS

Southern Illinois University, Plant Biology Department. Dr. David J. Gibson is the newest addition to the Faculty in the Plant Biology Department. His Ph.D. is from the University of Wales in Plant Science, under the direction of Dr. P. Greig-Smith, with postdoctoral work at Rutgers University. He was formerly in the Biology Department at the University of West Florida.

LOUISIANA

Louisiana State University, Department of Botany. Dr. Marshall D. Sundberg was awarded the Charles E. Bessey Award by the Botanical Society of America. Dr. Timothy B. Harrington, currently at Oregon State University, has accepted a tenure-track position at the University of Georgia School of Forestry. Tim graduated in Botany at LSU in 1980. Dr. Russell Chapman presented an invited research lecture at the University of Texas Marine Science Institute in Port Aransas, Texas. Dr. Marshall D. Sundberg presented two invited papers at the annual meeting of the Botanical Society of America in Honolulu, Hawaii. He also was elected to a three-year term as Council Member at Large to the AIBS. The Department welcomes Dr. Robert E. Burckhalter, a visiting professor for the 1992–93 school year. He is employed as a project scientist with Black and Veatch in Kansas City, Missouri. He studied delineation of wetlands, plant communities, and threatened/endangered plant species for projects in Arizona, Florida, Kentucky, and Missouri. His Ph.D. is from the University of Alabama. He taught sections of Biology and Botany courses during the fall.

NORTH CAROLINA

East Carolina University, Department of Biology. Dr. Robert Christian was elected secretary of the Atlantic Estuarine Research Society and Chairman of the American Academy of Microbiology's selections committee. Dr. Christian also has a \$21,716 grant from the College of William and Mary for Sediment-water Nutrient Exchange in estuarine sediments of differing trophic status. Drs. Wendall E. Allen, Takeru Ito, and Susan J. G. McDaniel were honored for 25 yr service. Dr. William G. Ambrose, Jr., has received four grants totalling approximately \$175,000 for specific areas in ecological research. Dr. Willem Roosenburg and Katherine C. Kelley were married in Philadelphia. Dr. Roger Rulifson received a grant to study Striped Bass Egg Abundance and Visibility in the Roanoke River and young-of-year survivorship for 1992. Drs. Joseph Luczkovich, Margie Gallagher, and Edmund Stelkweg received a grant from the UNC Institute of Nutrition for Microbially Mediated Utilization of Cellulose by Pinfish.

SOUTH CAROLINA

Furman University, Department of Biology. Karla M. Weidner is a new faculty member teaching Immunology and setting up a cell culture laboratory.

VIRGINIA

Virginia Commonwealth University, Department of Biology. Dr. Jackson E. Jeffrey has retired from the department. Since coming to the University in 1962, Dr. Jeffrey has taught and done research in Anatomy and Physiology as well as serving as Departmental Chairman on three separate appointments. After completing his brief postretirement adjunct teaching duties this year, he and wife, Barbara, have plans to live in Wilmington, NC.

MUSEUMS AND BOTANICAL GARDENS

GEORGIA

The *Columbus Museum, Columbus*. The flags unfurled this February for the grand opening of the Museum Guild's *Flying Colors Art Show and Sale*. Featuring regional and national artists, the fundraiser lasted one week. The proceeds were used by the Guild to benefit the Museum and its programs. Dorothy Dierks Harris and George Cress, nationally known artists, were represented.

LOUISIANA

Lafayette Natural History Museum, Planetarium, and Nature Station, Lafayette. The Gulf Coast Regional Native Plant Conference Steering Committee is pleased to announce the return of this popular conference on 9–12 June 1993, USL campus in Lafayette. The theme will center around the “community concept” of native plant design and usage. The conference will explore aspects of indigenous plant community identification, design, restoration, cultivation, and maintenance, as well as provide valuable information concerning many additional native plant usages, such as wildlife attraction and “folk” foods and medicines. There will be a diverse selection of field trips to river swamp and bottomland hardwoods forests, gulf coastal prairie and marsh, salt dome hardwood, and other transitional forests. On the lighter side, there will be two nights of cajun music and seafood included in the registration fee.

Organismal Courses—Please indicate which courses have been/are offered (not just listed in the catalogue). We are particularly interested in undergraduate courses, but if you are able to provide information on graduate courses, please list them as (U/G). If you do not have access to historical information, please complete the survey for 1992.

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<input type="checkbox"/> systematics	_____	_____	_____
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<input type="checkbox"/> invertebrate	_____	_____	_____
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CONTENTS

THE ASB BULLETIN

VOLUME 40, NUMBER 2, APRIL 1993

Pebble Nest Construction and Spawning Behaviors in <i>Semotilus thoreauianus</i> (Pisces: Cyprinidae) by E.G. Maurakis, S.H. Sabaj, and W.S. Woolcott	27
Program Summary of 54th Annual Meeting	31 & 41
Speaker for Plenary Session	37
Maps and Hotel Plans—Meeting Sites	39
ASB Candidates for Office—1993	45
ASB Paper and Poster Sessions	50
Author Index & Exhibitors	82
ABSTRACTS	88
Reviews	150
News of Biology in the Southeast	153
Questionnaire	156

WH301
A78*
v. 40
no. 3
July 1993

ASB BULLETIN

, Number 3

July 1993

CALL FOR PAPERS—NEW DEADLINE: November 15



Larval Horsehair worm, *Chordodes morgani* from Tennessee

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TIME AND PLACE OF FUTURE MEETINGS

1994	April 13-16	University of Central Florida, Orlando, FL
1995	April 19-21	University of Tennessee, Knoxville, TN
1996	April 10-13	Ga. Southern College, Statesboro, GA

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MAINTAINING PER CAPITA ECOSYSTEM SERVICES WHILE THE HUMAN POPULATION GROWS TO TEN BILLION: A MAJOR GLOBAL CHALLENGE FOR BIOLOGISTS

*John Cairns, Jr.**

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Environmental and Hazardous Materials Studies,
Virginia Polytechnic Institute and State University,
Blacksburg, VA 24061

To see what is right and not to do it is want of courage.

Confucius

EXPANDING HUMAN POPULATION/ DECLINING NATURAL SYSTEMS

In late 1992, a joint statement by the officers of the Royal Society of London and the U.S. National Academy of Sciences entitled *Population Growth, Resource Consumption, and a Sustainable World* was released. The release notes that world population is growing at the unprecedented rate of almost 100 million people per year, and human activities are producing major changes in the global environment. If current predictions of population growth prove accurate and patterns of human activity on the planet remain unchanged, science and technology may be unable to prevent the irreversible degradation of the environment or the continued poverty for much of the world. About the same time, the Union of Concerned Scientists (1992) issued the World Scientists' Warning to Humanity, which identified five inextricably linked areas that must be addressed simultaneously.

- (1) *We must bring environmentally damaging activities under control to restore and protect the integrity of the earth's systems upon which we depend.*
- (2) *We must manage resources crucial to human welfare more effectively.*
- (3) *We must stabilize population—which will be possible only if all nations recognize that such an undertaking requires improved social and economic conditions and the adoption of effective, voluntary family planning.*
- (4) *We must reduce and eventually eliminate poverty.*
- (5) *We must ensure sexual equality and guarantee women control of their own reproductive decisions.*

The original document is signed by over 1,600 scientists, including 102 Nobel laureates, and many colleagues have joined since then. I confess to a bias in favor of this warning, since I am privileged to be one of the original signers. This discussion focuses on one possible mechanism for addressing issues 1 and 2 (bringing environmentally damaging activities under control to restore and protect the integrity of the earth's systems upon which we depend and managing resources crucial to human welfare more effectively).

* ASB Society meeting Plenary address 14 April 1993, Virginia Beach, VA.

DEVELOPING A SYMBIOTIC RELATIONSHIP BETWEEN HUMAN SOCIETY AND NATURAL ECOSYSTEMS

Human society has reached its present population size, and level of affluence by exploiting ecological capital (*e.g.* Ehrlich and Ehrlich 1991). Illustrative examples of ecological capital are old growth forests, fossil water in underground aquifers, and large edible mammals such as the buffalo. The two alarm calls (issues 1 and 2 just cited) indicate that a substantial number of mainstream scientists believe that neither the present rate of population growth nor the rate of environmental destruction can continue. The relatively recent preoccupation of technological societies with the sustainable use of both the planet's natural and agricultural systems is an indication of an awareness that is shared by a significant numbers of citizens of the need for a new relationship between human society and ecosystems. (The buzz term *sustainable use* may be new to members of technological societies.)

The assumptions that form the intellectual basis for the development of a symbiotic relationship between humans and nature (a set of ethical considerations are discussed later) follow:

- (1) *It seems unlikely that humans could eradicate all life on earth, although it would be irresponsible to eliminate this possibility entirely.*
- (2) *Therefore, even extraordinary biotic impoverishment would leave some life forms from which, over millions of years, a diverse array of new species might well evolve.* Therefore, over enormous spans of time, the present species richness might be reestablished, but with quite different life forms.
- (3) *As a consequence, Homo sapiens may have enormous short-term effects on the number of species with which we share the planet, but such effects are unlikely to be permanent.* Therefore, while human society may cause species extinctions matching even the worst of the past, natural systems almost certainly will recover. However, if we continue on our present course, human society will be more seriously disrupted than it now is (especially if the population doubles early in the next century), and, at the worst, humans could join the many other species that have become extinct (such as *Tyrannosaurus rex*) or become a relic rather than a dominant species.
- (4) *Since the life support system for human society is both natural and technological, we should develop a symbiotic relationship with natural systems so that both human society and ecosystems flourish.* In short, human society must modify its lifestyle so that it does not threaten natural systems to the degree that it now does. In fact, it should be possible to develop a relationship in which both human society and natural systems flourish.
- (5) *As a first step in this more harmonious relationship, human society must develop a better understanding of the services that natural systems provide (e.g. regulating the atmospheric gas balance) and, further, develop a set of guidelines on ecosystem services per capita.* This relationship is the major focus of this discussion.

DETERMINING PER CAPITA ECOSYSTEM SERVICES

The major emphasis of the remainder of this discussion is taken from an invited plenary session address at WATERSHED '93 (Cairns, in press)—a national con-

ference on watershed management held in Washington, D.C., in March 1993. If ecological destruction continues at its present rate, it is virtually certain that no sizable, relatively undisturbed ecosystem will remain, even if the world's oceans are included. In addition, abundant evidence indicates that fragments of ecosystems cannot maintain viable populations of many species, and, with a few notable exceptions, these populations cannot be maintained in zoos at a cost acceptable to human society. Similarly, if the human population continues to grow at its present rate, the quality of life will almost certainly deteriorate below present levels, which are not satisfactory to much of the world's existing population. Even in an affluent society such as the United States, many parents realize that their children will be unable to live at a level of affluence comparable to theirs. Human society has been able to reach its present level of affluence and population density by exploiting a one-time bonanza of ecological capital, including old-growth forests, fossil fuels, metals and minerals, biomass of harvestable species (*e.g.* American buffalo and carrier pigeon), and fossil water, to mention a few examples. However, sustainable use of our ecological life support system requires that we focus on the services of ecosystems that can be utilized without destroying the ecological capital. Illustrative services are regulation of the atmospheric gas balance, influence on weather patterns and rainfall, providing models for medicinal drugs, and providing a genetic pool of edible crops that are more pest-resistant or adjusted to different environmental conditions than the limited array of cereal grains upon which human society primarily depends. Developing policy at the landscape level will depend upon integrating water and land management, and most of the assumptions and recommendations apply equally to both. The policy recommendations are based on the following four assumptions:

- (1) ecosystem services are important to the survival of human society in its present form.
- (2) the continued destruction of ecosystems and the concurrent rapid increase in human population size are serious threats to the delivery of ecosystem services.
- (3) the rapid global loss of species intimately connected with the loss of habitat will also impair the delivery of ecosystem services.
- (4) healing damaged ecosystems will enhance both the quality and quantity of ecosystem services.

There are five basic policy options regarding the relationship of ecosystem services and human population size and affluence: (1) continue ecosystem destruction and population growth at their present rates and see what happens before any action is taken—this would mean dramatic erosion of ecosystem services per capita in the near future, (2) adopt a policy of no-net-loss of ecosystem services—a balance between destruction and repair must be achieved at all times; this would still mean a decline of ecosystem services per capita but less rapidly than option 1, (3) exceed a no-net-loss of ecosystem services—develop a policy of healing or restoring ecosystems at a more rapid rate than their destruction; this would still mean a loss of ecosystem services per capita at the present rate of population increase, (4) stabilize human population growth and exercise option 2, which would maintain the status quo on ecosystem services per capita, and (5) stabilize human population growth and restore ecosystems at a greater rate than damage, which would improve ecosystem services per capita.

If we decide to restore ecosystems at a rate equal to or greater than their rate of destruction, these four basic elements should be part of a national and global restoration strategy: (1) restoration goals and assessment strategies should be set for each ecoregion, (2) principles should be established for priority setting and decision making, (3) policy and programs for federal and state agencies (or the United Nations) should be redesigned to emphasize ecological restoration, and (4) innovations should occur in financing and use of land and water markets. The National Research Council (1992) had the following illustrative goals for the United States for restoring aquatic ecosystems between now and the year 2010: (1) wetlands—restore 10 million acres (out of 117 million impaired or destroyed since the year 1800); (2) rivers and streams—restore 400,000 miles (12% of the 3.2 million miles presently considered impaired or damaged); and (3) lakes—restore 2 million acres (out of 4.3 million acres presently degraded). Although precise replication of predisturbance condition will rarely be possible, achieving a naturalistic assemblage of plants and animals of similar structure and function to the predisturbance ecosystem should be possible in most cases. However, if one adds the attributes of self-maintenance and integration into the larger ecological landscape in which the damaged patch occurs, both the temporal and geographic dimensions of the study area increase substantively. If exploratory restoration projects are added in each ecoregion, then the number of acres and the percent or actual size of the restored aquatic ecosystems just given do not appear excessive. Ecological restoration is a means of buying more time for human society to develop lifestyles less threatening to natural systems and for ecologists to develop more robust methods for restoring the earth's damaged systems.

GOING BEYOND ECOSYSTEM SERVICES

I regard the relationship between human population size and the maintenance of ecosystem services as extremely important. However, the quantity of ecosystem services and possibly even the quality might not be diminished even if many species now inhabiting the earth are lost. If the term *ecosystem services* is interpreted in a narrow sense (*i.e.* excluding attributes other than those necessary for human survival), then human society might forgo preserving as many as possible of the species with which it shares the planet. However, if *ecosystem services* is broadly interpreted, the concept might well include the honking of geese flying overhead (discussed in Aldo Leopold's *Sand County Almanac*), the mating dance of the whooping cranes, or just knowing that the snow leopard still exists even though most of us will never see one in its native habitat. I have espoused the idea of preserving ecosystem services hoping that enlightened self-interest of human society will arrest or, better yet, reverse the environmental destruction that marks the end of this century. However, human society has an ethical responsibility that should go well beyond self-interest to assumptions of fairness, equity, and the common good of all species. It is, of course, impossible for all of us to develop a feeling of kinship with each of the more than 50 million species estimated to inhabit the planet at present. It is not beyond our grasp, however, to feel a kinship with the habitats and natural systems upon which the survival of our fellow species depend. In order to do this, we must develop an ethos, or guiding belief, of both government and citizens. The respected Athenian leader and general Pericles noted that the chief safeguard of his society in 431 B.C. was that citizens

obeyed the customs and the laws “whether they are actually on the statute book, or belong to that code which, though unwritten, yet can not be broken without acknowledged disgrace” (Thucydides, Book 2, Chapter 6, 37).

The development of an ethos and fairness toward our fellow species will not by itself be enough unless accompanied by a widespread improvement in environmental literacy. This important subject is discussed in *New Perspectives on Environmental Education and Research* (Sigma Xi, in press). Developing a harmonious and sustainable relationship between human society and natural systems is not only a challenge for biologists but for all disciplines—and for all of human society.

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BASIC ACCOUNTING IN ECOLOGICAL STUDY AND ENVIRONMENTAL PRACTICE

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ABSTRACT

Business accounting methods are integral to ecological study and environmental practice. Ecological processes are concerned with input and output, inflow and outflow, and turnover rates and budgets. Material fluxes in ecosystems, models of nutrient cycling in nature, and energy partitioning in organisms reflect basic accounting strategies. Because ecological principles underlie virtually all environmental issues, application of innovative accounting practices is imperative in pollution control and other environmental protection activities. Natural resource accounting and auditing for social costs and externalities are essential features of green economics.

INTRODUCTION

Environmental accounting has been increasingly invoked during the last few decades, as ecologists confront the issues of environmental degradation and predict the future trends based on unbalanced budgets of energy, nutrients, water, and gases in certain ecosystems. Decreased input of energy (food) or nutrient (fertilizer) into living systems and increased output of toxic waste (heavy metals) and atmospheric contaminants (CO₂) from factories must now be accounted for on the environmental balance sheet. Economists and corporate accountants have become more outspoken about the need to account for social and environmental costs of pollution the last few years, primarily because of the Chernobyl and Exxon Valdez disasters. There is growing agreement among ecologists, economists, and environmentalists, that economic indicators (*e.g.* GNP) must incorporate environmental costs and account for natural resource depletion. Several so called green economic indicators have been proposed, *e.g.* Human Development Index (HDI), Human Suffering Index (HSI), Gross Sustainable Product (GSP), Net National Product (NNP), and others.

This paper: (1) illustrates to accountants and auditors the role basic accounting procedures have played in ecological studies and (2) demonstrates for ecologists and environmentalists the value of business accounting in environmental protection. The underlying message of this paper is for everyone to recognize the relevance of understanding basic ecological principles in preventing environmental degradation, and the need for better environmental accounting to conserve the earth's resources for sustainable human habitation.

BASIC ACCOUNTING CONCEPTS IN ECOLOGICAL STUDY

A simple illustration to demonstrate that accounting concepts are integral in ecological studies is the energy budget of individual organisms. Transeau (1926) examined a one-acre cornfield, which received solar radiation of 2,043 million

kilocalories of which 943 million was used by the plants per growing season. The corn plants used the energy received in two major processes—transpiration (910 kcal) and photosynthesis (33 kcal). The one-acre of corn plants used about 182,000 liters of water during a typical growing season of which evaporation consumed about 45% of the available light energy. In addition, 8 million kilocalories were released in respiration of the 33 million kilocalories rendered potential in photosynthesis over this one acre area. While the students of ecology recognize the fundamentality of bioenergetics, they usually do not conceive of the process in accounting terminologies of income and expenditure but rather of inflows and outflows of energy.

The accounting scheme for energy and nutrients apply to all levels of biological organization. Energy income of an animal body is expended in assimilation and excretion (Fig. 1). For example, de la Cruz and Davidson (1983) showed in a feeding experiment with captive rice rats, a rodent common in coastal marshes, that the animal's food intake of high protein natural diet (Crab Diet—CD) was $41 \text{ kcal day}^{-1} \text{ rat}^{-1}$ and $19 \text{ kcal day}^{-1} \text{ rat}^{-1}$ of high residue laboratory diet (Lab Chow—LC). Depending on the type of diet, the rats expended 1 (for CD) and 7 (for LC) kilocalories per day per rat with body weight of 50–60 g and the energy balance of 40 (for CD) and 12 (for LC) kilocalories was assimilated by the body. Assimilated energy minus the energy used in respiration is the net production energy which represents the sum of energy that went into tissue accumulation or growth, production of germinal tissues or reproduction, decomposition or normal breakdown of internal tissues, and other losses (Fig. 1).

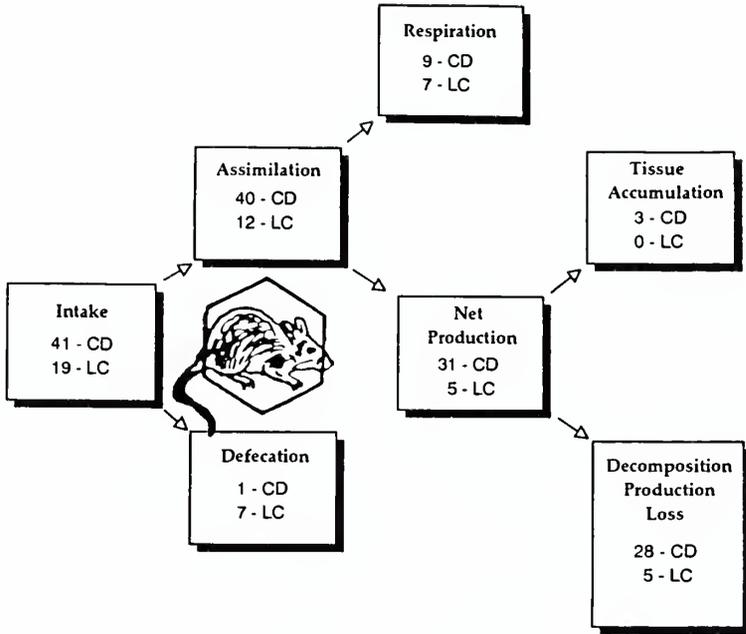
Accounting at the Ecosystem Level

E. P. Odum (1983) popularized the concept of an ecosystem as the fundamental unit in the study of ecology. Ecologists have represented nature as a black box with an energy throughput linked to a high quality solar energy input and a low quality heat energy output conduits (E. P. Odum 1983). A set of specific symbols are used in ecological modelling, *e.g.* circles represents energy sources, bullet-shape boxes for producers, hexagons for consumers, roofed semi-circles for energy storage, etc. (H. T. Odum 1971). This type of model is useful for conceptualizing ecosystem functions when empirical data is also available.

Accounting for the various input sources and output fates is crucial to the natural tendencies of a biological system to achieve balanced budgets with respect to energy, nutrients, water, and gases. Balanced budgets are required for living systems to survive and to produce surplus biomass for growth and reproduction.

Biological systems are in an import-export trade and the functioning of whole ecosystems, in fact the entire biosphere itself, revolves on income and expenditures of energy and nutrients. Ecosystem level studies are intriguing but complex, and ecologists must account for sources of energy entering the ecosystem and fate of nutrients leaving the system. Two classic studies will illustrate the rigorous accounting necessary in a complex ecological study. As an example of this accounting system, H. T. Odum (1957), computed the energy budget of Silver Springs, Florida, an aquatic ecosystem characterized by a relatively constant temperature of 21 to 25 C but varying levels of nutrient, oxygen, and salinity concentrations. Energy income and expenditures were $21,376 \text{ kcal m}^{-2} \text{ yr}^{-1}$.

A similar study performed on a salt marsh ecosystem in Georgia by Teal (1962)



INCOME
(kcal day⁻¹ rat⁻¹)

EXPENDITURES
(kcal day⁻¹ rat⁻¹)

CD = Crab Diet
LC = Lab Chow

9 CD; 7 LC Respiration
3 CD; 0 LC Growth
1 CD; 7 LC Defecation
28 CD; 5 LC Others

41 CD; 19 LC

41 CD; 19 LC

Fig. 1. Energy budget of rice rat.

showed two plant producers, the marsh plant *Spartina* and mud algae with gross energy production of 34,580 and 1,800 kcal m⁻² yr⁻¹, respectively, for a combined energy input into the marsh ecosystem of 36,380 kcal m⁻² yr⁻¹. Energy expenditure in the form of plant respiration was 28,175; consumer respiration 4,534; and net export from the system was 3,671 kcal m⁻² yr⁻¹. Note that in both of these studies, each trophic level (*i.e.* the animal or consumer components) has its own energy income (the net production of the preceding trophic level) and energy expenditures (respiration and net production available to the next trophic level).

The flow of energy through an ecosystem drives the recycling of water, gases, and other critical chemicals, (*e.g.* nitrogen, phosphorus) in the environment. Therefore water budgets, oxygen-carbon dioxide budgets, as well as accounting for the input and output of nutrient elements, are all important considerations in the understanding of ecosystem functioning.

The ecological literature is replete with studies and reports on ecological energetics and biogeochemical cycles. Text books have graphically popularized the energetics and cycle concepts in ecosystems, but as expected, have not treated the input-output rates from the perspectives of traditional business accounting. The problems of environmental pollution and degradation are ecological in nature because they ultimately cause imbalances in the energy or chemical budgets of ecosystems. There is an urgent need for better accounting of the costs of correcting and more importantly, the costs associated with preventing ecological imbalance.

ACCOUNTING PRACTICES AND ENVIRONMENTAL PROTECTION

Nelson Luscombe's editorial in the November 1989 Chartered Accountant Journal (Canada), referred to a statement made by the president of a major multinational logging company that "A tree only has value once it's cut down." Unfortunately, this statement is only true to the extent that economists, accountants included, do not account for the social costs of soil erosion, flooding, global warming, and loss of biodiversity once the forest is cleared. Alternatively, it is difficult for private investors to put a dollar value on the numerous ecological services a forest performs which benefit society. Social costs and/or social benefits should be accounted for.

Accounting for Nature's Functions

Ecologists have attempted various methods of accounting for monetary values for the ecosystems (Gosselinke *et al.* 1973; de la Cruz 1976). These include values obtained from the products of the ecosystem's major vegetations (*e.g.* craft materials, pulp, food, potential drugs) and values based on the different functions the ecosystems play in nature (*e.g.* in photosynthesis, recreation, as wildlife sanctuary, waste assimilation). Several approaches by which a coastal marsh ecosystem can be evaluated monetarily are listed in Table 1. Approximate annual return per hectare ranged from \$100 to \$500 in terms of cattle, pulp, or fishery harvest with an income-capitalized value of \$1,000 to \$7,000 per hectare. When the marsh is allowed to perform its natural functions of waste-water purification and primary production, annual return per hectare ranged from \$2,500 to \$7,500 with an income-capitalized value of \$14,000 to \$106,000 per hectare. Thus, wetlands in their natural state perform ecological functions which have important social benefits which can be accounted for using economic techniques.

Accounting for Social Benefits and Costs

The idea of social benefits (good for the society) and social costs (harmful to the society) can be extended to manufactured products. The price for these costs and/or benefits is not included in the market price of economic goods or services.

Table 1. Examples of accounting for monetary values of salt marsh ecosystem.

Approach	Basis of measurement	Approx. annual return per hectare (US \$)	Income-capitalized value per hectare at 7% interest ¹ (US \$)
Cattle ² production	Grazing capacity of marshland; 2.3 ha per animal unit	70	1,006
Paper production ²	Extractable pulp for paper making; \$85 per ton cellulose	174	2,486
Fishery production ²	Commercial finfish and shellfish harvest (in Mississippi)	481	6,878
Tertiary sewage treatment ³	Waste assimilation capacity of marsh plants (only phosphorus removal)	2,470	13,232
Aquaculture development ³	Potential value when converted to intensive fish and shellfish culture	2,964	42,343
Ecological primary productivity ³	Life support value in terms of net primary productivity of dominant vegetation; (10 ⁴ kcal = \$1)	7,452	106,457

¹ Income capitalized value $V = R/i$. V = value of parcel of land; R = annual return; i = interest rate.

² From A. A. de la Cruz (1976).

³ Estimates of J. G. Gosselink *et al.* (1973).

Economists call these external costs or externalities. Miller (1992) provided the following example: the price of an automobile reflects the sellers costs of building and operating the factory, raw materials, labor, marketing, shipping, and profits for manufacturer and dealer. The buyer's costs of maintenance, repair, and gasoline added to the price of the car are direct costs referred to as internal costs. However, if a car dealer builds an aesthetically pleasing sales building or a gasoline station provides a comfortable rest area and clean restrooms, this is an external social benefit to people who enjoy these perks. When the car factory and the cars sold emit pollutants into the environment, their harmful effects plus all the negative ramifications of the pollution (*e.g.* illness, death, medical bills, insurance cost, harmful effects on trees raising the price of paper and lumber, etc.) are external social costs. As a car-user, you also can pass on to society additional externalities, including driving a car in a manner that gets poor gas mileage, throwing trash out the window, or driving an extremely noisy car. While you may not pay directly for these harmful activities, you and others normally must pay indirectly for them in the form of higher taxes, health costs, insurance, and higher cleaning and maintenance bills.

External costs should be accounted for to the extent possible and added to the

market price of all economic goods and services. The market price of an economic good would be closer to its true cost when internalizing external costs.

ENVIRONMENTAL OR GREEN ACCOUNTING

Rubenstein (1990) stated that there is a monumental gap between the ordered world of double-entry accounting and the modern reality of large-scale pollution and its attendant cost. This gap largely exists because of the lack of accounting for social costs. Lester R. Brown, president of the World Watch Institute, observed that the present economic accounting system has led many governments to adopt ill-conceived policies in the management and use of resources (Brown 1984). These governments have focused on production and ignored the effects on the natural capital that makes production possible. Evidently, there is a need for greater environmental sensitivity in accounting.

As a result, people are now beginning to recognize the need of developing a more appropriate accounting system which better facilitates the internalizing of external costs. Miller (1992), for example, suggests that GNP (and GNP per capita) does not reflect social well being and environmental health. GNP hides the harmful effects of an economy by including production of harmful goods and services. GNP and GNP per capita will progressively increase when more cigarettes are produced which cause higher incidences of lung cancer and heart disease which increase health and insurance costs and decrease the quality of life through poor health and premature death. The \$2 billion price tag of the Exxon Valdez clean-up as well as the many other billions spent on environmental rehabilitation, helped push up the U.S. GNP. The more waste and pollution a country produces, the higher the GNP (Gross National *P*—pollution?). There is a need for supplementing existing economic indicators with other indices that will account for depletion and rehabilitation of the resource base (Table 2). Natural resource accounting is imperative to achieve sustainable growth. Applicability of economic/environmental indices will rely on the comprehensiveness of accounting entries. Further, Miller (1992) contends that when externalities are internalized sufficiently, economic growth will be redirected and we “would increase the beneficial parts of the Gross National Product, decrease the harmful parts, increase production of beneficial goods, raise the net economic welfare, and help sustain the earth.” These goals appear to be worth striving for. The difficulty, of course, is in developing appropriate accounting and disclosure methods to achieve the desired objectives.

Status of Environmental Accounting

Presently, the driving force behind accounting and auditing practices related to the environment in the U.S. is to maintain compliance with environmental laws and regulations. There are two important laws giving rise to concerns about accounting for the environment, these are the Superfund Act and the Clean Air Act.

Provisions of the Superfund Act of 1980 and 1986 would result in significant amounts for cleanup costs and liabilities not only for hazardous wastes but also for personal injury claims from employees and customers. The accounting profession is thus presented with the issues of measurement and accounting for cleanup costs and the related liabilities (Rousscy 1992). These issues include:

Table 2. New economic and social environmental indicators.

Indicator	Author	Definition
NEW (Net Economic Welfare)	William Nordhaus and James Tobin ¹	Calculations include price tag on pollution and other harmful goods and services included in GNP. The costs of the negative factors are subtracted from GNP.
PQLI (Physical Quality of Life Index)	Overseas Development Council ²	The index is based on three social indicators: life expectancy, infant mortality, and literacy.
HDI (Human Development Index)	United Nations ¹	This index, on a scale of 0-1, is an aggregate of three indicators: life expectancy at birth, literacy rates, and real GNP per capita.
HSI (Human Suffering Index)	Population Crisis Committee ¹	This index adds, on scale of 10, GNP per capita, inflation, job growth, unborn population growth, access to clean drinking water, infant mortality, adult literacy, food sufficiency, and personal freedom.
GSP (Gross Sustainable Product)	Kenneth Boulding ²	Measures the ratio between the value of goods and services based on sustainable resource use, reuse, and recycling over the value of goods and services based on the throwaway use.
NPP (Net National Product)	Robert Repetto ³	Measures the costs of depletion of natural resources (<i>e.g.</i> fossil fuel, mineral ores, etc.) and subtracted from GNP.
ISEW (Index of Sustainable Economic Welfare)	Herman E. Daly and John B. Cobb, Jr. ²	This comprehensive index includes per capita GNP adjusted for inequalities in income distribution, depletion of non-reuseable resources, loss of wetlands, loss of farmland due to soil erosion and urbanization, cost of air and water pollution, and estimation of long-term environmental damage from global changes such as ozone depletion and projected global warming.

¹ Miller (1992); ² Miller (1991); ³ Repetto (1989).

- (1) Evaluating and estimating the cleanup costs;
- (2) How would these cleanup costs be treated, as expense or are they to be capitalized?
- (3) How are contingent liabilities arising from environmental cleanup costs to be accounted for? Are these contingent liabilities being disclosed?

The Clean Air Act of 1990 addresses the emission of sulphur dioxide, a by-product of the use of coal and oil by electric-generating utilities. There are two important provisions of the law: (1) the creation of the so-called “allowances” which are rights to emit sulphur dioxide and (2) the establishment of a market and a bank for the “allowances.” “Allowances” can be acquired in two ways: (1) buying from a bank where allowances are bought and sold, and (2) earning the allowances through aggressive conservation, installation of pollution-control equipment, using clean fuels and replacing old generating plants with modern cleaner-burning plants. There are, however, accounting issues related to “allowances.”

- (1) Are “allowances” assets?
- (2) If “allowances” are assets, how are these valued? At cost or market? How should cost or market be established?
- (3) As assets, how are “allowances” to be classified—as inventory, marketable securities, intangible assets?

Dilemmas of Green Accounting

There are numerous concerns in accounting for environmental costs. The main concern is the ability to account fully for the costs of environmental damage. There is a call for “true-cost” accounting which will internalize the so-called “external costs” of the use and pollution of natural resources such as land, air, and water. These costs include: (1) costs incurred that relate to environmental matters, (2) future environmental costs resulting from past activities, and (3) social costs arising from environmental damage. Costs incurred that relate to environmental matters include cleanup costs and equipment purchased to comply with environmental laws or regulations. Future costs that result from past activities may include possible cleanup costs and health costs of employees and customers. Social costs arising from environmental damage include a wide range of activities from health problems of society brought about by pollution of air, water, and land to loss of utility of air and water by future generations.

Accounting, however, does not deal with all types of costs equally well. Accounting is historical in nature. It deals best with past transactions or events that already have occurred. Thus, accounting for environmental costs that have already been incurred presents no problem to accountants. Environmental costs that accountants find easy to account for include costs in: (1) studying the environmental problems, including the hiring of experts to study the problems, (2) costs of cleaning up toxic materials, and (3) costs incurred to prevent future contamination. Accounting for contingent liabilities as a result of past activities is more complex because of the uncertainty of the amount, timing, and possibility of future losses. When and to what extent should future possible contingencies adjust or be disclosed in financial statements? Liabilities would be recognized in the financial statements if at the date of the financial statement it is probable that a

liability has been incurred and the amount can reasonably be estimated. If the amount cannot be estimated or the probability is only reasonably possible, then disclosure is necessary. Otherwise, no disclosure is required. Attempting to apply these rules to social costs presents a dilemma to the accounting profession. An array of questions need to be discussed and answered by the profession such as:

- How much value do we place on air and water we consume? On air and water we pollute?
- How do we value health costs caused by polluted air and water?
- How do we value future costs related to present and future environmental damage?

Attempting to recognize social costs before they are actually incurred violates the very foundation of historical cost accounting and the generally accepted principles of objectivity, matching of costs against revenues, and conservatism.

Proposals for Green Accounting

Rubenstein (1991) proposed accounting for natural resources and environmental costs as part of regular accounting. His proposal included setting up a natural asset trust account with assigned physical and monetary values that would be part of a company's financial statements. The value of the land used as a dumpsite (Rubenstein 1991) would be the higher of potential cleanup costs or the estimated discounted cash value of the land's future productive value over its natural regenerative life cycle. As the company starts dumping waste onto the land, an expense will be recognized in the company's books with a corresponding credit to a liability account which would be a reduction to a natural asset trust account. This liability account would eventually be paid to fund reclamation efforts. His proposal accomplished two things: (1) by recognizing a depletion in the value of a natural resource asset, it makes a point that land is degradable; and (2) by setting up a liability account which eventually will be paid, it assures that the asset would be restored to its original state.

Wainman (1991) proposed a separate environmental accounting area of specialization. A separate set of environmental accounting statements would be subject to a different set of accounting principles and standards. By making environmental accounting independent from other accounting areas, it would free environmental accounting from the constraints of a historical cost accounting. This would then enable the recognition of all types of environmental costs and activities.

Both the accounting profession and corporations are reluctant to address the necessity of recognizing environmental costs and activities. The accounting profession's reluctance is caused by the uncertainty of the values to be placed on numerous environmental activities. The attendant valuation procedures would involve estimations of many environmental costs, some of which may never even happen in the future. To accommodate a call for "full accounting" of costs to include environmental costs would mean changing the very foundation of accounting.

Corporations have been slow to react to the greater need for sensitivity to the environment because there have been no incentives for them to do so. Our current accounting practices penalize corporations who are environmentally responsible

by hurting the "bottom line" of their Income Statement. Smaller bottom lines for them lowers their earning per share, which affects the interest of stockholders.

The above concerns of the accounting profession and the corporate world were not addressed by the proposals made by Rubenstein (1991) and Wainman (1991). Accounting procedures must be established that will sensitize corporations into making expenditures to meet their environmental responsibilities and yet would not penalize the "bottom line" of their general financial statements.

We propose a "green accounting" model which includes the following features:

- (1) Creation of separate natural resource accounts, *e.g.* assets, liabilities, revenues, expenses, gains and losses.
- (2) A separate accounting for all environmental costs and activities, apart from financial statements prepared in accordance with generally accepted accounting principles (GAAP). Environmental costs would include not only actual expenditures but also social costs and opportunity costs recognized using more liberal contingency rules than under GAAP, as, for example, from loss of use of a natural resource.
- (3) When those environmental costs actually occur they would be recognized in the regular accounting system as under current GAAP and find their way to the general financial statements. Environmental costs that are incurred with future alternative uses can be capitalized and identified as a green asset. Otherwise, all costs incurred should be identified as an environmental cost and expensed.
- (4) Potential environmental costs which have been incurred and are not recognized under current GAAP would be recognized in the "green accounts" created earlier, which would then be summarized and shown in a supplemental or satellite Income Statement and Balance Sheet. The results of these satellite statements would be updated as new potential and actual transactions occurred. Actual costs would be transferred to the general financial statements, while updated potential environmental costs would be reflected in the separate "green" financial statements.

Using a satellite model of green accounting is imperative (World Resources Institute 1991). A satellite Income Statement and Balance Sheet would highlight the corporation's sensitivity to the environment, create good public image for the corporation and help build goodwill and future customers. These statements would also help show compliance to government laws and regulations on the environment. In addition, treating the results of green accounting as a supplemental rather than an integral part of the regular financial statements avoids reducing earnings per share and lowering the "bottom line," which would encourage its use. Case studies to test the applicability of this green accounting model are currently in progress.

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ORLANDO, FLORIDA

DATE: 13–16 APRIL 1994

Please note the following deadlines which are to be met before our 55th Annual Meeting hosted by the University of Central Florida, Orlando, FL.

- 15 November 1993 — *New deadline date* for titles and abstracts of papers and posters. *Blue abstract forms will appear in the October 1993 issue of the Bulletin.*
- 30 October 1993 — Nominations for ASB officers and executive committee.
- 1 February 1994 — Applications for travel awards for graduate students.
- 1 December 1993/
1 February 1994 — Notice of research awards.

ASSOCIATION AFFAIRS

1993 MERITORIOUS TEACHING AWARD



Dr. Eloise Carter

The ASB Meritorious Teaching Award, sponsored by the *Carolina Biological Supply Company*, is considered the most prestigious award of the Association. The award, accompanied by a \$1,000.00 check, is presented at the annual banquet and is considered one of the highlights of the meeting. The recipient this year is Dr. Eloise Brown Carter, Associate Professor of Biology, Oxford College of Emory University. Dr. Carter earned the A.B. degree from Wesleyan College, Macon, Georgia, and the M.S. and Ph.D. degrees from Emory University. Prior to her appointment to Oxford College, Dr. Carter held faculty positions at Emory University and Agnes Scott College. She has an exceptional record in teaching, research, and service in biology. Documents which accompanied her nomination established that she is an excellent teacher. Former students write of her "love of biology," "true passion for teaching," and "enthusiasm for teaching never before experienced." Also, there is evidence that she promotes and directs undergraduate research and seeks internships and off-campus research experiences for her students. Dr. Carter has made significant contributions to biology through her own research and publications in plant ecology and genetics. In recent years, she has received several research grants, including the 1987 ASB Faculty Research Award. She is a member of several professional organizations and honor societies, including Phi Kappa Phi and Sigma Xi. Finally, Dr. Carter's teaching is not limited to the classroom, laboratory, and field. She is actively involved in communication

scientific and technical information to the public sector. Truly she is deserving of the 1993 ASB Meritorious Teaching Award.

ASB Bulletin Staff

Editor—Frank J. Schwartz, Institute of Marine Sciences, University of North Carolina, 3431 Arendell Street, Morehead City, NC 28557 (919/726-6841; Fax 919/726-2426).

Associate Editor—Nancy C. Coile, FL Dept. Agr. Consumer Services, Division of Plant Industry, P.O. Box 147100, Gainesville, FL 32614 (904/372-3505 ext. 402; Fax 904/633-2300).

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Stewart A. Ware, Biol. Dept., William and Mary College, Williamsburg, VA 23185 (804/221-2233; Fax 804/565-MITE).

1995: Cliff R. Hupp, U.S. Geol. Survey, 3850 Holcomb Brdg. Rd. Suite 160, Norcross, GA 30092 (404/409-7700; Fax 404/409-7725).

Geraldine W. Twitty, Zool. Dept., Howard University, Washington, DC 20059 (202/806-6953; Fax 202/806-4564).

- 1996: Claudia L. Jolls, Biol. Dept., East Carolina University, Greenville, NC 27858-4353 (919/757-6295; Fax 919/757-4178).
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1993 RESEARCH AWARDS

THE ASB FACULTY AWARD was presented by Dr. E. Clebsch to Daniel W. Llewellyn for his paper, coauthored with Dr. Gary P. Shaffer, entitled "Marsh restoration in the presence of intense herbivory: the role of *Justicia lanceolata* (Chapm.) small" (ASB Abstr. 108, vol. 40(2). 1993).

STUDENT RESEARCH AWARD, supported by the Martin Microscope Company of Easley, SC, was presented by Dr. D. Young to Rebecca Yeomans on "Turtle orientation: field tests of a water-finding ability in adult aquatic turtles" (ASB Abstr. 237, p. 146, vol. 40(2)). The award consisted of a plaque and a \$500 check.

EUGENE P. ODUM AWARD was presented by Dr. A. Ash to C. Stewart for the paper on "Phylogeny of cranberry (*Vaccinium macrocarpon*) populations from



ASB Executive Officers for 1993



New President Ken Marion receiving gavel from Past President Ross Hinkle



Multiple award winner R. Yeomans with Meritorious Teaching Award recipient Dr. Eloise B. Carter

random amplified polymorphic DNA (RAPD) data" (ASB Abstr. 249, p. 149). The award consisted of a plaque and a check for \$250 from the Southeastern Chapter of the Ecological Society of America.

SOUTHERN APPALACHIAN BOTANICAL SOCIETY AWARDS presented by Dr. J. Herr were as follows:

The Windler Award Committee—Bob Haynes, Jim Matthews, and David Whetstone—gave the Richard and Minnie Windler Award for the best systematic botany paper to appear in *Castanea*, 57(1): 52–65, to Warren Frank Lamboy for



Award winners Slack, Stewart, Cash, Baugh, and Yeomans

his paper, "The taxonomic status and probable origin of *Aster chlorolepis*, a southern endemic."

Dr. Lamboy integrated traditional techniques with new numerical methods to discern species relationships of this Appalachian endemic.

THE ELIZABETH ANN BARTHOLOMEW AWARD is presented to individuals who have distinguished themselves in professional and public service that advances our knowledge and appreciation of the world of plants and their scientific, cultural, and aesthetic values.

Selected for this year's award was Dr. Roy B. Clarkson of West Virginia University.

NORTH CAROLINA BOTANICAL AWARD was presented by Dr. B. Collins to Rebecca A. Case of the University of Tennessee, coauthored with Dr. E. Clebsch, on "Demography and size changes in two populations of *Cimicifuga rubifolia* Kearney" (ASB Abstr. 87, p. 108).

SOUTHEASTERN SOCIETY PARASITOLOGISTS-BYRD AWARD was presented by W. Font to R. Kohl and C. Barker.

SOUTHEASTERN DIVISION AMERICAN SOCIETY ICHTHYOLOGISTS AND HERPETOLOGISTS awards were presented by Dr. K. Dodd in Ichthyology to W. Slack of University of Southern Mississippi, coauthored with S. Ross and J. Huebner, on "Floodplain use of a Mississippi low order blackwater stream" (ASB Abstr. 145, p. 122) and in Herpetology to Julie Baugh, Townson State University, on "territorial prior residence effect in the dart-poison frog, *Dendrobates pumilio*" (ASB Abstr. 180, p. 132).

NOTE—the first call for papers and their abstracts are now due 1 November 1993 instead of 1 December, as in the past. This change will permit the host program chairman more time to prepare the program properly. A second call and the *blue abstract forms will appear in the October issue.*

RESOLUTION OF APPRECIATION TO OLD DOMINION UNIVERSITY, ADMINISTRATION, FACULTY, STAFF, STUDENTS, AND LOCAL ARRANGEMENTS COMMITTEE

WHEREAS, Old Dominion University and its President, Dr. James V. Koch, and the Dean of the College of Arts and Sciences, Dr. Paul J. Homsher, graciously invited the Association of Southeastern Biologists to hold its 1993 and 54th annual meeting in Virginia Beach, Virginia, with the University as host; and

WHEREAS, Old Dominion University and immediate community have extended to the membership of the Association their cooperation and assistance in addition to hospitality and friendship; and

WHEREAS, the Local Arrangements Committee Chair, Dr. Frank P. Day, and Program Chair, Dr. Harold G. Marshall, of the Department of Biological Sciences and their co-workers have given generously of their time, expertise, and enthusiasm to organize and conduct an enjoyable and productive meeting;

THEREFORE BE IT RESOLVED that the members of the Association of Southeastern Biologists express their gratitude and respect to Old Dominion University and to the Department of Biological Sciences for contributing to the continued success of our organization.

Graduate Student Travel Award Recipients

Thirty-seven applicants received funds to assist them in attending the Virginia Beach meetings. The number following each name refers to the abstract as found in the ASB Bull. Vol. 40(2), 1993.

- | | |
|-----------------|-------------------|
| S. Aulick 153 | E. Moore 112 |
| C. Beard 195 | L. A. Mullins 63 |
| C. Britson 236 | D. Nash 152 |
| P. Byrd 47 | M. Nowlin 151 |
| D. Chaffin 140 | L. Ordiway 186 |
| R. Cook 87 | C. Parkinson 181 |
| K. Daniels 113 | E. Pauley 30 |
| R. Duff 64 | N. Powers 62 |
| E. Emery 109 | A. Schildt 158 |
| S. Franklin 61 | P. Snyder 159 |
| J. D. Fritz 114 | T. Stark 97 |
| J. Graves 29 | L. Strazzante 160 |
| B. Green 71 | N. Summers 32 |
| T. Hayes 110 | N. Turrill 154 |
| J. C. Holt 143 | B. Wiltshire 51 |
| T. Jones 111 | S. Wisner 89 |
| K. McDaniel 37 | R. Wyrick 135 |
| C. Miller 42 | L. Zettler 96 |
| G. Mills 149 | |

Necrology

Bernard Lowry, Louisiana State University, Baton Rouge

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
TREASURER'S REPORT

1 JANUARY 1992-31 DECEMBER 1992

I. BEGINNING BALANCE		\$15,187.40	
II. RECEIPTS			
Regular Dues	\$19,560.00		
Patron Memberships	1,900.00		
Annual Meeting	4,873.05		
Bulletin Page Charges	1,682.54		
Directory Sales	197.00		
Interest	<u>431.91</u>		
TOTAL RECEIPTS		\$28,694.02	
III. TOTAL RECEIPTS AND BEGINNING BALANCE			\$43,881.42
IV. DISBURSEMENTS			
1. Membership			
Dues notices	321.61		
Brochure	<u>171.48</u>	493.09	
2. Publication			
ASB Bulletin 39(1)	3,491.28		
ASB Bulletin 39(2)	6,900.89		
ASB Bulletin 39(3)	3,649.65		
ASB Bulletin 39(4)	5,132.95		
Reprints	<u>219.75</u>	\$19,394.52	

3. Officer Expenses			
Post/copy/Interim	470.58	435.58	
4. Official Travel	589.00	589.00	
5. Awards and Honoraria			
Student Travel Awards	2,999.81		
Speaker Travel Expenses	472.00		
N.C. Botanical Garden Award	100.00		
Plaques & Certificates	93.51		
Research Awards	<u>1,000.00</u>	\$ 4,665.32	
6. Miscellaneous			
AIBS Affiliation	259.50		
Assoc. Sys. Col. 92, 93	100.00		
Miscellaneous	<u>253.02</u>	\$ 612.52	
TOTAL DISBURSEMENTS			\$26,225.03
V. ENDING BALANCE			\$17,656.39
ENRICHMENT FUND			
BEGINNING BALANCE		\$11,382.84	
RECEIPTS			
Gifts	487.14		
Interest	<u>415.21</u>	\$ 902.35	
ENDING BALANCE			\$12,285.19

Editor's Report 1992

A total of 196 pages, versus 189 in 1991, was published in ASB Bulletin Volume 39. One eight-page paper and one symposium on Ecology in Education (with three papers and reports, totaling 37 pages) appeared in the volume. Society items, reviews, news of biology in the Southeast, and abstracts (34 pages) accounted for 151 pages of the volume. A new three-year contract, following consultation with the president and president-elect, was signed with Allen Press to produce the Bulletin through 1995. Minor increases in cost will occur in 1994 and 1995, while 1993 production costs remain unchanged from those in 1992.

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ANNOUNCEMENTS

Phylogenetic Systematics Video Concepts and Application Copyright 1992

Eugene G. Majurakis and Williams S. Woolcott
Biology Department, University of Richmond, Richmond, VA 23172 U.S.A.

Concepts and application of phylogenetic systematics are presented in a two-part 25-minute video. Part I describes the development of a cladogram. In part II, cladistics is applied to an ethological phylogenetic analysis of relationships among cyprinid minnows that breed over gravel substrates. The video, accompanied by an instructor's manual, is an educational tool that can be used as an introduction to phylogenetic systematics.

U.S. standard video format (NTSC) and PAL/SECAM formats available. Contact Dr. Maurakis (804) 289-8977.

REQUEST FOR CONSERVATION ISSUES

The Conservation Committee would like to know the issues that ASB Members feel the committee should address over the short- and long-term. In recent years, this committee has generated resolutions on wetlands, biodiversity, and National Wildlife Refuge congressional legislation. We are not bound to only provide draft resolutions. There is a variety of actions our association could involve itself. Thus, we would also like your input on how this committee and our Association may facilitate the ecologically wise use or preservation of regional, national, and global resources. Please let us know your greatest conservation related-concerns and how you feel this committee may best serve our Association.

The Association represents a large number of the biologists in the Southeastern United States, which could serve as a resource to various other organizations and agencies. In addition to your input on conservation issues, the committee would like to know of individuals who would be willing to serve as speakers or consultants, or as members of state-oriented conservation subcommittees.

Please send your thoughts, ideas, or comments to: Cliff R. Hupp, Chair, ASB Conservation Committee, U.S. Geological Survey, 3850 Holcomb Bridge Road, Suite 160, Norcross, GA 30092; (404) 409-7709; FAX 404-409-7725.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS SURVEY OF BIOLOGY PROGRAMS IN THE SOUTHEAST

Please submit either a copy of the survey or the original by 1 September 1993 to: Dr. G. Middendorf, Department of Biology, Howard University, Washington, DC 20059. Thank you.

NOTICE: A limited supply of copies of two North Carolina Agricultural Experiment Station Technical Bulletins are available without cost:

Baranski, M. J. 1975. An Analysis of Variation within White Oak (*Quercus alba* L.). Tech. Bul. No. 236, 176 pp.

Kologiski, R. L. 1977. The Phytosociology of the Green Swamp, North Carolina. Tech. Bul. No. 250, 101 pp.

Requests should be sent to Dr. Ernest D. Seneca, Department of Botany, North Carolina State University, Raleigh, NC 27695-7612.

John Cairns, University Distinguished Professor of Environmental Biology, has been elected a Fellow of the Linnean Society of London. The Society, which was founded in 1788, is now the oldest extant scientific society in the world devoted to natural history. It takes its name from the celebrated Swedish naturalist Carl Linnaeus (1707–1778). Among early members of the Society were some of the great names in biology—Sir Joseph Banks, Charles Darwin, Sir Joseph and Sir William Hooker, Thomas Henry Huxley, and Alfred Russel Wallace. Among Cairns' other honors are: Member, National Academy of Sciences; Life Achievement Award in Science from the Commonwealth of Virginia and the Science Museum of Virginia; Award of Excellence, American Fisheries Society; Fellow, American Academy of Arts and Sciences; United Nations Environmental Programme Medal for Unique and Significant Contributions to Environmental Restoration and Sustainability; Morrison Medal for Outstanding Accomplishments in the Environmental Sciences (awarded at the American Chemical Society Pacific Rim Conference); Icko Iben Award for Interdisciplinary Research, American Water Resources Association; Founder's Award, Society for Environmental Toxicology and Chemistry; President, American Microscopical Society; Superior Achievement Award, U.S. Environmental Protection Agency; Charles B. Dudley Award for Outstanding Publications, American Society for Testing and Materials; Presidential Commendation; and Fellow, American Association for the Advancement of Science.

LATE ABSTRACTS

BONNER, LISA A.,¹ FRANK S. MENNITI,² and JAMES W. PUTNEY.² Peace College¹ and National Institute of Environmental Health Sciences²—*Calcium inhibition by an antiproliferative drug, L-651 582, in rat parotid acinar cells.*

Agonist-activated calcium mobilization is an important intracellular signal. A model for agonist-activated calcium mobilization involves two processes: (1) agonist-mediated release of intracellular calcium stores by the second messenger (1,4,5) IP₃, and (2) stimulated calcium influx from the extracellular medium. The mechanism governing the second phase of calcium mobilization is not fully understood but seems to depend on the disposition of calcium in the IP₃-sensitive organelle. Recently L-651 582, a novel antiproliferative, antimetastatic agent, has been shown to inhibit agonist-stimulated calcium influx and therefore may be a useful tool for studying the mechanisms of the second phase of calcium mobilization. In order to gain information on the effect of L-651 582 on calcium signaling, we used thapsigargin-induced calcium influx as a model for our experiments with intact rat parotid acinar cells. Thapsigargin is a tumor promoter which induces calcium influx, equal to that induced by agonist, by depletion of the intracellular calcium-storing organelle. We chose this approach because the effects of L-651 582

can be ascertained in the absence of possible effects on membrane receptors and/or inositol phosphate metabolism. Our data suggest that, in the therapeutic range, L-651 582 inhibits calcium influx but does not appear to block calcium efflux from the cell, nor does it inhibit IP₃-induced calcium release from the intracellular store.

PETERSEN, RAYMOND L., KEN V. LOATS, and JOANNE REBBECK. Howard University, Denison University, and U.S. Forest Service at Delaware, Ohio—*Effects of ozone on the fern *Osmunda cinnamomea* L.*

In a controlled experiment, employing open-top fumigation chambers, plants of *Osmunda cinnamomea* were assessed for the effects that ambient and twice ambient levels of ozone, might have on them. Based on image analysis for foliar damage, SPAD readings, total chlorophyll, photosynthetic rate, and dry weight determinations, it was found that the cinnamon fern is susceptible to the deleterious effects of ozone. Plants exposed to twice ambient levels of ozone showed significantly higher levels of foliar necrosis and drops in productivity when compared to plants grown in the presence of charcoal-filtered air. Symptoms of ozone toxicity, though less developed, were also detected in plants grown at ambient ozone levels.

BETA BETA BETA ABSTRACTS

DISTRICT I

Albert Kirk, Sigma Nu Chapter, University of Tampa—The effects of high temperature stress and relative humidity on the darkling beetle, *Tenebrio molitor* (Coleoptera).

Studies were conducted in order to determine the effects of high temperature stress and relative humidity on evaporative water loss (EWL) in various life cycle stages of the terrestrial beetle, *Tenebrio molitor*. Larval, pupal, and adult insects were exposed to a combination of temperature (30, 35, 40 C) and relative humidities representing xeric (10%) and mesic (70%) conditions over a 24-hour exposure period. Weight loss in milligrams was used as the index for EWL. Results indicated the EWL was significantly higher under high temperatures (40 C) and xeric conditions for all life cycle stages. The pupae were the most resistant stage, and the adults were least resistant to EWL. For larvae, exposure to high temperature and dry air resulted in significant EWL after only 2 hours of exposure, whereas in adults these effects were not observed until after 6 hours of exposure. The adaptive significance of these parameters will be discussed.

Traci E. Battle, School of Biology, Georgia Institute of Technology—Biochemical characterization of the mate recognition pheromone in *Brachionus plicatilis* (Rotifera).

Chemically mediated interactions among zooplankton are thought to regulate many important ecological processes, including mate recognition. The objective of this research is to investigate how male and female rotifers communicate and to understand the ecological consequences of this interaction. Mate recognition in the rotifer *Brachionus plicatilis* has been shown to be mediated by cell surface glycoproteins, which were purified using lectin affinity chromatography. Electrophoretic separation of glycoproteins on 12% SDS gels, revealed ten protein bands with molecular weights of 128, 94, 84, 76, 64, 53, 49, 37, 29, and 22 kilodaltons. Glycoproteins were radioactively labeled with tritiated glucosamine, mannose, and fucose and electrophoretically characterized. Male mating bioassays with the purified female glycoproteins covalently linked to sepharose beads elicited 26 male contacts. Male receptor binding bioassays were performed by labeling the purified glycoproteins with biotin and exposing them to males. Sites of male receptor binding were visualized with fluorescently labeled avidin, which binds to biotin, demonstrating that one or more of the purified female glycoproteins is recognized by male receptors. These findings indicate that the purification techniques used isolated a smaller number of glycoproteins which can account for mate recognition in rotifers.

Kimberly Buntin, Tri-Beta, Florida Institute of Technology—The effects of temperature and salinity on the growth of freshwater prawn (*Macrobrachium rosenbergii*) postlarvae.

Macrobrachium rosenbergii is a tropical freshwater prawn. Presently, a major constraint of freshwater prawn farming is climate. Understanding the effects of temperature and salinity of postlarval growth could increase worldwide culture, allowing expansion of freshwater prawn culture. Freshwater prawn (*Macrobrachium rosenbergii*) is an important aquaculture species in tropical and subtropical regions. The major constraint of its culture in the continental United States is climate. The prawn requires estuarine conditions during the larval stages, but lives in freshwater as juveniles and adults. Therefore, it is important to know how the salinity affects the prawn during the transition period when the prawn migrate as postlarvae from estuary to freshwater habitats.

A laboratory factorial experiment was conducted to test the effects of temperature and salinity on the growth of *Macrobrachium rosenbergii* postlarvae. Salinity (10 ppt) was found to retard growth, while, surprisingly, elevated temperature did not enhance to growth rates.

Michael Eric Frodyma, Sigma Psi, Florida Institute of Technology—*In vivo* footprinting of *Escherichia coli*'s chromosomal replication origin.

A fundamental step towards successful cell duplication is the replication of the genome. The regulatory mechanism for this process must be coordinated with cell growth. In *Escherichia coli*, replication of the circular chromosome is initiated once during the division cycle from a unique 245 base pair region termed *oriC*. The timing of regulatory protein interaction at binding sites within *oriC* must be a critical part of the initiation control mechanism. I examined the accessibility of *oriC* DNA in living *E. coli* to dimethylsulfate (DMS)-induced methylation. Protein binding is expected to block accessibility at some sequences and may increase accessibility at others. Patterns of DMS methylation within *oriC* are expected to change as proteins bind to or release from their binding sites at the moment of replication initiation. Changes in specific DMS methylation sites within *oriC* were measured in temperature-sensitive, conditional lethal, replication initiation mutants which initiate chromosome replication synchronously after shifting growth temperature from 42 C to 25 C. Accessibility of two novel sites in *oriC* changed at the time of initiation of chromosomal replication. These sites are found within the known binding site for a 12 kilodalton DNA bending protein called FIS. A model for the role of FIS in the regulation of initiation of chromosome replication will be discussed.

Teresa M. Napp, Tri-Beta, Florida Institute of Technology—The effects of temperature and salinity on the survival of *Penaeus duorarum* juveniles.

The pink shrimp (*Penaeus duorarum*) is the most abundant Penaeid shrimp found in Florida estuaries with high water temperatures and fluctuating salinities. This experiment tested for the effects of different salinity levels (ranging from 15 ppt to 35 ppt with 5 ppt intervals) with high water temperatures (32–35.5 C) on the survivorship of pink shrimp juveniles. The mortality rates generally decreased with increased salinity.

Philip Diller, Tri-Beta Florida Tech—Colorful seeds: deception or aposomatic coloration?

Palatable fruits are often brightly colored and have coevolved with vertebrate dispersers as a signalling mechanism. One paradox is the evolution of seed types which are brightly colored yet unpalatable. Are these seeds mimics (Batesian) of palatable fruits or are they brightly colored to warn potential predators of their distastefulness? For example, *Abrus precatorius* produces seeds which have been described anecdotally as highly unpalatable and whose bright red and black colors may serve to mimic other edible fruits. An experiment was designed to test quantitatively whether *A. precatorius* is employing Batesian mimicry or aposomatic coloration to warn predators of unpalatability. *Momordica charantia* and *Magnolia grandiflora* were selected as models, because of their similar appearance to *A. precatorius* and their palatable fruit. The data collected suggest that the color pattern in *A. precatorius* serves to mimic model fruits and to deceive animals, so gaining dispersal.

Jennifer Mercure, Tau Epsilon, Kennesaw State College—Ossabaw Island sea turtle project: Summer 1991.

As part of an ongoing study for the Georgia Department of Natural Resources, the nesting behavior of the endangered Loggerhead sea turtle, *Caretta caretta* was monitored from June through August of 1991 on the remote beaches of Ossabaw Island. Nests were counted daily and assigned numbers for reference purposes. In addition, false crawls, tidal inundation of nests, predatory effects, sea turtle strandings, and hatchling emergence were recorded. Since predation rates by feral hogs have been extremely high on Ossabaw, protection of nests was attempted through relocation of nests to hatcheries and screening of nests left on the beach. Despite protection efforts, hog predation remained high, calling for a new approach to the management of the island's feral hog population. Nests in the hatcheries, however, were well protected from hogs. Several of these nests hatched during the project period, suggesting the effectiveness of hatcheries at simulating natural nesting conditions. Hatchling emergence from natural nests was also noted late in the season, and hatching success rates were determined when possible. In addition, a decline in sea turtle strandings was recorded, possibly because the TED (Turtle Exclusion Device) ruling was instituted and remained in effect throughout the summer. Overall results show nesting is on the increase from previous years, reaching nearly as high as the peak in 1981. As a result of this study, a plan for the management of the feral hog population was implemented the following year, and hatcheries are being used more extensively.

M. Susan Hamel, Tau Epsilon, Kennesaw State College—Measurements of coliform bacteria: a comparison of two methods.

A direct comparison of the Fecal Coliform Membrane Filtration technique and the Colilert MPN Procedure, methods employed for the measurement of water-borne coliform, was the directive of this study. Secondary goals involved an evaluation of the convenience of the two techniques with respect to sampling, preparation, processing and reading of results. In this study data taken over four months from ten different sampling sites (five tributary sites feeding Lake Allatoona and five sites from Lake Allatoona proper) were analyzed to compare the recovery of fecal coliform bacteria from lake and tributary waters using the Membrane Filtration technique, and the recovery of total coliforms and *E. coli* using the Colilert MPN technique. Total coliform and fecal coliform showed no correlation. However, fecal coliform and *E. coli* showed a small correlation because fecal coliform increased as *E. coli* increased.

Amy Lilly, Sigma Nu, University of Tampa—Development of a defined medium for micropropagation of *Halophila englemannii*.

Seagrass micropropagation is an important new technique in the development of revegetation processes and for the study of seagrass physiological ecology. The goal of this study was to develop a completely defined growth medium for *Halophila englemannii* in axenic culture. To mimic the requirements for successful growth provided by coconut water, a series of trials with additions of vitamins and other complex organic compounds was run. Trials with nicotinic acid showed some negative growth affects, such as decreased new node production. The results of ongoing trials with biotin and vitamin + amino acid mixtures will be discussed.

Robert J. Moraca, Tau Nu, The Citadel, The Military College Of South Carolina--A scientific look at the cultural conception that riparian deforestation will reduce *Culicidae* populations.

Population counts of *Culicidae* were determined along forested, cleared and developed riparian areas in the Stann Creek District of Belize. A significant reduction in population size occurred in cleared riparian areas when compared to the forested areas. This would suggest that the clearing of land helps to reduce *Culicidae* populations. The results from the diel investigation showed that mosquitos are more active between 2100 and 2400 hrs; this was expected since the nocturnal, diurnal, and crepuscular species would all be active.

Brent Hall, Sigma Nu, University of Tampa—The effects of herbicides on the growth of epiphytic diatoms.

Runoff of herbicides and their effects on aquatic systems are an area of concern to fisheries managers. Diatoms are at the bottom of the food chain and are important food sources for juvenile fish and invertebrate prey species. Runoff of herbicides may affect the growth of epiphytic diatoms in estuaries, yet little research has been done in this area. This study looked at various concentrations of common herbicides on the growth rate of an epiphytic diatom *Cylindrotheca* sp. N1. During lag phase growth C. N1 showed growth enhancement at 0.5 μ M 2,4-D. Growth suppression was noted at concentrations greater than 2.0 μ M. Results of trials with atrazine will also be discussed.

DISTRICT II

Raymond Hix, University of North Alabama, Beta Zeta Environmental Sciences Division—Determining the metabolic status of microbial populations in polluted sediments using TLC-FID lipid analysis.

Microbial phospholipids were isolated and quantified from coal ash sediments and pure bacterial cultures using thin layer chromatography-flame ionization detection (TLC-FID). The lipids were

extracted from samples using a modified Bligh and Dyer technique. Microliter amounts of extract were spotted onto silica gel coated quartz rods. Development of the rods in multiple solvent systems in combination with varying scan lengths allowed separation of cardiolipin, phosphatidylcholine, and phosphatidylethanolamine. These phospholipids are common in bacterial membranes, and breakdown relatively rapidly after cell death. Their detection was used to determine biomass. As the percentage of fly ash in *Rhizobium leguminosarum* cultures was increased, bacterial phospholipids decreased.

Dana Pellegrin, Eta Lambda, Loyola University—Coastal variation in *Phragmites australis* found outside of the Mississippi River delta.

Previous isozyme studies of the common reed *Phragmites australis* indicate that only one phenotype is found throughout the entire Gulf Coast except in the Mississippi River delta, where two additional phenotypes exist. In an effort to assess variation outside of the Gulf Coast, collections were made in the Midwest, along the East Coast, and elsewhere in the United States and analyzed for isozyme variation.

Of the 12 enzyme systems assayed, no within-population variation was found for the 17 populations investigated (including a sample from the Gulf Coast and two from the Mississippi River delta). Unlike the Gulf Coast, which displays virtually no variation among populations, populations from the Midwest and the East Coast showed substantial interpopulational variation. Populations in the Rio Grande River Valley of Texas and the Florida interior displayed banding patterns very similar to that of the Gulf Coast phenotype. Monomorphism was displayed for all of the populations investigated in two of the enzyme systems.

Patrick O'Connell, Eta Lambda, Loyola University—A comparative study of the isozyme variations in Mississippi River delta *Phragmites australis*.

Phragmites australis, a common reed, has undergone recent progression in many areas of the Mississippi River delta and has become a dominant vegetation. Two subdeltas, West Bay and Baptiste Collette, were studied to determine the extent of isozyme variation present. Seventeen representative populations were sampled from within the two subdeltas. Isozyme analysis agrees with earlier studies made on other subdeltas indicating the presence of two dominant phenotypes. Another, unique, phenotype was also found in Baptiste Collette.

Janet Vaglia, Pi Delta, East Tennessee State University—A comparative development of the Osteocranium of two *Desmognathus* salamanders (family Plethodontidae).

Aquatic salamanders are large, lay aquatic eggs, and exhibit long larval periods, whereas, terrestrial species are smaller, have terrestrial eggs and short larval periods. These salamanders provide opportunities to determine whether development correlates with differences in life history. *Desmognathus ochrophaeus* metamorphoses at a small size in one year, and *D. quadramaculatus* metamorphoses after three years but at a larger size. Ossification sequences of cranial bones (not known for any *Desmognathus*) were used to compare development. Sample sizes were 48 (*D. quadramaculatus*) and 42 (*D. ochrophaeus*) and included larval to adult age-classes. Specimens were cleared-and-stained (modification of Taylor and Van Dyke 1985) to differentiate cartilage and bone. Skulls of hatchling larval *D. ochrophaeus* (<1-yr-old) have an ovoid shape, significant ossification of the cranium and mandible, and extremely early loss of the larval palatopterygoid. Skulls of 3-yr-old larval *D. quadramaculatus* show less ossification, are triangular-shaped, and have a persistent palatopterygoid. Conversely, bones of the braincase and jaw articulation ossify earlier in *D. quadramaculatus* than in *D. ochrophaeus*. It is hypothesized that either (1) the larger *D. quadramaculatus* has added a specialized larval stage or that (2) *D. ochrophaeus* has shortened larval development by compaction of early stages.

Patty Walchak, Mu Gamma, Western Kentucky University—Interleukin-2 production in *Trypanosoma cruzi*-infected mice maintained at elevated environmental temperature.

When maintained in 36 C environmental temperature, C3H mice infected with *Trypanosoma cruzi* survive an infection which is lethal to those mice maintained at temperatures between 24 and 26 C.

In order to study the role of cell mediated immunity in this phenomena, interleukin-2 (Il-2) concentrations in the sera of *T. cruzi*-infected mice were measured using an Il-2-specific, enzyme-linked immunosorbent assay. The results of this assay showed no significant differences in the Il-2 levels in the sera of *T. cruzi*-infected mice held at 36 C (26.9 pg Il-2/ml) and the controls—*T. cruzi*-infected mice held at 24 to 26 C (31.3 pg Il-2/ml), non-infected mice held at 36 C (17.6 pg Il-2/ml), and non-infected mice maintained at 24 to 26 C (25.1 pg Il-2/ml). Overall, Il-2 concentrations in the sera of *T. cruzi*-infected mice maintained at 36 C showed no significant variation throughout the 93-day study. The results of this study indicate that systemic Il-2 levels in *T. cruzi*-infected mice are not enhanced by elevated environmental temperature, suggesting that this cytokine does not play a substantial role in the survival of these mice.

Valerie Bodet and Chris Danner, Eta Lambda, Loyola University in New Orleans—Isolation and characterization of organellar genomes from synurophycean algae.

Little is known about the biology of the Synurophyceae, a class of flagellated, golden-brown algae. Protocols were developed to isolate the organellar genomes of several Synurophycean species. Hoeschst dye 33258 density gradients were used to isolate 2 satellite DNA species. Based upon published comparisons, these DNA's are believed to be of chloroplast and mitochondrial origin. Restriction endonuclease analysis was used to characterize the genomes. The potential of using these genomes in comparative studies for evaluating organellar evolution and algal systematics will be discussed.

Stephen E. Davis III, Beta Upsilon, Georgetown College, KY—Advective nutrient flux in tidal creeks of North Inlet, S.C.

A study was conducted to examine advective movement of nutrient rich interstitial water in tidal creeks of the North Inlet Estuary. Previous studies by Whitting and Childers (1989) have shown that this movement of interstitial water plays an important role in the nutrient dynamics of tidal creeks. A chamber was designed to tap into this interstitial water and measure its flow into the overlying water column. Three tidal creeks with different ontogenies were chosen for this study: 1) Town Creek, an old creek located less than 500 meters from the Atlantic whose sediments are 90% sand and about 10% clay; 2) Oyster Landing, a transgressive (young) marsh with a small terrestrial watershed and tidal influence whose sediments are similar to those of Town, but has an accumulation of silts and clays near the banks; 3) No Man's Friend, an old creek located on the tidal node between a large terrestrial watershed and the Atlantic's tide. No Man's Friend's sediment profile averaged about 50% sand and 40% silt. All nutrients measured (PO_4 , NO_3 , NH_4 , and DOC) were exported through advective flow. Town Creek displayed the largest flux of NH_4 and PO_4 ($92.290 \mu\text{g-at m}^{-2} \text{ tide}^{-1}$ and $19.960 \mu\text{g-at m}^{-2} \text{ tide}^{-1}$ respectively). Oyster Landing exhibited the largest flux of DOC ($34.556 \mu\text{g-at m}^{-2} \text{ tide}^{-1}$) and No Man's Friend had the greatest flux of NO_3 at $5.438 \mu\text{g-at m}^{-2} \text{ tide}^{-1}$. Overall, NH_4 was the largest export in the North Inlet, followed by DOC.

Nina Skinner, Eta Lambda, Loyola University of New Orleans—A comparison of the composition of the seed banks within *Scirpus*- and *Sagittaria*-dominated communities within the Mississippi River delta.

Seed bank studies have become increasingly important in recent years because their significance in relation to ecological theory and application has been recognized in studies on population dynamics, ecological succession, environmental management, and habitat disruption. A seed bank study on the virgin substrate of the newly deposited soils of the Mississippi River delta provides a unique opportunity to examine colonization events. Four study sites were established on three mudflats to quantify the richness and density of seeds by standard collections and *in vivo* germination techniques. Two collections of 10 cores from each site were made in the summer and fall. The seeds were allowed to germinate in a greenhouse to identify species and quantity of seedlings. A total of 17 non-woody species was collected. Sedges were the major constituents of the seed bank (74%), followed by grasses (21%) and forbs (5%). No *Scirpus* or *Sagittaria* germinated within the soil collected. Multivariate analysis of the results indicated a highly significant ($p = .001$) difference in the composition of the

seed banks between the *Scirpus*- and *Sagittaria*-dominated sites, while the three *Scirpus*-dominated sites had indistinguishable seed banks.

Nancy Ayers, Mu Gamma Chapter, Western Kentucky University—Isolation and partial purification of DNA polymerase gamma in spinach and soybeans.

DNA polymerase gamma, a large molecular weight polymerase associated with DNA replication in mitochondria and chloroplasts, was isolated from two plant sources, spinach and soybean leaves. Chloroplasts were initially isolated from the leaves by homogenization and centrifugation through a Percoll gradient. Further purification included ammonium sulfate precipitation, desalting by Sephadex G-50 column chromatography and DEAE-cellulose ion exchange chromatography. Protein concentrations were quantitated by spectroscopy and comassie blue assays. DNA polymerase gamma activity was assayed using ³H-labelled dTTP. Results indicated that the active enzyme from spinach chloroplasts was removed from the DEAE-cellulose column by elution with a 350 mM sodium phosphate buffer at pH 8.0. Results from soybean leaves indicate the presence of DNA polymerase gamma in chloroplasts associated with extra-nuclear DNA replication, yet at this time comparisons of the two enzymes require additional study.

Dawn Turner Mosby, Mu Gamma, Western Kentucky University—Topoisomerase I activity in soybean hypocotyls.

Topoisomerase I is an enzyme which relieves supercoils in DNA caused by the replicating fork. The enzyme breaks a single strand of DNA, which reduces tension on the strand, and repairs the break without the use of ATP. The purpose of this research was to characterize Topoisomerase I activity in the meristem (rapidly dividing cells) of soybeans. Following homogenization, proteins from the meristems were centrifuged and salted out with saturated ammonium sulfate. Further purification involved a G-25 sephadex column and DEAE cellulose ion exchange chromatography. Samples from column were assayed separately with pBR322, a supercoiled DNA plasmid. The presence of enzyme activity was determined by relaxation of supercoils as monitored by gel electrophoresis. The results of the experiment indicate that the first protein peak eluted off the DEAE column exhibits nuclease activity but not topoisomerase activity. The protein fraction eluted with salt (0.4 M KCl) exhibited a reduction in the amount of supercoiled DNA. Additional assays indicated a gradual reduction in the amount of supercoiled DNA over time. In conclusion, replicated studies demonstrate that the enzyme eluted with salt is Topoisomerase I.

REVIEWS

Ernst, Carl H. 1992. **Venomous Reptiles of North America.** Smithsonian Institution Press, Washington, DC. \$35 hard cover. 236 p.

This book's most disappointing aspect is its poor editing. A precursory scan of the text will reveal a large number of typographical and spelling errors. Many of these are misspelled scientific names. I will by no means list them all, but as an example, p. 69 contains at least seven misspellings (*Notropis* misspelled as *Notropus*, *Aphredoderus* misspelled as *Apherdoderus*, *Phalacrocorax* misspelled as *Palhalacrocorax*, *Porzana* misspelled as *Porzama*, "chickadee" misspelled as "chicadee," *Ammospiza* misspelled as *Amnospiza*, and *Pipilo* misspelled as *Papilo*). The names of several authors and contributors are also misspelled in the acknowledgements and literature citations in the text. A sentence (p. 61) made in reference to the defensive musk of the copperhead, reads: "Contrary to the folktale, this musk has its own odor and does smell like cucumbers." Apparently the intended statement was "... does not smell like cucumbers." An inconsistency in name usage is exemplified in the use of "eastern pygmy rattlesnake" as a common name for *Sistrurus miliarius miliarius* on p. 2, whereas the correct common name, "Carolina pigmy rattlesnake," is used elsewhere in the text. The caption for the photograph of *Sistrurus miliarius streckeri* on p. 83 is somewhat unclear, and might serve to mislead the reader into the impression that the specimen in the photograph was collected from Hermosa Beach, California (which lies well outside the species' range), rather than having been photographed in a private collection in that city. The range map for the pigmy rattlesnake depicts the range extending too far north in the Coastal Plain of North Carolina. The last sentence in the species account for the cottonmouth is poorly worded and its meaning is unclear: "Females comprised 53% of the adult specimens and in a group of 48 embryos (8 broods) examined by Burkett (1966)."

The book consists of an introduction with a strong plea for conservation, a key to identification of North America's venomous reptiles, a brief description of each of the three families of venomous reptiles on the continent, species accounts for all 21 species, an extensive bibliography, a useful glossary of scientific names, and a taxonomic and subject index. Illustrations include 55 color and 33 black and white photographs, several line drawings, and a range map for each species. The photographs are of generally good quality, though most are not particularly outstanding.

The species accounts are generally well written and informative, with strong emphasis on natural history. The format of each includes sections on recognition, karyotype, fossil record, distribution, geographic variation, confusing species, habitat, behavior, reproduction, growth and longevity, food and feeding, venom and bites, predators and defense, populations, and remarks. However, certain of these sections are missing from some of the accounts, for unknown reasons. For instance, the cottonmouth account is the only one for which a "remarks" section is absent. Surely there are remarks that can be made about such a well-known species. The accounts for *Crotalus mitchelli* and *C. tigris* lack sections on "populations." The yellow-bellied sea snake account lacks a section on "confusing species," and while it is true that that species is not easily confused with any other in the area, the same is true for the Gila monster, yet that fact is made mention of in the "confusing species" section in its species account.

Despite its poor editing (which seems very uncharacteristic of Smithsonian Press), this book is a valuable reference, representing the only recent comprehensive account of North America's venomous reptiles. Most herpetologists, as well as many other biologists and naturalists, will want access to a copy. Professionals as well as amateurs will find the book readable and useful. The emphasis on conservation of venomous reptiles should be praised. The price is within reason, but for all but the most avid herpetologists, I would almost recommend awaiting a second printing before purchasing a copy; perhaps by then the errata can be corrected, and this book will become the fine work that it otherwise is.

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Louw, G. N. 1993. **Physiological Animal Ecology**. John Wiley and Sons, NY. \$49.95. 288 p.

Physiological Animal Ecology is a book in the tradition of Knut Schmidt-Nielsen's *How Animals Work or A Companion to Animal Physiology* edited by Taylor *et al.* Dr. Louw proposes, in the preface, that his book should provide animal ecologists with an appreciation for the physiological adaptations exhibited by animals to their environments in order to make animals more than black boxes in an ecological construct. Additionally, he hopes to enlighten physiologists with regard to the broader ecological and evolutionary implications of their work. The book should serve to do both; however, it is more an environmental physiology text than an ecological treatise.

The book is divided into four chapters: Temperature and Thermoregulation, Water Relations, Nutrition and Energy, and Reproduction and the Environment. The first and third chapters are by far the stronger. Each chapter is elegantly and logically laid out with an initial explication of the physical and chemical principles underlying the material to be covered. Each proceeds to a discussion of physiological principles in general, and then goes on to describe "case studies" as specific examples of the basic principles. The chapter on temperature, for instance, first explains the basic ideas of the effect of temperature on biochemical reaction rate, the physical concepts of heat exchange (conduction, convection, radiation and evaporation/condensation), and the ways in which temperature and heat transfer are measured. This is followed by a discussion of the basic mechanisms of heat balance, control systems, metabolic rate, color and the evolution of endothermy. The chapter ends with specific examples, including actual data, from a variety of systems ranging from thermogenesis and freezing adaptations in insects to countercurrent heat exchangers in muscles of fish and brains of cheetahs.

The chapters on water relations and reproduction are light on the basic principles. In particular, the topic of water relations begins with a brief treatment of diffusion and osmosis and leaps straight into whole animal osmoregulation. The topic might well have been better introduced by an explanation of the need for all animal cells to avoid a Gibbs-Donnan equilibrium by moving salts and water. The advantages of whole animal osmoregulation would then follow logically and be put in evolutionary context. Likewise, the chapter on reproduction begins with hormonal control of mammalian reproduction, and only later in the chapter gives passing reference to basic concepts of sexual and asexual reproductive strategies.

Despite these few shortcomings, the book is extremely well written. The formalisms and equations are all well illustrated by intuitive examples and are well woven into the text. There is also abundant, and well chosen graphic material that supports all the major concepts. The result is a very readable book that should prove quite accessible to advanced undergraduates and graduate students. The book should serve the purpose of educating ecologists to the physiology related to their discipline and should serve to remind physiologists of the excitement that may still be found in the study of comparative physiology.

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Fielder, Peggy L. and Subodh K. Jain (eds). 1992. **Conservation Biology: The Theory and Practice of Nature Conservation, Preservation and Management**. Chapman and Hall, Inc., NY 10001. \$35.00. 507 p.

Among the more than 150 terms defined in the glossary of this book are the following: allelopathy, biodiversity, coevolution, ecotone, ecotype, genetic drift, island biogeography, landscape ecology, mycorrhizae, patch dynamics, restoration ecology, stochasticity, and weed species. Most biologists are familiar with the concepts represented by these terms but would assign each to a particular subdiscipline of biology such as evolution, ecology, genetics or demography. Conservation biology attempts to unify these and other biological concepts into an applied science. As John Harper says in the Foreword of this volume, "Nature conservation has changed from an idealistic philosophy to a serious technology." *Conservation Biology* makes an important contribution to this end by bringing together a broad spectrum of scientists and practitioners in this emerging field.

This book, more an anthology than a textbook, is an outgrowth of a graduate seminar in conservation biology held at San Francisco State University in 1988. The 18 chapters are arranged into four parts. The parts and one representative chapter of each cover: Part I, the Natural Order (Chapter 2, Peggy L. Fielder and Jeremy J. Ahouse, Hierarchies of Cause: Towards an Understanding of Parity in Vascular

Plant Species); Part II, Processes and Patterns of Change (Chapter 6, Peter B. Moyle and Robert A. Leidy, Loss of Biodiversity in Aquatic Ecosystems: Evidence from Fish Faunas); Part III, Population Biology and Genetics (Chapter 10, Eric S. Menges, Stochastic Modeling of Extinction in Plant Populations); and Part IV, The Practice of Conservation, Preservation, and Management (Chapter 18, G. Ledyard Stebbins, Why Should We Conserve Species and Wildlands?).

The editors, not unexpectedly, call in the Epilogue for continued efforts by workers in the various areas that fall under the umbrella of conservation biology to develop unifying principles for this emerging science.

References listed at the end of each chapter should be of great value to workers in this field. Graphs and black and white photographs are adequate but not necessarily attractive. This paperback publication is no doubt the best source of information for conservation biologists and other applied ecologists.

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Stoskopf, M. K. 1993. **Fish Medicine.** W. B. Saunders Co. Phila., PA. \$95.00. 882 p.

Medicine, by definition, is the art or science of treating diseases, especially by application of internal medicine. Stoskopf's aim is for fish medicine to become "a valuable tool in the development of clinical fish medicine." There are many pressures for such an approach: production of food as fishes continue to grow, increased fishery and medical management, needs of the increasing fish hobbyist trade, fisheries biology, and fisheries management. The book is designed to "focus on clinical approaches to living fishes, both as individuals and as populations." Forty-seven authors attempt to accomplish the humongous task of presenting available information in two large chapters: Part I—General Medicine is comprised of 17 chapters while Part II contains 85 chapters. Eight appendices (36 pp.) along with a species, subject index (27 pp.) round out the 817-page text.

On first reading one wonders if the book's aims have been met, for there are whole sections on taxonomy (Sects. 3, 4, 5, 8, h. 18, etc.) freshwater diseases, physiology (Ch. 3), eye (Ch. 2), water analyses (Ch. 13), reproduction, tropical freshwater fishes (Ch. 23, 37, and a rehash of Hoffman's freshwater fish disease book), reproduction (Ch. 47, 77, marine tropical fishes, p. 604) that are well done but are better and more completely treated in various books authored by Ali, Hoar and Randall (12 volumes), Koelath, Hoffman, Lagler *et al.*, Nelson and Spotte (see ASB Bull. 39(3): 129–130), etc. Deletion of this material would not have detracted from the volume and would have left room in most chapters to pursue a topic in depth rather than the usual 2–4-page chapters. Yet, if one considers that the book was aimed at the clinician who has little or no background, their exposure to the above aspects will save them time, serve as an education medium, and the book's aim at completeness. Deletion would also have saved some 200+ pages and subsequent reduction in pagination and production cost.

While fish medicine tries to cover every possible aspect, *i.e.* fish diagnostic labs, (Appdx. III), chemotherapeutics (Appendix V), there are numerous problems that will need to be corrected in a subsequent reprinting. Scientific names are all placed at the end in Appendix VI and instead common names are used throughout the text. This usage causes problems often as to which species is meant, *i.e.* anchovy is mentioned on p. 676 yet which species is really meant is uncertain for there are three species listed in the index p. 847; New Jersey anchovy, *Anchovia duodecim*, northern anchovy, *Engraulis mordax*, or silver anchovy, *Engaulis eurystole*. Otoliths, Chp. 15, are said to be of calcium rather than aragonite and other materials. Fish histology information, Chp. 2, we are told, are "relatively unavailable," p. 31, yet simple searching of the literature and medical journals reveals they are replete with fine histological photos and reports on various aspects of fish diseases, etc. The terms fish and fishes are improperly used on p. 247 for standard usage employs fishes to mean more than one species, fish only one species. Neoplasia (Chp. 28) also are known in the common sucker (Cancer Research 24(7): 1194–1201, 1964). Why do we need identical pH meters depicted in Figs. 75-2 and 75-4 on pages 621–622? Why is the tuna, a temperate-tropical inhabiting species, included with cold water fishes (Chp. 80)? Cownose rays, *Rhinoptera bonamus*, weigh up to 20 kg (45 lbs.) at most, not 45 kg (99 lbs.) as on p. 748. The marine leech *Stilarobdella macrothela*, a parasite of marine sharks, is omitted from Table 100-1, p. 778, while the monogenetic trematode, *Benedeniella posterocolpa*,

occurs abundantly on the cownose rays frequenting the western north Atlantic rather than just Florida (p. 784). Cownose rays, listed in the index, are missing on pp. 748–749, Table 100-1.

Stoskopf is to be commended for taking the bold and arduous task of bringing together the voluminous information that has a bearing on fish medicine. As he states in the foreword, Fish medicine is a “systematic and comprehensive review of the state of a clinical art. Use it wisely and it will help you answer important questions, discover new knowledge, and most of all, ask new questions.” *Fish medicine* is a must for everyone studying fishes, no matter the aspect.

FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Cox, George W. 1993. **Conservation Ecology.** Wm. C. Brown Co., Dubuque, IA. \$41.25. 325 p.

Textbooks written for lower division courses in environmental science/conservation abound. One author alone, G. Tyler Miller, Jr., currently has three titles in print, each suitable for a variation of such a course. However, for upper division and graduate level courses in conservation biology, the selection of texts is greatly limited. This book is one of the few currently designed for somewhat more advanced courses in applied ecology, and for those emphasizing a biological as opposed to a geological/geographical approach. The author, from San Diego State University, is known to many teaching ecologists as the author of five editions (1967–90) of *Laboratory Manual of General Ecology* (Wm. C. Brown).

Following a review of basic principles (Part One), the next four parts utilize an ecosystem approach to treat the major ecological patterns and problems of both terrestrial and aquatic ecosystems. As an example, Chapter 3, “Temperate Forests, Woodlands and Shrublands,” correlates the occurrence of mule deer, caribou, and ruffed grouse with early vs. late successional stages. Also discussed in Part One is the effect of fragmentation on forests and shrublands. A broader approach is taken in the last two parts that includes such chapters as “Management of Exotic Species,” “Endangered Species Preservation,” and “Global Conservation Programs.”

A desirable balance is maintained, throughout the book, between aquatic vs. terrestrial ecosystems and principles vs. conservation strategies. There is, however, a great deal more attention given to the conservation of animals than plants. As for another criticism, one might cite the lack of attention given to major global problems such as global warming (discussed very briefly), depletion of the ozone layer (mentioned once), and the effects of increasing human population (not even mentioned).

This is a handsome book with attractive photographs and graphs in both color and black and white. Literature cited is almost entirely that of North America.

I recommend *Conservation Ecology* highly as a text for courses in Conservation Biology/Ecology, and as a useful reference for related courses.

THOMAS E. HEMMERLY, *Biology Department, Middle Tennessee State University, Murfreesboro, TN 37212.*

Zeiller, Warren. 1992. **Introducing the Manatee.** University Press of Florida, Gainesville, FL. \$19.95 paper. 151 p.

Since the mid-1970's, the plight of the manatee in Florida has received increasing public attention. Sanctuaries have been established. Watercraft speeds have been limited in some areas. The Florida Department of Natural Resources is continually assessing the situation and evaluating new sanctuaries/refuges, boat speed zones and habitat protection plans. Facilities like the Miami Seaquarium, Sea World of Florida, and the Lowry Park Zoo spend hundreds of thousands of dollars each year rescuing and rehabilitating sick, injured and orphaned manatees.

“Introducing the Manatee” provides a unique perspective on sirenians and, in particular, on the history of the manatee program at the Miami Seaquarium. The book is divided into three main parts (Part I, Part II and Appendices). Part I has four sections that deal with the history of manatees at the Seaquarium and the plight of the manatee in Florida. I found Part I quite interesting from the historical perspective because I know the facilities and the animals well having spent a number of years on the faculty of the University of Miami's Rosenstiel School of Marine and Atmospheric Science which is

adjacent to the Seaquarium. Unfortunately, Part I does not bring the reader fully up to date on the Seaquarium's manatees. Juliet (the manatee matriarch) has had several more calves than listed in the book and several of the animals have been moved to other facilities. Lorelei (Juliet's first-born) currently resides at The Living Seas (EPCOT, Walt Disney World) with her most recent calf. "Out of the Wilderness" (Part I, section 4) points out that many manatees are injured and killed by watercraft propellers and promotes propeller guards as a possible solution. Unfortunately (for the manatee) boat speed is a significant factor in manatee mortality in Florida. Manatees die as a result of high-speed impact from watercraft and these animals may not have any fresh propeller wounds.

Part II (Sirens Through The Ages) provides a brief overview of the natural history of the sirenians and some of their relatives (elephants, hyraxes, and armadillos) and includes many historical anecdotes and stories about the use of manatees by humans. Some of the information presented is questionable. For example, on page 71 Zeiller states that ". . . manatees are confined to fresh waters (euryhaline)." Only the Amazonian manatee is (as far as we know) restricted to freshwater and this would be considered stenohaline. The West Indian and West African manatees go between the salinity extremes (*i.e.* they are euryhaline).

The four appendices include a chart of the sirenian fossil record; a summary of sirenian taxonomy; a summary of legislation protecting manatees in the United States; and a list of manatee refuges in Florida. The latter is out of date as it lists the Miami River (power) Plant and the Turkey Point Generating Plant as warm water refuges for manatees. While the Miami River Plant was a refuge in the 1950's and 60's, it has been closed for years and is not currently a refuge. The Turkey Point Generating Plant (on southern Biscayne Bay) has a closed cooling system and is not a manatee refuge.

Introducing the Manatee provides an interesting historic perspective on manatees at the Miami Seaquarium and on sirenian natural history. Unfortunately, the information is dated (in some cases, inaccurate) and an opportunity to provide the reader with a current review of the plight of the manatee in Florida is missed.

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NEWS OF BIOLOGY IN THE SOUTHEAST

Jon R. Fortman—*News Editor*
Division of Science and Math
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ABOUT PEOPLE AND PLACES

ALABAMA

Jacksonville State University, Department of Biology. Drs. Thomas Cochis, Lowell Duffey, L. G. Sanford, and Bill Summerour have retired. The new Chairperson is Dr. William R. Bowen, a plant morphologist and formerly Professor of Biology with the University of Arkansas at Little Rock and Adjunct Associate Professor of Pathology with the University of Arkansas for Medical Sciences. New faculty in the Department are: Dr. Jeri Higginbotham (Ph.D., University of North Carolina), a plant population geneticist; Dr. Safaa Al-Hamdani (Ph.D., Oklahoma State University), a plant stress physiologist; Dr. George Cline (Ph.D., Oklahoma State University), a herpetologist and vertebrate ecologist; and Dr. Gary Durrant (Ph.D., University of Indiana), a comparative animal physiologist. Drs. David Whetstone, William Bowen, and Frank Romano have received a grant to develop a microscopy laboratory for undergraduate research, and Dr. Lajoyce Debroy has received a planning grant from NIH-MIRI. A Field School has been established at Little River Canyon, now a National Park Preserve, to provide summer workshops in systematic and environmental biology for precollege students and teachers.

University of North Alabama, Department of Biology. Dr. Paul Yokley, Jr., has retired from the department after 42 years of service. Dr. Paul Yokley, Jr., has received several contracts to study the impact of highway construction projects on the mollusk populations of selected streams. Dr. Thomas Haggerty has received a grant to pursue the project "The effects of supplemental feeding on nestling care in the Carolina wren." Dr. Donald Roush is the recipient of a research grant for "Identification of microbial populations in poultry waste compost." Dr. Terry Richardson has organized a Symposium on the Zebra Mussel to be held at the 70th annual meeting of the Alabama Academy of Science.

FLORIDA

University of Florida, Department of Botany. Gabriela Romano has been awarded the Catherine H. Beattie Fellowship of the Garden Club of America for her genetical (DNA) study of the Florida Bonamia. Dr. Scott Zona has received a grant from the National Geographic Society to continue his studies on the "Systematics and Biogeography of *Roystonea*, the Royal Palm." Gerald Guala has obtained a Garden Club of America award for Tropical Botany and a graduate research grant from the American Society of Plant Taxonomists for his dissertation work in Africa and Brazil. Several of the Department's graduate students are involved with projects supported by the Nature Conservancy. Keith Uridel has a project on the re-establishment of a long-leaf pine and wire grass community in a recently acquired extension to the San Felasco State Park north of Gainesville. Jennifer Cornejo presented her research on vegetation types associated with the die-back of the palm *Sabal palmetto* near Cedar Key, Florida, at the College of Liberal Arts and Sciences Undergraduate Symposium. Jennifer was a sophomore and all of the other 15 participants were graduating seniors or very recent graduates. The department currently has 37 graduate students, 19 registered for the Ph.D. The number of undergraduate majors is also increasing. The Botany Club has been restarted with an enthusiastic core of undergraduates. Dr. F. E. (Jack) Putz has been promoted from Associate to Full Professor.

Florida Southern College, Division of Natural Sciences and Mathematics. Drs. John Griffiths and Malcolm Manners of the Horticulture Department has received their Ph.D. degrees from the University of Florida. Dr. Griffiths's research for the thesis concerned coconut palm embryo culture, and Dr. Manners's investigated avocado flowering physiology.

GEORGIA

West Georgia College, Department of Biology. Dr. Edward E. Gilbert, Professor of Biology and Chairman of the department, is retiring after 23 years of service. Dr. Gilbert received degrees from SMU and his Ph.D. from CAL, Berkeley, in Entomology. He taught at S.U.N.Y. Stony Brook and Northeast Missouri State University. His future plans include finishing research that he has been engaged in for the past 10 years.

Georgia College, Department of Biological and Environmental Sciences. Dr. Elizabeth Bennett (Ph.D., Clemson University) has joined the department. Her area of expertise is plant pathology.

Georgia Southern University, Department of Biology. During the Winter Quarter, the department had the following seminar speakers: Dr. Francis Chandler, Medical College of Georgia; Joel Hutcheson, Institute of Arthropodology & Parasitology, Georgia Southern; Dr. Patricia Gowaty, University of Georgia; Dr. Daniel B. Good, Dept. of Geology/Geography, Georgia Southern; Dr. Cluff Hopla, Dept. of Entomology, University of Oklahoma; Dr. Ann Pratt, Georgia Southern; Dr. Becky Moulton, Georgia Southern; Clint C. Ready, Georgia Southern; Dr. Colleen Keery and Dr. David Gantt, Georgia Southern.

The University of Georgia, Savannah River Ecology Laboratory. The Laboratory has published *40 Years and Beyond*, highlighting the years from 1951 to 1992. It begins with an article of Dr. Eugene Odum and the early years at SREL. Another article looks at the rapid change and growth in the 1960's when Dr. Frank Golley became director in 1962. Finally the "boom" years from 1973 to 1991 are presented. The publication has many pictures of students and staff personnel from earlier days as well as the present SREL Research and Faculty members. The publication concludes by looking at three major research initiatives for the '90's.

MISSISSIPPI

Gulf Coast Research Laboratory, Ocean Springs. A number of summer courses are being offered at the laboratory beginning on May 31. The first term courses were: Marine Science I, Oceanography, Marine Invertebrate Zoology, Marine Ecology, and Parasites of Marine Animals. From July to August, courses are being taught in Marine Ichthyology, Fauna & Faunistic Ecology of Tidal Marshes, Seagrasses & Sand Beaches; Comparative Histology of Marine Organisms; Salt Marsh Plant Ecology, and Coastal Marine Geology. Dr. Ervin G. Otvos and Wade E. Howat have been chosen to receive the First Place Best Published Paper Award by the Society of Economic Paleontologists and Mineralogists. Angela D. Ruple, Supervisor of Seafood Quality and Assistance Office, has been elected to a three-year term on the executive committee of the Tropical and Subtropical Fisheries Technological Society of the Americas.

NORTH CAROLINA

East Carolina University, Biology Department. Dr. Graham Davis, retired ex-chairman and Professor, continues to travel and research from Australia to Alaska. Dr. Joseph J. Luczkovich demonstrated and discussed *Underwater hockey* on Channel 7 (WITN) Washington, NC. He and David B. Knowles edited a laboratory manual, *Laboratory in Environmental Biology*. Dr. Robert Chapman received a grant for "Identification of Stock Structure and Recruitment Patterns for the Red Snapper." Dr. Mark Brinson also received a grant for "Evaluating the Ecological Functions of Wetlands: Technique Development and Testing." Dr. Joseph Luczkovich and David Knowles received an award to study "Experimental Analysis of the Effects of Thin-layer Disposal of Dredged Materials on a *Juncus roemerianus* Marsh in Wsocking Bay." Dr. William Ambrose gave the keynote address, "Benthic Processes in the Northeast Water Polynya" at a symposium on the Norwegian and East Greenland Seas in Kiel, Germany. Dr. Ambrose along with Dr. Stanley Riggs (Geology) received a grant to study the "Role of Nutrient-rich Submarine Groundwater Discharge upon Hardbottom Inhabitants and Reef fish Recruitment: Onslow Bay." Dr. Roger Rulifson and Dr. John Cooper (ICMR) received a Weyerhaeuser grant to study "Benthic Biocriteria Assessment of the Lower Roanoke River." Dr. Rulifson and the New Aquatic Sciences Club members have helped in restoring the old Pump Station (38-room lodge) and Stack at the Lake Mattamuskeet National Wildlife Refuge in cooperation with the NC Wildlife Resources Commission and others. An award of \$124,844 has been received by Dr. Terry West and Dr. William Ambrose for "Fish and Invertebrate Utilization of Natural and Man-made Wetlands in Beaufort County, NC." Dr. Donald Stanley has received \$76,000 to study "Texasgulf Effluent Monitoring and Water Quality in the Pamlico River Estuary." Martha N. Jones was invited

to present "Copper: An Alternative to Mercury in Kjeldahl Digestion" at the Laboratory Environmental Compliance Workshop in Annapolis, MD. *Dr. Herhard Kahmus* and the very active Biology Club officers, have established a Tau Gamma Chapter of the National Biology Honor Society of Beta Beta Beta in the Department.

SOUTH CAROLINA

Furman University, Biology Department. Dr. Karla Weidner, (Ph.D., University of Illinois—immunology) has joined the Biology faculty.

Francis Marion University, Department of Biology. Dr. John Rae has received funding for three years from the State of Florida to support his research on the population and reproductive ecology of the federally endangered fragrant prickly-apple cactus.

TENNESSEE

The University of Tennessee, Knoxville, Department of Botany. Drs. Eugene Wofford and Edward Clebsch are Principal Investigators on contracts with the Nature Conservancy to carry out rare plant surveys on the Fort Campbell, KY (Wofford) and Arnold Air Force Base, TN (Clebsch) reservations. Dr. Wofford's study is in cooperation with *Dr. Wayne Chester* of Austin Peay State University. Dr. Clebsch's study is a continuation of one carried out in 1992 by *Dr. H. R. DeSelm* (retired). *D. K. Smith, Ed Clebsch and Don Byerly* conducted an ecological workshop in the Great Smoky Mountains National Park, for teachers enrolled in the Academy for Teachers of Science and Mathematics Summer Programs. This program is an intensive exposure for middle and high school teachers to science and math in the university setting. Teachers participate in research studies in the National Park to gain experience with data gathering techniques, data interpretation, and problem solving as a tool for resource management.

Middle Tennessee State University, Department of Biology. Dr. Sarah F. Barlow recently presented an instructional development project as part of a university-wide workshop on "Multimedia in Academics." The project, titled "Interactive Computer/Videodisc Learning System for Introductory College Biology," is designed to be used by students independently or in small groups. *Dr. Thomas Hammerly* has received a research grant for the purpose of preparing a book, "Wildflowers of the Southern Appalachians." This publication will be a companion volume to his *Wildflowers of the Central South*, published by Vanderbilt University Press. *Dr. Michele L. Barnard* attended the annual meeting of the Federation of American Societies for Experimental Biology. *Dr. Patrick Doyle* will be a panelist for the Vanderbilt University Earth Week '93, "The Campus and Environmental Responsibility." *Dr. Padgett Kelly* was invited to Washington, DC, to attend a White Ceremony recognizing the recipients of the President's Conservation and Environmental Challenge Award. Dr. Kelly received a citation for directing Project C.E.N.T.S.

MUSEUMS AND BOTANICAL GARDENS

ALABAMA

Alabama Museum of Natural History, Tuscaloosa. Dr. Jack Horner, Curator of Paleontology at the Museum of the Rockies at Montana State University, spoke in April on the topic "Tyrannosaurus rex: Hunter or Scavenger?" He was featured in a recent article in *National Geographic* called "Dinosaurs."

Anniston Museum of Natural History, Anniston. During the Spring of 1993, exhibition features included selections from the Warner Art Collection of Gulf States Paper Corporation. The British artist, *Mr. Ede*, has become an influential milestone in the history of bird painting. He was commissioned by The Warner Collection to paint a new "Wild Birds of America" series, a monumental project that had not been attempted since John James Audubon painted more than 150 years ago.

MISSISSIPPI

The Crosby Arboretum, Picayune. The Mississippi Forestry Commission's "America the Beautiful Program" has given the Arboretum a \$15,000 grant to help with the nation's goal of planting and

caring for 30 million trees in 40,000 communities. The Arboretum will use this money to label approximately 40 species at Pinecote that are suitable for planting in cities and towns. *Dr. James Puckett* gave a presentation on the medicinal and cultural uses of plants native to the Gulf Coast region. The Arboretum is cooperating with the Walter Anderson Museum of Art in Ocean Springs to present the first exhibit devoted to plants of Walter Anderson. Anderson's drawings, watercolors, crayon sketches, and woodblock prints of life in a pitcher plant bog opened on 16th April through 1 August 1993.

NORTH CAROLINA

North Carolina State Museum of Natural Sciences, Raleigh. The Research and Collections Section received over \$100,000 in grants and contracts in 1992. *Rowland Shelley*, Curator of Invertebrates, spent six months at the National Museum, funded by an NSF Mid-Career Fellowship grant. The primary subject of this work was the evolution of mosaic complexes in the Diplopoda. Approximately 20,000 new specimens were added to the museum's research collections in 1992. Unusual acquisitions included the fossil remains of two giant ground sloths found near Wilmington. These specimens will anchor a major exhibit area when a new facility is built. Additionally, a large collection of reptiles, amphibians, and fishes, amassed over several decades by *Dr. Joe Bailey* at Duke University, is being transferred to the Museum. Forty-seven popular and scientific papers written by the Research and Collections staff were published or accepted for publication in 1992. *Dr. R. A. (Dick) Lancia*, Professor of Zoology and Forestry at NCSU, is the new editor for the museum's zoological journal, *Brimleyana*. Issue number 18 is in press and number 19 will follow shortly thereafter. The museum's publication series, *Occasional Papers of the North Carolina Biological Survey*, currently has a significant backlog of submissions. The Nongame section of the Wildlife Resources Commission granted funds to *Mary K. Clark* (Curator of Mammals) that will allow the museum to publish several papers in this series. Additionally, the Museum Director has encumbered funds to publish several others. Most of the backlogged manuscripts describe the endangered, threatened, and rare fauna of the state.

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CONTENTS

THE ASB BULLETIN

VOLUME 40, NUMBER 3, JULY 1993

Maintaining Per Capita Ecosystem Services While the Human Population Grows to Ten Billion: A Major Global Challenge for Biologists by J. Cairns, Jr.	159
Basic Accounting in Ecological Study and Environmental Practice by A.A. de la Cruz, G.M. Agacer, and J.T. Rigsby . . .	164
CALL FOR PAPERS, IMPORTANT DEADLINES, AND ANNOUNCEMENTS	175
Association Affairs	176
Announcements	185
Late Abstracts	186
Beta Beta Beta Abstracts	187
Reviews	193
News of Biology in the Southeast	198

e ASB BULLETIN

40, Number 4

October 1993

LAST CALL FOR PAPERS—DEADLINE: November 15



Jellyfish *Liriope tetraphyllus* from inshore North Carolina (see p. 216)

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Club, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1994 April 13-16 University of Central Florida, Orlando, FL

1995 April 19-21 University of Tennessee, Knoxville, TN

1996 April 10-13 Ga. Southern College, Statesboro, GA

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PRESIDENT'S CORNER

A VIEW FROM HERE



With the Call for Papers in this issue of The Bulletin, I would like to personally invite and encourage you to attend the 55th Annual Meeting of ASB to be held in Orlando on April 13–16, 1994. Our annual meetings are not only an appropriate format for presenting scientific research, but are also excellent opportunities to meet colleagues in similar disciplines. Many lifelong friendships have been established, and many graduate students have launched their careers through ASB annual meetings. The 1994 meeting, hosted by the University of Central Florida, should be particularly interesting. Jack Stout and his Local Arrangements Committee are working long and hard to set up an exciting location for our traditional Thursday night supper and to provide us with a wide array of interesting field trips. The central Florida and Orlando area also offers a tremendous variety of entertainment options and is a great place to bring the entire family. Some of you may wish to seriously consider this possibility for our upcoming meeting.

Our organization has just completed a very successful year. An enjoyable and efficiently-run meeting at Virginia Beach is now a pleasant memory (thanks to Frank Day and his staff at ODU) and, under the tutelage of Past Presidents Sandra Bowden and Ross Hinkle, an updated Membership and Resource Directory was completed and issued. Jim Ross and Jim Fralish deserve special acknowledgments for their work on the Directory.

As for this year, I would like to update you on the major actions taken thus far, my long-term goals, and our present and future needs. This spring the Executive Committee changed the abstract deadline to November 15 in order to allow the Program Committee to meet a printing deadline (please note this). As President, I have charged our committee chairs with the appropriate actions specified by the Executive Committee. Responses to changing needs are required to keep our organization running smoothly. I have sent letters to members in arrears, reminding them of the benefits of ASB membership. I have targeted a number of institutions in the southeast whose faculty members have historically had little or no participation in our

organization. Letters and membership brochures have been sent to contact people established at these institutions. I am pursuing several other biological societies for possible affiliation with ASB. It is my belief that annual meetings are strengthened by a diversity of biological disciplines. There will be no new affiliates present at the Orlando meeting, as such arrangements take time. However, I am optimistic that the groundwork is being laid for a couple of organizations to affiliate with us in the near future. I am also hoping that we as an organization can continue to encourage the participation of minorities in both our organizational activities and in biological career selection. The Committee on Women, Minorities, and the Handicapped (ad hoc; Chair, Lafayette Frederick) has given us a good start in this direction. I think that a future meeting at a largely minority institution would provide a great impetus, and I have instructed the Place of Meeting Committee to actively pursue this possibility. Finally, we need to clarify the uses and direction of the ASB Enrichment Fund. The Fund was established a number of years ago to give our organization a financial buffer and to allow for activities to benefit biologists in the southeast. It essentially has not been used and is appreciating only very slowly. The Enrichment Fund Board of Trustees needs a clear direction from the Executive Committee. For short-term visibility, the Executive Committee has authorized the expenditure of a small portion of the Fund for use in a future environmental education symposium. We are pursuing possibilities for the Orlando meeting. Of a more long-term nature, I have established an ad hoc committee of Past Presidents Bowden and Hinkle and myself to define long-term uses of the Fund and to recommend whether or not we pursue an active business/foundation solicitation process.

There are a number of other items that I would like to point out that might be of benefit to both our membership and to ASB. First, The Bulletin wishes to solicit research papers from our members. More research papers strengthen both The Bulletin and our organization. Ten pages per member per year will be provided free for acceptable manuscripts! Secondly, Wildlife Supply Company has recently established a student Aquatic Biology Research Award (see Call for Papers). I encourage eligible applications. Additionally, perhaps our most distinguished honor, the ASB Meritorious Teaching Award needs formal applications to honor many of our deserving members. Last, but not least, early payment of membership dues considerably improves our fall cash flow.

As I close this report, I would like to thank the officers, former officers, committee members, and the Executive Committee for their unselfish work on behalf of ASB. If you have suggestions that might enhance the goals and objectives of our organization, make sure you convey these to one of our officers. Only by your participation can ASB move forward and achieve its goals.

THE 55TH ANNUAL MEETING

HOST: UNIVERSITY OF CENTRAL FLORIDA

MEETING SITE: ORLANDO, FLORIDA

DATE: 13-16 APRIL 1994

Please note the following deadlines which are to be met before our 55th Annual Meeting hosted by the University of Central Florida, Orlando, Florida.

November 15 - Titles and abstracts of papers and posters (use blue abstract form). This will be the only call for papers. They must reach the program chairman by this date.

October 30 - Nominations for ASB officers and executive committee.

February 1 - Application for graduate student "travel awards".

December 1/-
1 February - Submissions for research awards.

Anytime - Membership application (see the October issues of the ASB Bulletin). Please encourage your graduate students, colleagues on the faculty, and your institutional librarian to join.

ASB MEETING

CALL FOR PAPERS & POSTERS FOR THE 1994 MEETING

DEADLINE: 15 November 1993

Individuals presenting papers or posters are expected to be members of ASB!

This form, with the original (blue) and one photocopy of the abstract must be addressed to the Chairman of the Program Committee, Dr. Franklin F. Snelson, Jr., Department of Biology, University of Central Florida, P.O. Box 25000, Orlando, FL 32816-2368 (407/823-5394) and received no later than 15 November 1993, if the title is to appear on the program and the abstract published in the April 1994 ASB Bulletin. All papers and posters should be presented. In the event of emergency absence, notify the **Program Chairman** before the meeting.

TYPE OR PRINT CAREFULLY

1. AUTHOR(S): _____

2. INSTITUTION(S): _____

3. CHECK: _____ PAPER or _____ POSTER (see guidelines in January 1992 ASB Bulletin)

4. TITLE (Keep short and concise; omit higher taxa -- see No. 6 below):

5. PROJECTION EQUIPMENT, unless specifically requested, is a 35 mm projector provided by the host institution [] 35 mm [] Other _____ TIME LIMIT for presentations and questions is **15 minutes**.

6. RECOMMENDED SECTION to which paper should be assigned. Check appropriate one(s). **RANK** sections as to your preference (with "1" being first preferred) if you check more than one. Indicate **Higher Taxon** to help program committee in arranging papers (omit these from the title

unless necessary):

- | | |
|--|--|
| <input type="checkbox"/> Aquatic ecology | <input type="checkbox"/> Animal physiology |
| <input type="checkbox"/> Microbiology | <input type="checkbox"/> Plant ecology |
| <input type="checkbox"/> Cytology/Genetics | <input type="checkbox"/> Parasitology |
| <input type="checkbox"/> Animal ecology | <input type="checkbox"/> Plant systematics |
| <input type="checkbox"/> Plant physiology | <input type="checkbox"/> Cryptogamic botany |
| <input type="checkbox"/> Cell/Molecular biol. | <input type="checkbox"/> Developmental biol. |
| <input type="checkbox"/> Teaching biology | <input type="checkbox"/> Wetlands Biology |
| <input type="checkbox"/> Invertebrate zoology | |
| <input type="checkbox"/> Ichthyology/Herpetology | |

Other: _____ Sections will be established based on needs.

7. **ABSTRACT:** Since abstracts will be printed in the April ASB Bulletin by photo-offset, **it is critical that the abstract be typed carefully, with a good black ribbon, in the box on the blue form, following the directions there in detail. Do not use a dot-matrix printer.** Additional copies of the form may be obtained from the Editor (Dr. Frank Schwartz, 919/726-6841). Do not photocopy the blue form for an original. **Poorly prepared abstracts will be rejected and returned to the author.**
8. **AWARDS:** I intend to submit an abstract and manuscript, if appropriate, for the following:
(see January ASB Bulletin for instructions)
 Student Research Award (\$500)
 Faculty Research Award (\$500)
 Odum Award (\$250)
 NC Botanical Garden Award (\$100)
 SE Am. Soc. of Ichs and Herps travel Best Student Paper
9. **NOTE--If you wish to be notified of the day and time of your presentation, please include a self-addressed, stamped postal card with this Title Sheet.** Indicate title, your name, and leave a blank for day and time.
10. **REPRINTS OF ABSTRACTS ARE NOT AVAILABLE.** You may duplicate the printed abstracts from the ASB Bulletin.

- 11. **IMPORTANT:** In case of error in your name or title when printed, or question about your presentation, please notify **PROGRAM CHAIRMAN** as soon as possible, not the moderator of your paper session

NOMINATION FOR ASB OFFICERS AND EXECUTIVE COMMITTEE POSITIONS

DEADLINE: 31 AUGUST 1993

To members of the Nominating Committee: I wish to suggest that you consider the following ASB member(s) in selecting nominees for officers and executive committee positions. (Please include the institutional address of each nominee.)

PRESIDENT-ELECT _____

VICE-PRESIDENT _____

TREASURER _____
 EXECUTIVE COMMITTEE (3-yr. terms) _____

MAIL TO: Dr. C. Ross Hinkle, Bionetics, BIO-2, Kennedy Space Center, FL 32899 (407/853-3281).

NAME & ADDRESS OF NOMINATOR: _____

"TRAVEL" SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB

DEADLINE: 1 February 1994

Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be members of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

1. Give information as to whether you submitted a title and abstract for a paper or poster.
2. Give a conservative, itemized estimate of meeting expenses excluding transportation. Student travel awards are granted on a competitive basis. Applicants must document expected expenses and list other sources of support for this meeting, including institutional aid, shared lodging and shared transportation.
3. In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications which have appeared or in preparation, degree sought, name of major professor, and any other pertinent professional details.
4. Give your source(s) of support while in graduate school; e.g., NSF, NIH, USDA, Teaching Asst., Research Asst., etc.
5. Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.
6. Send application, with supporting letter, all in triplicate, to: Dr. Frances G. Kennedy, Dept. of Biol., Agnes Scott College, Decatur, GA 30030 (404/371-6267).
7. Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

"TRAVEL" SUPPORT AWARDS FOR SEASIH STUDENTS:

A limited number of travel grants (\$50 each) are available to selected students presenting papers in ichthyology and/or herpetology. Students seeking travel awards should provide a brief justification for their request by February 1, 1994. Send to: Dr. Peggy Shute, Tennessee Valley Authority, Regional Natural Heritage Project, Natural Resources Building, Norris TN 37828.

MERITORIOUS TEACHING AWARD NOMINATION

DEADLINE: 1 February 1994

Each year, the ASB recognizes one of its members for especially meritorious teaching. This award of \$1,000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the July ASB Bulletin.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a southeastern institution for at least ten years, and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his or her institution (important assignments and other contributions specifically related to effective teaching, and teaching awards) and the number of 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, using the form in the ASB Bulletin 37:127, 1990, and include supporting documentation (biographical sketch or CV, supporting letters, photograph of candidate, etc.). Send all of this, once compiled, to: Dr. Patricia M. White, Biol. Dept., Agnes Scott College, Decatur, GA 30030 (404/371-6284).

NOTE: Supporting letters for nominees should be sent to the nominator, not to the selection committee. Past unsuccessful

nominees will not be reconsidered unless they are re-nominated. Nomination materials of unsuccessful nominees will be returned to nominator.

RESEARCH AWARDS

DEADLINES: 15 November 1993 and/or 1 February 1994

If you intend to present a paper at the Annual Meeting, you are encouraged to submit your manuscript, or abstract, in competition for one or more of four Research Awards. These cash awards are indicated below.

ASB Student Research Award (\$500) and ASB Research Award (\$500).

Rules are as follows: (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting. In order to qualify for presenting the paper, the author(s) must submit an abstract by the 1 December deadline. Papers submitted for the competition must be received in triplicate and in their entirety by 1 March and must be journal-ready manuscript worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission. (b) Only ASB members are eligible. The student award is given to the senior author if he/she is a graduate or undergraduate student at the time of presentation. (c) Papers may be in press but not published prior to the previous annual meeting. (d) Papers are judged by eminent scientists, selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses or objectives, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Research Award Committee, the award may be withheld or it may be split in case of a tie. (e) Winners will be announced at the annual banquet. The original

copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. The appropriate box should be checked on the ASB title form.

Send to: **Faculty** - Dr. Robert N. Muller, Dept. of Forestry, Univ. of Kentucky, Lexington, KY 40546-0073 (606/257-7596).
Student - Dr. Miriam P. Perry, Biol. Dept., Clayton State University, Morrow, GA 30260 (404/961-3622).

ASB STUDENT RESEARCH AWARD IN AQUATIC BIOLOGY (\$100) - The purpose of the award is to encourage excellence in research in aquatic biology by undergraduate and graduate students. The award is sponsored by Wildlife Supply Company (Wildco). Rules are as follows:

- (a) Students who are members of ASB and whose research is sponsored by a faculty member or biology professional who is also an ASB member are eligible.
- (b) The paper must be based on research designed and completed by the student.
- (c) The paper must be presented orally by the student as senior author in a regular paper session at the annual meeting. The student must submit an abstract in compliance with the **15 November deadline** in the call for papers. By **1 February** the student must submit three typed or printed copies of the manuscript, a brief biographical sketch, and a letter from the faculty/professional sponsor affirming student status and their sponsorship to the chair of the ASB Student Research Awards Committee.
- (d) The manuscript must conform to the style and general content of peer-reviewed journals in an area of aquatic biology.
- (e) Oral presentations will be verified by the Student Awards Committee and the manuscripts will be evaluated in accordance with the following criteria:

significance of the research to the field, validity of hypotheses tested, innovativeness and appropriateness of methods, validity of conclusions, clarity of presentation of results, and quality of writing style.

- (f) It is intended that aquatic biology be broadly interpreted; for example the research could involve an entomological project on an aquatic insect.
- (g) An award will not be given if in the judgement of the Committee there is no meritorius paper.
- (h) The winner will be announced at the annual banquet.

The appropriate box should be checked on the ASB title form. Send manuscripts and other required materials to: Dr. Miriam P. Perry, Biology Department, Clayton State University, Morrow, GA 30260, (404) 961-3622.

EUGENE P. ODUM AWARD - \$250 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points:

- (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology;
- (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of

- SE/ESA;
- (f) Submit title and abstract to program chairman by 15 November. A second copy must be sent to the award coordinator by the same date. The appropriate box should be checked on the ASB titled form. Send to: Dr. Andy Ash, Dept. Biology, PembrokeState University, Pembroke, NC 27832-1510 (919/521-6000, ext. 418).

The North Carolina Botanical Garden Award - \$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is awarded for a paper presented at the annual ASB meetings that best advances our understanding of the biology and conservation of southeastern plants and thus contributes to the mission of the North Carolina Botanical Garden. Of special interest to the Garden are the rare plant species of the Southeast: why they are rare; how they interact with plants, animals, and their environment; and what can be done to ensure their survival. As noted below, the paper may deal with a broad area including systematics, ecology, and conservation.

The presentation will be evaluated by a panel of judges at the time of presentation on the following points: (a) significance of ideas; (b) quality of methodology; and (c) clarity of presentation. The prize will be presented at the annual ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award. They may be students, faculty or others.
- (b) The paper must deal with systematics, ecology, evolution, species biology (including population biology, pollination, dispersal, establishment, and maintenance), propagation, or conservation of vascular plants that are native in the southeastern United States.
- (c) The paper must be presented in a regular Plant



Systematics or Plant Ecology contributed paper session; papers presented in poster sessions or in symposia are not eligible.

- (d) The title and abstract of the paper must be submitted to the Award Coordinator at the time of submission to ASB; this may be a copy of the same abstract submitted to ASB by 15 November. The appropriate box should be checked on the ASB Title Form. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. Peter White, Department of Biology, CB3280, University of North Carolina, Chapel Hill, NC 27599.

**SOUTHEASTERN DIVISION OF THE AMERICAN
SOCIETY OF ICHTHYOLOGISTS AND
HERPETOLOGISTS OUTSTANDING STUDENT
PAPER AWARDS**

\$100 each will be awarded to the best student research papers in both ichthyology and herpetology that are presented at the annual ASB meeting. Student must be the senior author and present the paper. All authors must be members of ASIH. The appropriate box should be checked on the ASB Call For Papers form. Please submit the title and abstract to the ASB Program Chairman by 15 November. A second copy should be sent by the same date to the President of SEASIH: Dr. Peggy Shute, Tennessee Valley Authority, Regional Natural Heritage Project, Natural Resources Building, Norris, TN 37828. Winners will be announced at the ASB banquet.

NOTES

AN INSHORE OCCURRENCE OF THE JELLYFISH *LIRIOPE TETRAPHYLLUS* IN NORTH CAROLINA

The jellyfish *Liriope tetraphyllus*, a 10–30 mm wide Trachymedusan of the family Geronidae, is known worldwide to depths of 300 m in euryhaline, polyhaline, and oceanic waters, regardless of salinity (Gosner 1971; Kramp 1961; Schmidt 1973; Voss 1972). Prior seasonal occurrences are known along the western Atlantic (Kramp 1961), from August to November in the Virginian portion of Chesapeake Bay (Voss 1972), and the harbor of Charleston, South Carolina



Fig. 1. *Liriope tetraphyllus* from Beaufort Inlet Coast Guard harbor, North Carolina, 13 May 1993. Dome width 2.75×.

(McCrary 1857). Rupert and Fox (1988), Schwartz (1979), Smith (1964) and Wilson (1979) do not list *L. tetraphyllus* from North Carolinian waters. A recent mass inshore congregation of *L. tetraphyllus*, that occupied the Beaufort Inlet Coast Guard harbor, Carteret County, North Carolina 13 May 1993 and turned the harbor waters pinkish, now establishes the species in North Carolina.

L. tetraphyllus is a clear-domed, smooth-margined swimming medusa that has no attached stage but gives off sperm and eggs from separate medusae (Hyman 1940; Pearse *et al.* 1987). The resultant zygote becomes a ciliated free-swimming planula that develops into another larval stage, the actinula, that in turn becomes a medusa (Pearse *et al.* 1987). The four heart shaped opaque gonads are readily visible through the clear dome of the medusa (Fig. 1). Passano (1965) has studied the nervous system activity of this poorly known species.

The Gulf Stream position varies 24 to 64 km off Beaufort Inlet, North Carolina. Winds play a major role in determining its seasonal position. Southwest winds prevail, March to November, along the coast and inlet area of North Carolina for nine months of the year, while north, northeast, or northwest winds prevail for three to four of the winter months, November to March. Northeast winds or storms often shear off masses or "rivers" of Gulf Stream waters and push them ashore along the North Carolina, Beaufort Inlet-Bogue Banks area. Southeasterly or easterly winds, storms, and hurricanes are more influential in forceably diverting Gulf Stream waters, with its flora and fauna, shoreward.

Environmental conditions prior to the May inshore occurrence of *L. tetraphyllus* were characterized by 9–20 km southeasterly winds on 3–4, and 9 May; and 18.5 km easterly winds on 15 May 1993; southerly winds of 18 km prevailed during the intervening dates. Concentrations of floating sargassum, indicators of high saline offshore waters, were found as late as 17 May in Beaufort Inlet and for distances of at least 6.5 km west in Bogue Sound, North Carolina. Water temperatures and salinities at Beaufort Inlet were, at the time of occurrence, 22.2 to 23.8 C and 32–33 ppt respectively. Occurrence of *L. tetraphyllus* now adds another jellyfish to the invertebrate fauna of North Carolina.

ACKNOWLEDGMENTS

Dr. L. Mercer, N.C. Division of Marine Fisheries, Morehead City, kindly made the specimens of *L. tetraphyllus* available for study and identification and reviewed the manuscript. R. Barnes and H. Page of IMS produced Fig. 1. Brenda Bright typed the text.

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Morehead City, NC 28557

BOOK REVIEWS

Arditti, J. and R. Ernst. 1993. **Micropropagation of Orchids**. John Wiley & Sons, NY. \$115.00. 682 p.

When one thinks of the successful application of plant tissue culture techniques for the commercial production of ornamental plants, orchid micropropagation immediately comes to mind. Discoveries made in the late 1950's and early 1960's demonstrated that the *in vitro* culture of isolated orchid "meristems" was an efficient vegetative method to rapidly propagate virus-eradicated orchids. Today, approximately 60% of the commercial micropropagation laboratories worldwide produce orchid using modifications of these original techniques. Given the importance of this crop and the flood of scientific papers on orchid tissue culture, surprisingly there have been few comprehensive reviews of orchid micropropagation techniques and procedures. Consequently, orchid researchers and commercial growers have been forced to search the scientific literature to find appropriate but often poorly defined procedures. Researchers and growers now need not look further than *Micropropagation of Orchids* by Arditti and Ernst. *Micropropagation of Orchids* is an impressive encyclopedic update of tissue culture propagation information originally published as an appendix in Arditti's 1977 publication *Orchid Biology: Reviews and Perspectives Vol. 1*. This current book has been written for those who want practical information on the *in vitro* propagation of orchids.

Chapter 1 provides an extensive historical review of the science of plant tissue and its relationship to advances made in orchid tissue culture. This chapter begins with a brief but useful glossary of terms used in the review. Insightful discussions concerning who was actually the pioneer of orchid propagation by tissue culture make for interesting reading. Chapter 2 provides practical information on the general methods and procedures for culture media preparation and storage and the isolation of orchid cells, tissues and organs for *in vitro* culture. The section on substitution of medium nutrient salts should be especially useful in countries where limited availability of specific medium components can be a problem. Much of the information is presented in tabular form. The authors provide information on culture conditions and useful tables for converting different light intensity units from different light sources. However, the readability of the generalized diagrams depicting the steps for excision and isolation of meristems (Figure 2-5) and other explants (Figure 2-6) could be improved. Citation of original source references occurs throughout the chapter. The chapter concludes with a useful source list for micropropagation supplies and equipment.

Chapter 3, comprised of 520 pages, provides detailed practical methods for the *in vitro* culture of 83 orchid genera. Depending on available literature, procedures for tissue explant selection, surface sterilization, culture media preparation and culture conditions are described. Useful recipes for the preparation of the specific media and concentrated stock solutions are meticulously outlined in numerous tables. A general comments section for each genus provides practical tips for those attempting to use the procedure. In the fourth and final chapter general culture media components and conditions for the *in vitro* propagation of orchids are summarized. However, this information appears to be somewhat redundant to that presented in Chapter 2. The chapter concludes with a factual discussion of the positive and negative aspects of the application of orchid tissue culture.

In summary, *Micropropagation of Orchids* is the most comprehensive book currently available on the *in vitro* culture of orchids. It should be on the bookshelf of every plant tissue culture researcher, instructor, and orchid grower who utilizes micropropagation technology. Given the wealth of practical information contained within its covers, *Micropropagation of Orchids* is a bargain at \$115.00!

MICHAEL E. KANE, *Department of Environmental Horticulture, University of Florida, Gainesville, FL 32611.*

Odum, Eugene P. 1993. **Ecology and Our Endangered Life-Support Systems**, 2nd ed. Sinauer Assoc., Inc., Publ., Sunderland, MA. \$18.95 (paper). 301 p.

The second edition of Odum's *Ecology and Our Endangered Life-Support Systems* is a synthesis of ecological principles and environmental applications. The author stresses ecology as a discipline that integrates "the study of organisms, the physical environment, and human society."

The book contains six chapters ("The Life-Support Environment," "Levels of Organization," "The Ecosystem," "Energetics," "Material Cycles and Physical Conditions of Existence," "Population Ecology," "Development and Evolution," and "Major Ecosystem Types of the World"), a prologue and epilogue, and an index. Each chapter has suggested readings, many of which are cited in the text.

The prologue ("The Flight of Apollo 13") introduces the reader to the concept of life-support systems and how their failure can lead to severe problems if not disaster.

Each chapter gives an admirably thorough introduction to basic ecology and its application to current environmental problems. The sole part for which I lamented lack of detail was the section on tundra in Chapter 8. (Neither permafrost nor oil pipelines were explicitly discussed.)

The epilogue discusses four gaps (income, food, values, and education) which must be narrowed in order for humanity and its environment to have a sustainable, long-term relationship. "The bottom line" is that only when "the three E's," ecology, economics, and environmental ethics, are merged can we "be optimistic about the future of humankind."

Most diagrams are well-chosen and quite clear, although I must express a personal dislike for the "energy language" symbols used in many. Other types of diagrams might be more accessible for the aimed-at audience. Photographs are also well-chosen, but a few suffer from reduction or lack of clarity (e.g. I could not see the discussed cacti in Figure 10, Chapter 8).

In a careful reading, I found only two typographical errors. Of more concern to me were two matters of factual disagreement. On page 178, the author states that "overuse [of antibiotics] simply encourages the disease organism to mutate, creating a new organism that is resistant to the antibiotic." I have always understood that the agent of selection (the antibiotic, in this case) acts on *already existing* variant alleles. My disagreement may be only semantic; certainly the allele (mutation) for resistance is selected for when antibiotics are overused.

My other concern is on page 208, wherein discussing the evolution of the biosphere, the author states that "The big change began with the appearance at least two million years ago of the first photosynthetic microorganisms, the cyanobacteria . . ." While 3.5 billion years ago is certainly "at least two million," I would prefer to use the more precise estimate for the earliest cyanobacterial fossils known at this time.

In summary, I found this book very readable, well-written and produced, and up-to-date. I would recommend it most highly for a course in environmental science or applied ecology as taught through on-base programs for the military (which need a concise text) or a one-semester non-major community college course. It should be a good tool for discussion because of its blend of ecological principles and interesting, real-life applications and problems. I feel that a book of this length does not contain enough detail on ecological theory to serve as the sole text in an ecology course for biology majors, although some instructors might want to supplement it with readings.

BARBARA J. ABRAHAM, *Dept. of Biological Sciences, Hampton University, Hampton, VA 23668.*

***Boschung, H. T.* 1992. *Catalogue of Freshwater and Marine Fishes of Alabama.* Bull. Ala. Mus. Nat. Hist. No. 14, Univ. Alabama Press. \$40.00, 288 p.**

Retirement hasn't slowed Herb (Bo) Boschung's scientific productivity. A *Catalogue of Freshwater and Marine Fishes of Alabama* and the Gulf of Mexico to 200 m and between the 87th and 89th meridians listing 38 orders, 156 families, and 918 species is his latest effort. This 288 page, 8½ × 11" two column format publication lists over 2,600 nominal taxa, 1,100 references as literature cited, a table of contents that dubs as a checklist, an index for all scientific names, and all common names. An "Abbreviations and full titles" section, p. 199–204, gives the full title for the journals and periodicals used, with annotations; the latter of use to users who have no idea where, when or by whom a journal or change was published. Each species, in most cases, is treated by a citation to the original designation, synonyms important to Alabama species, literature citations, documentation of occurrence, range, and distribution. This Catalogue also gives insight into the tremendous marine and freshwater fish faunas of Alabama and the nearby Gulf of Mexico waters. Just being able to reach for one publication that lists which species occurs in Alabama and the nearby northern Gulf of Mexico will more than pay for the modest price of this publication.

A problem that the Catalogue brings up is that some users may be uncomfortable or confused with some of the usages for a number of families, species, genera, and overall ranges. This stems from many biologists considering the American Fisheries Society (AFS) publication: *Common and Scientific Names of Fishes of the United States and Canada* (Robins *et al.* 1991) as the accepted "bible" for

name spellings, etc. when in actuality many ichthyologists will follow the classification of Mayden, Burr, Page, and Miller (1992). Catalogue genera changes for the many minnows and catfishes follow Mayden's (1989) and Lundberg's (1982) revisions of those groups. While Steyskal (1983, p. 4) pointed out that some fish family names should include an added "id," both the AFS list and the Catalogue use Echeineidae instead of Echeineididae or Dasyatidae for Dasyatididae.

A set pattern of treatment for each Catalogue species gives the range of a fish (freshwater fishes). Some freshwater fish ranges aren't given unless they differ substantially from that of the atlas (Lee *et al.* 1980) or for fishes described since 1980 (p. 10, col. 2, 4 range). Some samples of other fishes, *e.g.* *Gephyroberyx darwini*, however, do reach North Carolina and Canada (Schwartz 1989; Van Guelpin 1993). The Catalogue adds 35 fishes to the North American fauna that are not in the AFS list. It corrects a number of publication dates and some misspellings, *e.g.* *Acipenser oxyrinchus* Mitchell, 1814 should be *A. oxyrinchus* Mitchell, 1815.

A few typos appear on: p. 2, col. 1, carpsucker should be chubsucker; some of the last line on p. 175, 147.8.2 is missing; and all of Etnier's references, where he was senior author, were omitted.

Regardless that everyone will not be in complete agreement with the family, genera or species names used, Boschung's Catalogue gives us a more thorough look at what has been recorded from Alabama and its surrounding waters. It also whets our appetite to anticipate that other species will appear as part of the Alabama fish fauna.

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- FRANK J. SCHWARTZ, *Institute of Marine Sciences, University of North Carolina, Morehead City, NC 28557.*

Goodenough, J., B. McGuire, and R. A. Wallace. 1993. Perspectives on Animal Behavior. John Wiley and Sons, NY. \$59.95. 764 p.

The authors stated that their objective was to write a textbook that began with the history of animal behavior studies and, once that perspective was established, move to the cutting edge of modern research in all the major areas of animal behavior. Aware that animal behavior is taught as an upper level course in biology and psychology departments, and "not much could be taken for granted regarding students' backgrounds," the authors included information "to provide the necessary background, enabling the student to follow the finer points of any discussion without first having to bone up the hard way, through independent study."

After a brief introductory chapter, the book is divided into three parts. Approaches to the Study of

Animal Behavior (chapters 2–8), Behavior of the Individual Surviving in its Environment (chapters 9–15), and Behavior of Groups (chapters 16–19). The first part covers the history of the study of animal behavior (classical ethology, comparative psychology and the nature/nurture controversy and the modern synthesis), genetic analysis of behavior, natural selection and ecological analysis of behavior, learning, physiological considerations in behavior, and the development of behavior. The second discusses the biological clock, orientation, foraging, antipredator behavior, sexual reproduction and selection, parental care and mating systems. The third part includes information on sociality, communication, and altruism (no reference to dear enemy phenomenon). Although there is reference to the relation between behavior and phylogeny, there is no discussion on the latest techniques and perspectives in the use and analysis of behavioral characteristics in phylogenetic studies. The book ends with an appendix on magnetism, a reference section, indices by author, subject, and species, and a list of common and scientific names of selected species discussed in the text. Aside from the numerous uses of slang, an upside down photograph (p. 202), and order and style inconsistencies in the reference section, the book is generally well-written for its audience, upper level students with varying backgrounds in biology.

The hard-bound book with an attractive color cover is set in easily read type. For the most part, the text has detailed information to assist students to fully understand fundamental concepts and approaches in the study of animal behavior. The contents of each chapter are abstracted in well-written chapter summaries. The 31 color and 450+ black and white photographs and graphs are clear, relevant, and are thoroughly described and referenced. A glossary of terms would have been a help to students.

In summary, the book serves its purpose as a general comprehensive text on animal behavior, and should be adequate for beginning students.

EUGENE G. MAURAKIS, *Saint Paul's College, Lawrenceville, VA 23868.*

Laws, Edward A. 1993. **Aquatic Pollution.** John Wiley and Sons, NY. \$54.95. 611 p.

Dr. Laws, professor and chairman of the Department of Oceanography at the University of Hawaii at Manoa, has updated his text on Aquatic Pollution (2nd edition). The references are current and three new chapters have been added to cover acid deposition, groundwater pollution, and plastics in the sea. As in the first edition, the first three chapters provide background information for the intended audience of college undergraduates. These chapters provide an adequate matrix for subsequent information and are particularly readable, an important quality for an undergraduate text.

The following 14 chapters range from urban runoff to radioactivity and while these topics are not all weighted equally, the subject matter is greatly enhanced and strengthened by use of case studies and there is a smooth transition between marine, estuarine, and freshwater habitats. Laws, having authored more than 50 journal articles, most on phytoplankton and many related to aspects of pollution, might be expected to have a decided bias, but he does a good job of presenting information, balanced information, on a wide range of topics. Almost all graphs have been redrawn from their original sources to give a clear and uniform presentation of data.

It would have been easy for a Harvard trained chemical physicist to remain in "pure science" but his interest in and contribution to more applied areas, studies of aquatic pollution, is laudable. I recommend this text as a good introduction to aquatic pollution, a basis for a more informed public, and as valuable, general review for those of us working in aquatic sciences.

PATRICIA A. TESTER, *National Marine Fisheries Service, NOAA, Beaufort, NC 28516.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN-*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

GEORGIA

Georgia Southern University, Department of Biology. During the Spring quarter the following people were guest speakers: *Dr. Donald Drake*, University of Hawaii; *Dr. D. Craig Sheppard*, University of Georgia Experiment Station; *Mr. Arthur E. Miller*, USDA Animal and Plant Health Inspection Service; *Dr. Brian T. Forschler*, University of Georgia Experiment Station; *Mr. Roger D. Ditmer*, Superintendent of Resort Grounds, The Cloister, Sea Island, Georgia; *Dr. William Gutzke*, Memphis State University; *Col. Robert Clegern*, Armed Forces Pest Management Bd.

KENTUCKY

Georgetown College, Biological Sciences Department. *Dr. Dwight Marsee Lindsay*, professor emeritus of biological sciences, taught for more than three and a half decades at Georgetown. In recognition for his "long commitment to the liberal education of scientists, for his extensive loyalty to Georgetown College, and for his splendid example as a Christian scholar," Lindsay received an honorary Doctor of Letters degree at the 164th commencement ceremony 8 May 1993. Lindsay is well known throughout Kentucky for the many medical doctors and dentists whose careers were inspired in his classroom. His former students have endowed the Dwight M. Lindsay Chair of Biological Sciences when he retired in 1986. *Dr. Julie Mann* has been named a full-time assistant professor of biology. Her doctorate in anatomy is from the University of Kentucky.

Western Kentucky University, Department of Biology. The University was saddened upon the death of *Dr. Larry Neil Gleason*, due to heart failure on 27 April 1993. *Drs. Kenneth Nicely* and *Jeff Jenkins* have opted for early retirement after 30 and 27 years respectively in the Department. Both will be available for part-time work. *Dr. Charles Kupchella*, Dean of the Ogden College and a member of the Department has taken the position of Provost of Southeastern Missouri State University.

NORTH CAROLINA

High Point University, Biology Department. *John E. Ward, Jr.*, 52, passed away on 29 May 1993, following a short illness. John came to High Point to teach in 1970. He received his Ph.D. from the University of South Carolina. He was a member of ASB, Sigma Xi, the Mycological Society of America, and the North Carolina Academy of Science. He served as Department Chair from 1988 to 1992. He was active in his community, his church and in the academic community. John was recognized as an outstanding teacher by his students and by his teaching colleagues. Memorials may be made to the John E. Ward, Jr. Scholarship Fund, % High Point University, University Station-Montlieu Ave., High Point, NC. 27262-3598.

University of North Carolina at Wilmington, Department of Biological Sciences. Two new faculty joined the department this past Fall, *Dr. Simona Bartl* (Ph.D. University of California at San Diego) and *Dr. Jonathan B. Geller* (Ph.D. University of California at Berkeley). *Dr. Bartl* comes from a postdoctoral fellowship at the Hopkins Marine Station of Stanford University where she has been studying the evolution of MHC/Ig superfamily genes in marine organisms and the molecular and cellular basis for allorecognition in bony and cartilaginous fishes and protochordates. *Dr. Geller* was a NSF postdoctoral fellow at the Hopkins Marine Station. His research interests include the ecology and genetics of marine biological invasions and molecular approaches to studying the dispersal of genes, individuals, and species.

Elon College, Department of Biology and Allied Health. *Dr. Phillip J. Mason*, formerly Chair of the

Division of Environmental Programs at Unity College in Maine, has been named Departmental Chair succeeding *Dr. Herbert House* who returns to full time teaching.

SOUTH CAROLINA

Wintthrop University, Department of Biology. *Dr. Paula L. Mitchell* (Ph.D. University of Texas, Austin) joined the faculty in August 1993. *Dr. Mitchell* is an entomologist and is editor of the *Journal of Economic Entomology*. She replaces *Dr. Keith Bildstein*, who resigned to become Research Director, Hawk Mountain Sanctuary, Kempton, PA.

Wofford College, Department of Biology. *Dr. G. R. Davis* (Ph.D. University of North Carolina-Chapel Hill) is a new member of the faculty. *Dr. Davis* did postdoctoral research at the University of Missouri on recovery from spinal cord injuries. He will replace *Dr. Ray Leonard*, who is retiring after serving 44 years at the college.

Furman University, Biology Department. *Dr. Margaret Ann Goodman* has joined the biology department as a sabbatical replacement. *Dr. Goodman* received her doctorate from Stanford. *Drs. Rex Kerstetter* and *Laura Thompson* are on sabbatical leave for the 1993-94 academic year.

MUSEUMS AND BOTANICAL GARDENS

ALABAMA

Alabama Museum of Natural History, Tuscaloosa. During the summer of 1993, *Dr. Ian Brown*, Curator of Gulf Coast Archaeology, and *Richard Fuller*, both from the University of Alabama, led a crew of students to conduct archaeological excavations at the Bottle Creek Indian mounds in the Mobile-Tensaw Delta. Another crew was led by *Diana Silvia Mueller* of the University of South Alabama. *Dr. Boyce Driskell*, the Museum's senior archaeologist and director of the Dust Cave research team, conducted a summer field camp for undergraduate students. Dust Cave has been the site for excavation and research for the past three years. Test excavations reveal that humans probably occupied the cave as early as 10,500 years ago and as late as 6,000 years ago. The 15th annual Museum Expedition was led by *Brown Hawkins*, Curator of Paleontology, assisted by *James Lamb*. The group worked at the world famous Harrell Station Paleontology Site near Selma in Dallas County. This site is internationally known for its rich fossils from the Age of Dinosaurs.

Mississippi

Mississippi Museum of Natural Science, Jackson. *Charles Knight* has been hired as the staff Ichthyologist to fill the position vacated when *Roger Weill* retired. *Mr. Knight* is currently a Ph.D. candidate in Ichthyology at the University of Arkansas where he is working on trophic ecology and importance of crayfish to stream fishes. He has also curated the vertebrate collection for the Louisiana University Biological Field Station; served as assistant curator, Zoology collection at the University of Arkansas Museum, and worked for the University of Arkansas, Cooperative Fish/Wildlife Unit to design and implement, and analyze studies to characterize fish community composition and structure in relation to habitat.

ASB MEMBERSHIP DUES STRUCTURE

Please complete information, enclose check or money order to **ASB**, and mail to **Patricia Parr, Oak Ridge National Laboratory, Box 2008, Oak Ridge, TN 37831-6034**. Check the mailing label to see the year you are paid through—for example, if the date is 1991, you need to pay for 1992 and 1993. Please contact Pat Parr if there is an error (615-576-8123). Thanks for your support!

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CONTENTS

THE ASB BULLETIN

VOLUME 40, NUMBER 4, OCTOBER 1993

President's Corner-A View from Here	203
55th Annual Meeting and CALL FOR PAPERS-Deadline 15 November	205
Note: An inshore occurrence of the jellyfish, <i>Liriope tetra- phyllus</i> in North Carolina, Frank J. Schwartz	216
Reviews	219
News of Biology in the Southeast	223

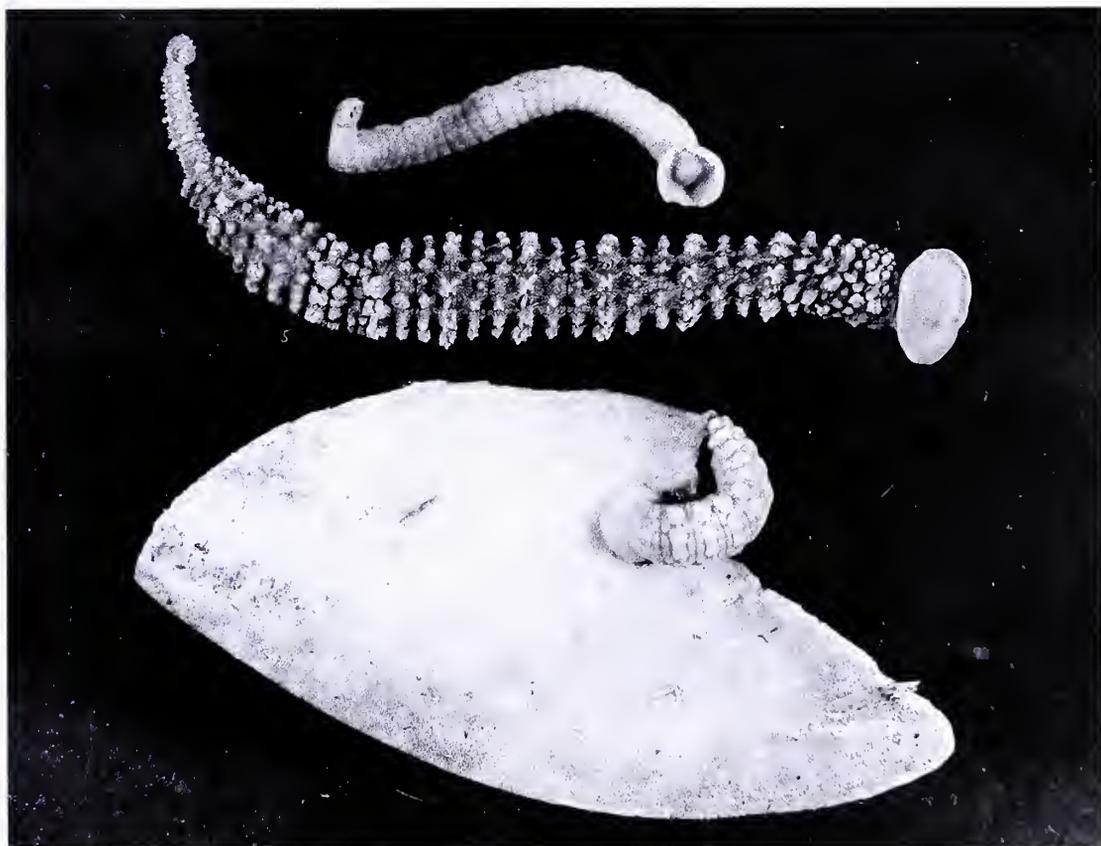
Cover photo of the Gulf Stream jellyfish *Liriope* courtesy of the editor F. J. Schwartz.

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ASB BULLETIN

Volume 41, Number 1

January 1994



Marine Leech, *Stilarobdella macrothela*, from sharks

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Society, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1994 April 13-16 University of Central Florida, Orlando, FL

1995 April 19-21 University of Tennessee, Knoxville, TN

1996 April 10-13 Ga. Southern College, Statesboro, GA

PATRON MEMBERS

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55th ANNUAL MEETING in ORLANDO, FLORIDA

The University of Central Florida and the Department of Biology welcome the 55th annual meeting of the Association of Southeastern Biologists to Orlando, Florida, 13-16 April, 1994. All activities except the Thursday evening social and field trips will be held at the Clarion Plaza Hotel on International Drive near Sea World and Walt Disney World. The Thursday night social will be at Sea World.

SOCIETIES MEETING WITH ASB IN ORLANDO

**American Society of Ichthyologists and
Herpetologists, Southeastern Division
Beta Beta Beta**

**Botanical Society of America, Southeastern Section
Ecological Society of America, Southeastern Chapter
Southeastern Fishes Council
Southern Appalachian Botanical Society**

Orlando is located near the center of peninsular Florida. The area is rich in history as evidenced by the sites of the earliest Spanish landings and settlements in North America (St. Augustine, Fort Matanzas National Monument, and San Marcos de Apalache). Orlando is surrounded by excellent examples of coastal plain ecosystems (pine flatwoods, sandhills, scrub, salt marshes, forested wetlands, barrier islands, and beaches); many of which are in protected areas. Weather in Orlando in April is very pleasant. The ocean water will be cool. Daytime air temperatures should be in the 80's.

The Clarion Plaza Hotel is located on International Drive at Plaza International adjacent to the Orange County Convention Center, just 15 minutes from the Greater Orlando International Airport. International Drive is a commercial tourist section of southwest Orlando and the gateway to the famous theme parks.

The Clarion has 810 units (rooms, suites, and parlors) and 60,000 sq. ft. of meeting facilities.. The Clarion opened for business in 1991. The hotel has excellent lodging and dining facilities, meeting rooms, pools, scheduled transportation to the airport and area attractions, and free parking.

The University of Central Florida is a state University located on a 1,227 acre campus 13 miles northeast of downtown Orlando in eastern Orange County. The school was founded in 1963 as Florida Technological University and accepted its first students in 1968. The name was changed to the University of Central Florida in 1979 to better reflect the mission of a metropolitan University with traditional academic programs. There are more than 23,000 students enrolled in 75 bachelor's, 46 master's, and 14 doctoral programs.

The Department of Biology has a full-time faculty of 11 and shares the Biology Building with the Department of Molecular and Microbiology. The department has had an M.S. program since 1974. Special facilities include an electron microscope complex, an herbarium, greenhouse, arboretum, experimental ponds, nature preserve system and an animal care facility.

POINTS OF INTEREST IN THE ORLANDO AREA

CENTRAL FLORIDA ZOOLOGICAL PARK. Visit over 400 exotic and native reptiles, mammals, and birds in a natural Florida setting. Admission fee.

CHURCH STREET. Unique shops and restaurants in Victorian atmosphere.

KENNEDY SPACE CENTER. Showplace for the United States space program/home of the space shuttle. Admission fee.

LEU BOTANICAL GARDENS. 1730 North Forest, Orlando. Large collection of orchids, palms, camellias, and roses. Historic home. Admission fee.

MERRITT ISLAND NATIONAL WILDLIFE REFUGE. Barrier island ecosystems with numerous threatened and endangered species of plants and animals.

Excellent photographic opportunities. Free.

ORLANDO SCIENCE CTR./JOHN YOUNG PLANETARIUM. 810 Rollins Street, Orlando. Admission fee.

PARK AVENUE, WINTER PARK. Numerous boutiques, specialty shops, and restaurants with a European flavor.

SEA WORLD. One of the premier marine life parks, featuring live shows. Home of Shamu the killer whale. Admission fee.

UNIVERSAL STUDIOS. Movie studio attraction. Admission fee.

WALT DISNEY WORLD RESORT EPCOT CENTER. Walt Disney's dream of two dazzling worlds: Future World and World Showcase. Admission fee.

WALT DISNEY WORLD RESORT MAGIC KINGDOM. 40 attractions in Main Street, Adventureland, Frontierland, Fantasyland, and Tomorrowland. Admission fee.

WEKIWA SPRINGS STATE PARK. One of Florida's showcase parks. Splendid examples of longleaf pine and wiregrass dominated sandhill ecosystems restored by prescribed burning. Other ecosystems found within the park include sandpine scrub, hydric hammocks, pine flatwoods and a major spring and spring run. Admission fee.

WET 'N WILD. A 25 acre family water recreation park. Admission fee.

ENTERTAINMENT IN THE ORLANDO AREA

A great variety of entertainment is readily available in the area. International Drive is a focus of restaurants and casual entertainment spots. In addition, we can recommend the theaters and museums in Loch Haven Park, the historic districts in downtown Orlando (e.g., Church Street Station), and city and county parks. Check the local newspaper for concerts, sports,

festivals and special events at the Citrus Bowl, the Bob Carr Performing Arts Centre and the Orlando Arena.

THURSDAY NIGHT BUFFET SUPPER

The Thursday night social will be held from 6:00 to 10:00 p.m. on 14 April at **Sea World** (profiled earlier under points of interest). ASB will have transportation to and from **Sea World**. Two shows will be provided: first, the SEA LION AND OTTER SHOW to be followed by SHAMU "NIGHT MAGIC" SHOW. The Dinner will be an All-You-Can-Eat buffet featuring barbecued ribs and chicken served in the Shamu Pavilion. A band will provide after dinner entertainment. Tickets include cost of admission to **Sea World**, shows, access to exhibits and the buffet.

TRAVEL TO ORLANDO

Automobile: When approaching from the north, the easiest route is Interstate 75, Florida's Turnpike, and Interstate 4. Also from the north, Interstate 95 and Interstate 4. These routes intersect with exits to International Drive from Interstate 4. The Clarion Plaza Hotel is near the midpoint of International Drive, a hotel-entertainment-commercial strip on the east side of Interstate 4.

Air Travel: Orlando is served by The Greater Orlando International Airport which offers more than 800 flights daily through 21 major airlines. Delta Airlines has been designated as the official carrier for those attending the Association of Southeastern Biologists Meeting, 13-16 April, 1994. A special convention fare is available which offers a 5% discount off the lowest possible fare available to an individual or a 10% discount off the regular coach fares.

SPECIAL AIRFARE INSTRUCTIONS

To obtain the discount, you must call 1-800-241-6760 Refer to the ASB meeting and identify yourself as a participant with the code R-1107

Airport Transportation: The Greater Orlando International Airport is a 15-minute drive from the Clarion Plaza Hotel. Car rentals are available at the airport through several national car rental agencies. The regular individual fare via Airport Shuttle to the Clarion is \$20.00 (round-trip).

ACCOMMODATIONS

A block of 225 rooms is available at the Clarion Plaza Hotel at special convention rates. Please plan to stay at the Clarion and be at the center of the meeting activities. ASB has had to guarantee sufficient rooms to offset the cost of the meeting facilities. There is ample free parking associated with the hotel complex. Reservations must be made directly with the hotel by 11 March, 1994. After that date, requests will be handled on a space available basis. All reservation requests must be secured by a first night's deposit in the form of a check, money order or major credit card.

The special convention rates are extended for three days prior to and following the meeting. The special rates are as follows: single, double, triple or quad, \$75 per night per room. To insure that you receive the special room rates be sure to indicate that you are an ASB meeting participant.

Clarion Plaza Hotel
9700 International Drive
Orlando, Florida 32819-8114

Toll Free Reservations Call:
1-800-627-8258

or:

1-407-352-9700
FAX 1-407-351-9111

Note: You must specify that you are an ASB registrant when you make your reservation.

Information on the many other motels and hotels in the area can be obtained by calling 407-363-5871.

PRE-REGISTRATION AND REGISTRATION

A pre-registration form is provided with this copy of the *Bulletin*. **THE DEADLINE FOR RECEIVING PRE-REGISTRATION MATERIALS IS 30 MARCH 1994.** Your pre-registration will allow us to plan facility needs and services for the meeting. Pre-registration packets and late registration will be at the Clarion Plaza Hotel on Wednesday from 12:00 noon until 10:00 p.m., on Thursday from 8:00 a.m. until 5:00 p.m. and on Friday from 8:00 a.m. until 12:00 noon.

PRE-REGISTRATION IS NECESSARY TO ENSURE THE MOST EFFECTIVE PLANNING FOR FIELD TRIPS, SPECIAL MEALS, AND SOCIAL EVENTS. Late tickets for social events and special meals may not be available at the meeting.

Pre-registration fees are fully refundable **PROVIDED we receive notification of cancellation by 5:00 p.m. on 30 March 1994.**

Please bring your April, 1994 *ASB Bulletin* containing the detailed program and abstracts to the meeting. Copies will be sold at the registration desk for \$3.50.

GENERAL SCHEDULE

**ALL EVENTS AT THE CLARION PLAZA HOTEL
EXCEPT WHERE OTHERWISE NOTED**

WEDNESDAY, 13 APRIL

Registration	12 Noon-10:00 PM
ASB Executive Committee Meeting	3:00:7:00 PM
Council Meeting, SABS	6:30-9:30 PM
ASB Wine and Cheese Social Provided by the Clarion Plaza Hotel	7:30-10:00 PM

Continuation of ASB Executive Committee Meeting
(if necessary) 8:30-10:30 PM

THURSDAY, 14 APRIL

Past Presidents' Breakfast 7:00-8:00 AM

Registration 8:00 AM-5:00 PM

Placement Service 8:00 AM-5:00 PM

General Plenary Session: 8:30-9:45 AM
Welcome by Dr. Gary E. Whitehouse, Provost,
University of Central Florida
Announcements by Local Committee

Tentative Speaker - Carol Browner, EPA

Exhibits 9:45 AM-5:00 PM

Paper and Poster Sessions 10:00 AM-5:00 PM

Symposium: ASPECTS OF THE BIOGEOGRAPHY OF FLORIDA. Organized and Moderated by Richard Franz (Florida Museum of Natural History) and Paul Moler (Florida Game and Fresh Water Fish Commission) 10:00 AM-5:15 PM

Symposium: ENVIRONMENTAL JUSTICE - THE EPA PERSPECTIVE. Organized by Dr. Gerry Twitty (Howard University) and Moderated by Dr. Clarice Gaylord (EPA) 10:00AM-12:00 Noon

Symposium: ANIMAL CARE AND USE GUIDELINES: HOW THEY AFFECT YOUR TEACHING AND RESEARCH. Organized by Dr. Skip Sedovick (Appalachian State) 1:00 PM - 5:00 PM

Beta Beta Beta Field Trip 1:00-5:30 PM

- Business Meeting: Southeastern Division, American Society of
Ichthyologists and Herpetologists 4:00-5:00 PM
- Business Meeting: Southeastern Fishes Council 5:00-6:00 PM
- Buffet Supper at SEA WORLD 6:00-10:00 PM

FRIDAY, 15 APRIL

Breakfast and Business Meeting:
Southern Appalachian Botanical Club and Southeastern
Section, Botanical Society of America 7:00-8:30 AM

Placement Service 8:00 AM-5:00 PM

Registration 8:00 AM-12 NOON

Exhibits 8:00 AM-12 NOON

Luncheon: Beta Beta Beta 12:15-1:45 PM

Paper and Poster Sessions 8:00 AM-5:00 PM

**SYMPOSIUM: "BIOLOGICAL ASPECTS OF
WATER QUALITY ASSESSMENT IN
SOUTHEASTERN UNITED STATES." Sponsored by
Southeastern Chapter, ESA, Organized by Dr. Cliff
Hupp (USGS) 8:00 AM-12:00 NOON**

**Teaching Update Workshop: "ISOZYME
ELECTROPHORESIS, HARDY-WEINBERG, AND
PLANT MATING SYSTEMS: A SPEEDY,
DRAMATIC LAB EXERCISE ON POPULATION
GENETICS. Conducted by Dr. David McCauley
(Vanderbilt University) 9:00-11:00 AM**

Business Meeting: Beta Beta Beta 10:30-11:30 AM

ASB Business Mtg. and Election of Officers
11:30 AM-12:30 PM

Luncheon Meeting: Southeastern Chapter of
Ecological Society of America 12:30-2:00 PM

**"SPECIAL" WORKSHOP SPONSORED BY THE
ASB ENRICHMENT FUND: "PROFESSIONAL
BIOLOGISTS/ECOLOGISTS AND K-12
TEACHERS: A WINNING PARTNERSHIP."
Organized by Dr. Don Hall (University of Florida)**

2:00-4:00 PM

Beta Beta Beta Paper Sessions 1:00-4:00 PM

Social Hour (Cash Bar) 6:00-7:30 PM

ASB Banquet 7:30-10:00 PM

SATURDAY, 16 APRIL

ASB Executive Committee Meeting 7:00-9:00 AM

Field Trips: Departure from the Clarion Plaza Hotel
7:30 AM to 8:00 AM

FIELD TRIPS

Transportation and lunch (except for Beta Beta Beta) are provided for all field trips. Departures will be from the main lobby of the Clarion Plaza Hotel. Please note the departure times.

**1. CANAVERAL NATIONAL SEASHORE-MERRITT
ISLAND NATIONAL WILDLIFE REFUGE**

Saturday, 16 April, 8:00 AM - 4:00 PM

The trip will view a diversity of barrier island ecosystems to include dune, scrub, coastal flatwoods, hammocks, marshes and impoundments. Led by Dr. Ross Hinkle and Dr. Paul Schmalzer of The Bionetics Corp. Limit 18. Cost: \$17.25.

2. WEKIWA SPRINGS STATE PARK

Saturday, 16 April, 7:30 AM - 1:00 PM

Trip to one of Florida's showcase parks. Splendid examples of longleaf pine and wiregrass dominated sandhill ecosystems restored by prescribed burning. Other ecosystems to be visited include sandpine scrub, hydric hammocks, pine flatwoods and a

major spring and spring run. This park is included in the Wekiva Basin GEOPark which supports a black bear population. Led by park staff. Limit 18. Cost: \$12.80.

3. THE DISNEY WILDERNESS PRESERVE

Saturday, 16 April, 8:00 AM - 4:00 PM

This 10,000 acre preserve is jointly owned by The Nature Conservancy and Walt Disney Co. A great diversity of wetland and upland ecosystems typical of central Florida are to be found within the preserve. The hydrology of this former working cattle ranch is being restored by an active management program under the direction of The Nature Conservancy. The biota includes many rare and endangered species. Led by staff of the preserve. Limit 18. Cost: \$18.50.

4. BETA BETA BETA TRIP TO KENNEDY SPACE CENTER.

Thursday, 14 April, 1:00-5:30 PM

Trip details to be announced in the next *ASB Bulletin*..

NOTICE OF AWARDS FOR 1994

"TRAVEL" SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB

DEADLINE: 1 February 1994

Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be members of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

1. Give information as to whether you submitted a title and abstract for a paper or poster.
2. Give a conservative, itemized estimate of meeting expenses excluding transportation. Student travel awards are granted on a competitive basis. Applicants must document expected expenses and list other sources of support for this meeting, including

institutional aid, shared lodging and shared transportation.

3. In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications which have appeared or in preparation, degree sought, name of major professor, and any other pertinent professional details.

4. Give your source(s) of support while in graduate school; e.g., NSF, NIH, USDA, Teaching Asst., Research Asst., etc.

5. Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.

6. Send application, with supporting letter, all in triplicate, to: Dr. Frances G. Kennedy, Dept. of Biol., Agnes Scott College, Decatur, GA 30030 (404/371-6267).

7. Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

"TRAVEL" SUPPORT AWARDS FOR SEASIH STUDENTS:

A limited number of travel grants (\$50 each) are available to selected students presenting papers in ichthyology and/or herpetology. Students seeking travel awards should provide a brief justification for their request by February 1, 1994. Send to: Dr. Peggy Shute, Tennessee Valley Authority, Regional Natural Heritage Project, Natural Resources Building, Norris TN 37828.

MERITORIOUS TEACHING AWARD NOMINATION

DEADLINE: 1 February 1994

Each year, the ASB recognizes one of its members for especially meritorious teaching. This award of \$1,000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the July ASB Bulletin.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a southeastern

institution for at least ten years, and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his or her institution (important assignments and other contributions specifically related to effective teaching, and teaching awards) and the number of 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, using the form in the ASB Bulletin 37:127, 1990, and include supporting documentation (biographical sketch or CV, supporting letters, photograph of candidate, etc.). Send all of this, once compiled, to: Dr. Patricia M. White, Biol. Dept., Agnes Scott College, Decatur, GA 30030 (404/371-6284).

NOTE: Supporting letters for nominees should be sent to the nominator, not to the selection committee. Past unsuccessful nominees will not be reconsidered unless they are re-nominated. Nomination materials of unsuccessful nominees will be returned to nominator.

RESEARCH AWARDS

DEADLINES: 15 November 1993 and/or 1 February 1994

If you intend to present a paper at the Annual Meeting, you are encouraged to submit your manuscript, or abstract, in competition for one or more of four Research Awards. These cash awards are indicated below.

ASB Student Research Award (\$500) and ASB Research Award (\$500).

Rules are as follows: (a) Given for especially meritorious paper presented orally by the author(s) at the annual meeting. In order to qualify for presenting the paper, the author(s) must submit an abstract by the 1 December deadline. Papers submitted for the competition must be received in triplicate and in their entirety by 1 March and must be journal-ready manuscript worthy of publication. A short biographical sketch of each author must accompany the manuscript at the time of submission. (b) Only ASB members are eligible. The student award is given to the

senior author if he/she is a graduate or undergraduate student at the time of presentation. (c) Papers may be in press but not published prior to the previous annual meeting. (d) Papers are judged by eminent scientists, selected by the committee from institutions either within or beyond the southeast. Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses or objectives, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Research Award Committee, the award may be withheld or it may be split in case of a tie. (e) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. The appropriate box should be checked on the ASB title form.

Send to: **Faculty** - Dr. Robert N. Muller, Dept. of Forestry, Univ. of Kentucky, Lexington, KY 40546-0073 (606/257-7596). **Student** - Dr. Miriam P. Perry, Biol. Dept., Clayton State University, Morrow, GA 30260 (404/961-3622).

ASB STUDENT RESEARCH AWARD IN AQUATIC BIOLOGY (\$100) - The purpose of the award is to encourage excellence in research in aquatic biology by undergraduate and graduate students. The award is sponsored by Wildlife Supply Company (Wildco). Rules are as follows:

- (a) Students who are members of ASB and whose research is sponsored by a faculty member or biology professional who is also an ASB member are eligible.
- (b) The paper must be based on research designed and completed by the student.
- (c) The paper must be presented orally by the student as senior author in a regular paper session at the annual meeting. The student must submit an abstract in compliance with the **15 November deadline** in the call for papers. By **1 February** the student

- must submit three typed or printed copies of the manuscript, a brief biographical sketch, and a letter from the faculty/professional sponsor affirming student status and their sponsorship to the chair of the ASB Student Research Awards Committee.
- (d) The manuscript must conform to the style and general content of peer-reviewed journals in an area of aquatic biology.
 - (e) Oral presentations will be verified by the Student Awards Committee and the manuscripts will be evaluated in accordance with the following criteria: significance of the research to the field, validity of hypotheses tested, innovativeness and appropriateness of methods, validity of conclusions, clarity of presentation of results, and quality of writing style.
 - (f) It is intended that aquatic biology be broadly interpreted; for example the research could involve an entomological project on an aquatic insect.
 - (g) An award will not be given if in the judgement of the Committee there is no meritorius paper.
 - (h) The winner will be announced at the annual banquet.

The appropriate box should be checked on the ASB title form. Send manuscripts and other required materials to: Dr. Miriam P. Perry, Biology Department, Clayton State University, Morrow, GA 30260, (404) 961-3622.

EUGENE P. ODUM AWARD - \$250 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for Winners will be announced at the ASB banquet. the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points:

- (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;

- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) Submit title and abstract to program chairman by 15 November. A second copy must be sent to the award coordinator by the same date. The appropriate box should be checked on the ASB titled form. Send to: Dr. Andy Ash, Dept. Biology, PembrokeState University, Pembroke, NC 27832-1510 (919/521-6000, ext. 418).

The North Carolina Botanical Garden Award - \$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Club). This is awarded for a paper presented at the annual ASB meetings that best advances our understanding of the biology and conservation of southeastern plants and thus contributes to the mission of the North Carolina Botanical Garden. Of special interest to the Garden are the rare plant species of the Southeast: why they are rare; how they interact with plants, animals, and their environment; and what can be done to ensure their survival. As noted below, the paper may deal with a broad area including systematics, ecology, and conservation.

The presentation will be evaluated by a panel of judges at the time of presentation on the following points: (a) significance of ideas; (b) quality of methodology; and (c) clarity of presentation. The prize will be presented at the annual ASB Banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award. They may be students, faculty or others.
- (b) The paper must deal with systematics, ecology, evolution,

species biology (including population biology, pollination, dispersal, establishment, and maintenance), propagation, or conservation of vascular plants that are native in the southeastern United States.

(c) The paper must be presented in a regular Plant Systematics or Plant Ecology contributed paper session; papers presented in poster sessions or in symposia are not eligible.

(d) The title and abstract of the paper must be submitted to the Award Coordinator at the time of submission to ASB; this may be a copy of the same abstract submitted to ASB by 15 November. The appropriate box should be checked on the ASB Title Form. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. Peter White, Department of Biology, CB3280, University of North Carolina, Chapel Hill, NC 27599.

SOUTHEASTERN DIVISION OF THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS OUTSTANDING STUDENT PAPER AWARDS

\$100 each will be awarded to the best student research papers in both ichthyology and herpetology that are presented at the annual ASB meeting. Student must be the senior author and present the paper. All authors must be members of ASIH. The appropriate box should be checked on the ASB Call For Papers form. Please submit the title and abstract to the ASB Program Chairman by 15 November. A second copy should be sent by the same date to the President of SEASIH: Dr. Peggy Shute, Tennessee Valley Authority, Regional Natural Heritage Project, Natural Resources Building, Norris, TN 37828.

GUIDELINES FOR POSTER SESSIONS

Poster sessions have been incorporated as a regular means of scientific presentation at the annual ASB meetings. This type of presentation provides a more informal environment that encourages a direct interchange of ideas and discussion between presenter and audience.

Adherence to the following guidelines will help ensure the effectiveness of poster sessions. Posters will be organized by subject matter and numbered sequentially in accord with abstract listings in the *ASB Bulletin*. All posters will be on display for a half day, although authors or co-authors are required to be with their posters only during a specified session. Thumb tacks, tape, backing paper, scissors, and other special display material **will not** be provided and should be supplied by each presenter.

Posters should be carefully planned to maximize clarity and simplicity in conveying information. Poster boards four feet in height and eight feet in width will be available for each paper. Arrange for a heading including title, author(s) name, and author(s) institution(s) to be placed at the top in letters no less than three cm high. The body of the poster should be self-explanatory and should include figures, tables, graphs, maps, or photographs displayed in a well organized and coherent sequence from top to bottom. Do not crowd the display. All materials, including text legends and captions on figures or tables, should be legible from a distance of about two meters. Each illustration should be captioned. A limited degree of text can be included, but care should be taken not to overwhelm the audience. Authors may choose to post a large typeset copy of the abstract at the top of the poster and include a clear listing of specific conclusions at the bottom.

LOCAL ARRANGEMENTS COMMITTEE

CHAIR: I. Jack Stout
(REGISTRATION AND ACCOMMODATIONS)

PROGRAM : Franklin (Buck) Snelson

AUDIOVISUALS: Christine Small

EXHIBITS : David H. Vickers

FIELD TRIPS and TRANSPORTATION : Susan Sanwald

SOCIAL ACTIVITIES : Michael W. Dennis

HOST INSTITUTION : University of Central Florida
Dept. of Biology
David H. Vickers, Chair
Orlando, Florida 32816-2368
(407) 823-2919
FAX (407) 823-5769

MEETING HEADQUARTERS: Clarion Plaza Hotel
9700 International Drive
Orlando, Florida 32819-8114
(407) 352-9700
FAX (407) 351-9111

ASB ANNUAL MEETING 13-16 APRIL 1994
PRE-REGISTRATION FORM

(Type or print; one form per registrant; duplicate as needed)

Name _____

Social Security Number (Office Use Only) _____

Mailing Address _____

Institution _____

City _____ State _____ Zip _____

Office Phone (_____) _____

Name Tag Information (if different from above)

Name _____

Institution _____

Pre-registration deadline is 30 March 1994

Affiliation (Check where appropriate):

ASB _____ BBB _____ BSA _____

ESA _____ SWS _____ SABS _____

SFC _____ ASIH _____ SSP _____

If you desire vegetarian meals, please check _____

Registration:

Regular: \$40.00 \$ _____
 Student: \$18.00 \$ _____

(Late registration: Regular \$45.00; Student \$23.00)

Thursday Night SEA WORLD

Regular: \$35.00 x _____ Tickets . \$ _____
 Student: \$25.00 x _____ Tickets . \$ _____

ASB Banquet (Friday)

Regular: \$27.00 x _____ Tickets . \$ _____
 Student: \$24.00 x _____ Tickets \$ _____

Name: _____

Breakfasts

ASB Past Presidents: \$16.25 x _____ Tickets \$ _____
 SABS/SE-BSA: \$16.25 x _____ Tickets \$ _____
 Executive Committee: \$16.25 x _____ Tickets . . \$ _____

Luncheons

Beta Beta Beta: \$18.25 x _____ Tickets \$ _____
 ESA/SE Chapter: \$18.25 x _____ Tickets \$ _____

Field Trips

No. 1: \$17.25 x _____ Tickets \$ _____
 No. 2: \$12.80 x _____ Tickets \$ _____
 No. 3: \$18.50 x _____ Tickets \$ _____
 No. 4: \$10.25 x _____ Tickets \$ _____

TOTAL AMOUNT ENCLOSED \$ _____

Make checks payable to University of Central Florida and print name, address, SSN, and phone # on the front of the check.

Mail form and fee to:

ASB MEETING
University of Central Florida
Center for Continuing Education
P. O. Box 160950
Orlando, FL 32816-0950

Note: To become a member of ASB, please complete the application form in the back of this issue and send to the ASB Treasurer with the appropriate dues.

ANNOUNCEMENTS

CHANGE IN THE BY-LAWS:

Revision of Article IX. Association of Southeastern Biologists Enrichment Fund

Section 2. The Association of Southeastern Biologists Enrichment Fund shall be managed by a Board of Trustees which shall be responsible for the prudent investment of all endowment funds of the ASB. **With approval and guidance from the Executive Committee of ASB, the Board shall also be responsible for planning and directing the recruitment of funds from the ASB membership and external sources.** The Board shall consist of five (5) members. . . .

Section 6. Investment Policy—In order to protect the funds contributed and entrusted to the trustees of the Association of Southeastern Biologists Enrichment Fund by donors to meet short and long-range objectives, funds shall be invested in conservative investment vehicles offering the highest interest rates at the time of purchase. Since changes in the economy and other factors greatly affect interest rates and earnings, funds shall be invested up to a period of five years unless otherwise approved by the Board of Trustees.

REQUEST FOR CONSERVATION ISSUES

The Conservation Committee would like to know the issues that ASB Members feel the committee should address over the short- and long-term. In recent years, this committee has generated resolutions on wetlands, biodiversity, and National Wildlife Refuge congressional legislation. We are not bound to only provide draft resolutions. There is a variety of actions in which our Association could involve itself. Thus, we would also like your input on how this committee and our Association may facilitate the ecologically wise use or preservation of regional, national, and global resources. Please let us know your greatest conservation-related concerns and how you feel this committee may best serve our Association.

The Association represents a large number of the biologists in the Southeastern United States, which could serve as a resource to various other organizations and agencies. In addition to your input on conservation issues, the committee would like to know of individuals who would be willing to serve as speakers or consultants, or as members of state-oriented conservation subcommittees.

Please send your thoughts, ideas, or comments to: Dr. Donald J. Drapalik, Biol. Dept., Ga. Southern Univ., Statesboro, GA 30460 (912/681-5494).

ERRATA

A new *Secretary* will be elected at the April meeting rather than as reported in 40(4) of the ASB Bulletin. Treasurer.

HIGHLANDS BIOLOGICAL STATION SUMMER COURSES IN FIELD BIOLOGY, 1994

The Highlands Biological Station, located in the Blue Ridge Mountains of southwestern North Carolina, will offer the following courses in field biology in 1994:

Larval Amphibian Biology. June 6–17. Richard J. Wassersug (Dalhousie University) and guest instructors.

Conservation Biology with Special Reference to Old-Growth Forests. June 20–July 1. Peter S. White (University of North Carolina at Chapel Hill).

Freshwater Fishes. July 4–15. Dr. Edward F. Menhinick (University of North Carolina at Charlotte).

Ecological Research Techniques. July 18–29. Team taught by Alan E. Stiven (University of North Carolina at Chapel Hill) and Thomas R. Wentworth (North Carolina State University).

Biology of Spiders. August 1–12. Team taught by Frederick A. Coyle (Western Carolina University) and William A. Shear (Hampden-Sydney College).

All courses are taught at the advanced undergraduate-graduate level. Credit (three semester hours) is available for each course through either Western Carolina University or the University of North Carolina at Chapel Hill. Financial aid may be provided to qualified students through a scholarship program of the Highlands Biological Foundation, Inc.

For further information and application forms contact the Highlands Biological Station, P.O. Box 580, Highlands, North Carolina 28741. Tel. 704-526-2602. FAX 704-526-2797.

MOUNTAIN LAKE BIOLOGICAL STATION SUMMER PROGRAM 1994

The Mountain Lake Biological Station offers a summer program of study and research in environmental and evolutionary biology. Situated at an elevation of 4,000 feet in the Allegheny Mountains of southwestern Virginia, the station draws faculty and students from across the nation. Students may pursue the master's degree in biology by summer study, a program that is particularly suitable for teachers in secondary education. Opportunities for independent study by graduates and post doctoral fellows and an undergraduate research program are available.

First Term**June 12-July 16**

Course Title	Instructor	Home Institution
Ecological Genetics	J. J. Murray, Professor of Biology and David West, Professor of Zoology	University of Virginia, VPI&SU
Ornithology	Raymond Chandler, Assoc. Prof. of Biology	Ball State University
Molecular Techniques for Population Genetics and Evolutionary Biology (June 12-July 1)	Daniel Burke, Assoc. Prof. of Biology and Michael Timko, Assoc. Prof. of Biology	University of Virginia

Second Term**July 17-August 20**

Conservation Biology	Peter Kareiva, Prof. of Zoology	University of Washington
Behavioral Ecology	Alistar Innman, Asst. Prof. of Biology and Anne Houtman, Asst. Prof. of Biology	Wesleyan College

Scholarships Available—Service awards for students cover room and board. Scholarships provide tuition assistance. Post-Doctoral Research Awards. Undergraduate Research Assistantships.

Further Information—Director, Mountain Lake Biological Station, Gilmer Hall, University of Virginia, Charlottesville, VA 22903-2477.

REVIEWS

Arditti, Joseph. 1992. **Fundamentals of Orchid Biology**. John Wiley and Sons, NY. \$95.00. 691 p.

A textbook on orchid biology has been missing from the literature, so *Fundamentals of Orchid Biology* was written to meet this need. While many orchid books are aimed at horticultural audiences, *Fundamentals* will reach anyone with an interest in the Orchidaceae. The most immediately striking feature of the book is an abundance of figures, tables, diagrams, and plates. The author has created an amalgamation where the reader can meet historical figures of orchid biology, interpret data upon which conclusions in the book are based, and visualize micromorphological features from SEM plates. This attractive text draws information from many independent sources conveniently compiled under one cover.

Amateur and professional orchidologists alike will benefit from reading the book. Growers, perhaps lacking training in plant physiology, can learn why ethylene is detrimental to blooms and why trace elements, such as molybdenum, are important for well grown plants. Persons interested in orchid anatomy should find the designations of velamen types, including tilosome inclusions, useful for comparative studies. Although treatments of some subjects may appear brief, others are extremely detailed. If unsatisfied with the treatment of a topic, the reader may refer to the references cited to begin a detailed search. The book will appeal to a wide array of readers, but a good biological background will be required for understanding some of the more detailed sections.

The opening chapters of the book describe the history of orchids in Asia, Africa, Europe, and Australia. Early Chinese writings make reference to the fragrant blooms of *Spiranthes* and *Cymbidium*. Some of the earliest fascination with these plants concerned the powers of the testicle-like roots, as revealed in the writings of Theophrastus and Dioscorides. Demand for orchids as herbal remedies was eventually joined by a desire of European growers challenged by the growing and flowering of the tropical species as early as 1731. Much of the allure of orchids that interested people centuries ago continues today.

The chapters concerned with the taxonomy and naming of orchids treat a touchy subject about the family. Enthusiasts and growers often express discontent with continuously changing names and classifications. Arditti explains the goals and means of such endeavors in an attempt to instill an appreciative understanding of the difficulty of the discipline. The primary techniques employed in constructing classifications, phenetics and cladistics, are explained, along with the pitfalls associated with each. A comprehensive review of characters used to construct classifications is included, culminating in an explanation of the need for synthetic approaches utilizing several independent data sets.

Chapter three addresses evolution in the Orchidaceae. It is stimulating to consider not only the ways in which orchids differ from other flowering plants but also how their great diversity has come about through evolutionary history. The many specializations unique to the family are discussed in light of their evolutionary origin and the environmental conditions under which these adaptations may have originated.

Arditti next tackles cell biology and primary metabolism. The diverse topics addressed include details of cell division and structure. Most important for orchid hybridizers, however, is an explanation of the effects of ploidy level on breeding. A description of CAM photosynthesis in orchids is compared to C3 photosynthesis typically found in other plants, followed by the basic steps of respiration that have been studied in orchids. As a grower and researcher of orchids, I found these two chapters particularly valuable. My understanding of cultural requirements was enhanced by descriptions of mineral nutrition, including functions associated with each primary or trace element and the functional concentrations required. Complementary to this, mechanistic explanations are offered for physiological processes commonly observed, such as the wilting of flowers from which the pollinia have been removed.

A phytochemistry chapter discusses various pigments responsible for flower color, including the taxonomic importance of relative distributions of anthocyanins and flavonoids. The function of pigments and the composition of floral exudates and fragrance mixtures are presented in relation to their importance in pollination. Other secondary compounds discussed include vanillin, which can have

androgenic properties, and the alkaloid dendrobine, which has been shown to reduce cardiac activity in mice.

Diversity in growth form, inflorescence, pollinaria, and seeds are described in a chapter on morphology, followed by one on anatomy. The internal organization of tissues and organs offer many valuable features for growers and scholars to consider. The grower will benefit from an understanding of leaf architecture that aids water conservation in epiphytes, while the systematist may find unutilized characters useful for comparative studies. The numerous plates help make the often unappreciated aspects of orchid anatomy and morphology exciting. Velamen types, stigma types, and stomatal complexes, for example, are discussed in detail.

Mycorrhizae may have a crucial role in the life cycle of an orchid at various stages and for differing periods of time, depending upon the species. Arditti attempts to portray the critical need of orchids for fungi under natural conditions and the effect this has had upon the evolution of the family.

Three chapters covering pollination, embryology, and reproduction are organized together. The reader is first introduced to the wide variety of vectors involved in the transfer of pollen from anther to stigma. The significance of this process is reinforced by an explanation of pollen and ovule development, including meiosis. Finally, a description is provided of seed formation. The suggestion of Athanasius Kircher in the 1600's, that orchids originate from the fermented semen of goats, will surely come into doubt after the reading of these chapters!

Orchids are generally thought of as having little economic importance outside their ornamental value. The culminating chapter, commercial and ethnobotanical uses of orchids, is an interesting account of many actual or potential uses. The intrigue most of us feel towards these mysterious flowers obviously has meaning for people who treat flowers in a very different manner from our own culture. The fascinating use of *Ansiella gigantea* blooms in ensuring sterility in unmarried females in Africa and the use of *Orchis maculata* against witchcraft in ancient Europe are two examples. While few readers may find interest in all sections of the book, it bridges the gap between "heavy-reading" textbooks and popular accounts with limited technical appeal.

TODD J. BARKMAN, *Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824.* (Current address: *Department of Botany, University of Texas, Austin, TX 78713.*)

Martin, William H., Stephen G. Boyce, and Arthur C. Echternacht (eds). 1992. **Biodiversity of the Southeastern United States: Lowland Terrestrial Communities.** John Wiley and Sons, NY. \$69.00. 502 p.

This is the first of a series of three volumes whose production is supported by the ASB and the Southeastern Section of the Ecological Society of America. The inception of this project arose at the 1982 ASB meeting, with an appointed steering committee of William Martin, Frank McCormick and Elsie Quarterman, whose goal it was to focus on the structural and functional relationships of integrated aquatic and terrestrial ecosystems at the "watershed" level. As spelled out in the preface of this volume, the entire series is designed as the first real effort to "synthesize information that has accumulated for over 300 yrs." The goal of this series, as stated, is the development of a single source of information concerning southeastern biodiversity, in which references are provided to the "enormous literature of ecological research and resource documentation" involved, and to consolidate interpretations from the people who "study, observe and manage ecosystems in the Southeast." The title of the series itself has changed twice from its initial name ("Ecosystems of the Southeast United States," then "Biotic Communities of the Southeastern United States," and finally "Biodiversity of the Southeastern United States"). The two coming volumes are designed to round out the treatment of the Southeast's biodiversity, in considering, respectively, aquatic and upland terrestrial ecosystems.

The work of 23 contributing authors is presented in 10 chapters, following a foreword and preface, along with a subject index. The three leading chapters effectively form a first part of the book, providing discussions on the definition and parameters of biodiversity, physical setting in the Southeast, resource use and management, the evolution and organization of the vegetation of the region (all of Chapter 2), and in Chapter 3, a summarizing treatment of fauna and wildlife, including a complete list of all vertebrate species ("fauna" equals native species, "wildlife" equals fauna plus introduced animals), and a discussion of vertebrate biogeographic patterns. The following seven chapters ("Maritime Communities," "Mangrove Forests," "The Everglades," "Pocosins, Carolina Bays, and Mountain Bogs," "Southern Floodplain Forests," "Pine Flatwoods and Xeric Pine Forests of the Southern (Lower

Coastal Plain," "Southern Mixed Hardwood Forest: The Former Longleaf Pine Forest") form the major portion of the text. This arrangement incorporates a reasonably loose definition of "Terrestrial" environments: in other treatments, mangrove forests, the Everglades, floodplain forests, pocosins, Carolina bays, and various wetland components of longleaf pine communities might be considered "Palustrine." The reader must be aware that "Lowland Terrestrial Communities" are those of the Atlantic and Gulf Coastal Plains. "Upland" communities (next volume) are those within the Piedmont, Interior Plateaus, and southern Appalachian highlands. Truly aquatic and estuarine environments are separated out, and treated in another volume. Each chapter presents information on: (1) the physical environment, (2) vegetation, (3) animal communities, (4) resource use and management effects, and (5) ecological research and management opportunities.

There is an assortment of fairly modest typos within the text of this book ("treading" for "trending," p. 21; "Souamata" for "Squamata," pp. 88-90; "Gns" for "Grus," p. 92; "sawinsonii" for "swainsonii," p. 97; "Caldium" for "Cladium," p. 211; "prostatum" for "prostratum," p. 277; "cinnamomea" for "cinnamomea," p. 281; "felxuosum" for "flexuosum," p. 286; "campensis" for "capensis," p. 336; "flacata" for "falcata," p. 379; etc.) which, although unfortunate, can be largely discounted. More serious, however, are problems with nomenclature of various taxa, especially from chapter to chapter. Perhaps the list of vertebrate species (Chapter 3) should have been used as the source for all the animal names in the book, instead of having *Odocoileus* on p. 137 (but it's *Odocoilus* on p. 179, and *Odocoileus* on p. 139) for *Dama* (p. 102). Similarly, *Zibethicus ondatra* on p. 137 occurs as *Ondatra zibethicus* in Chapter 3, while *Megaceryle* on p. 177 is actually *Ceryle* in Chapter 3. There are some problems with common names, too: "Caribbean monk seal" occurs in the text (p. 103), but as "West Indian seal" on p. 102. *Ophisaurus* sp. probably is most commonly "Island glass lizard," rather than "grass" lizard (p. 147). *Magnolia grandiflora*, listed on p. 127 as canopy species of maritime forests, is treated as *M. virginiana* on p. 130.

A few rough edges occur elsewhere. The southeastern Coastal Plain includes parts of NC, SC, GA, AL, MS, LA, TX, and all of FL, according to the first sentence of Chapter 9, but the accompanying map provided in Chapter 1 (p. 19) includes, additionally, portions of AR, TN, KY, MO, and OK (the last two not considered as part of the Southeast). The map of Kùchler vegetation types (p. 4) is difficult to use, with too many shades of grey. A succinct discussion concerning reasons for concern over the plight of Southeastern biodiversity would be useful.

The success of this work much exceeds these complaints. Its chapters are well written, representing a distillation of an enormous literature (all totaled, 1,396 references appear, 33% of which are from the current decade). This book will serve as a valuable text and reference source for academics and their students, as well as professionals involved in management and inventory. Perhaps most importantly, in this apparent 11th hour of our remaining biodiversity, this book will be useful as a source for governmental agencies and politicians genuinely sensitive to the alarming losses taking place around us.

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Gunderson, D. R. 1993. Surveys of Fisheries Resources. John Wiley and Sons, NY. \$44.95. 248 p.

This detailed and quantitative book addresses methods and analyses for fishery surveys directed at individual target species, in which the goal is accurate assessment of abundance or biomass of populations. The author argues against use of catch per effort surveys based on commercial fishing efforts, and focuses instead on population/biomass estimates from direct survey methods requiring only a single pass through the area of interest. The book is most applicable to surveys of fish species of commercial interest, although examples are given related to endangered species and other non-commercial applications. The techniques discussed in this volume are probably of less utility in studies of whole fish communities, e.g. those by ichthyologists in which the goal is determination of total species and their relative abundance in a given lake, stream reach, etc.

This book is well-organized, and presents material in a readable fashion. It opens with a chapter on biological and statistical considerations for survey design, and these principles are good food for thought even for biologists planning studies of communities, non-game species, etc. The author reminds us of the critical need to understand basic distribution and biology of the target species (e.g. migration patterns), the value of finding "windows of opportunity" when populations are concentrated in an area, and the requirement to understand quantitatively the capture range of the gear being used. Again,

these approaches apply most directly when the goal is determination of absolute density, biomass, etc., per unit area or for a whole population, and may be less applicable if relative abundance within a community is the goal. The latter part of the first chapter is a concise treatment of statistical topics that are often ignored in survey planning, such as determination of confidence intervals, sample size requirements, allocation of effort, bootstrapping, and transformations of data.

The rest of the book consists of chapters on four classes of survey methods: bottom trawls, acoustics, egg/larvae, and direct counts. Each chapter provides a detailed explanation of gear, with excellent schematics of operating features, assessment of avoidance, and statistical approaches to interpretation of catch data. A beneficial feature of each chapter also is a section on actual examples of successful application of that survey approach, with references to published literature. I cannot think of any other "methods" book that has combined this approach, providing both technical specifics and real-world applications.

Usefulness of the four technical chapters will vary, depending on one's area of interest. The chapter on bottom trawl surveys seems most applicable to marine and estuarine fisheries work, with less direct application in freshwater, although the discussions of otter and beam trawls would be useful for work in reservoirs, large lakes, or big rivers. The chapter on acoustic surveys is applicable for any open-water systems, and provides a clear explanation of how acoustic monitoring works, with clear diagrams of beam characteristics (but without swamping the nontechnical reader with too much physics!). There is a useful discussion of integrating midwater trawls with acoustic surveys for the purpose of target identification, determination of fish size and similar problems. This chapter stands as a readable "handbook" that provides a good overview of acoustic sampling, and it should be useful in particular to scientists needing a concise introduction to this technique. The one omission is much detail on specific acoustic equipment (brand names, models, etc.), but these change so rapidly that perhaps the omission is warranted. The egg and larvae chapter provides basic information on development of young fish, their avoidance of gear, design of sampling surveys, and arithmetic treatment of data to obtain population parameters. However, this chapter provides only a limited review of the many kinds of actual sampling gears, such as Tucker trawls, bongo nets, etc., and the interested reader will have to look elsewhere for detailed comparisons. The chapter focuses more on how to lay out a survey design and interpret data than on how to actually catch a larval fish. The final chapter on "direct counts" focuses on strip and line transects, touching on aerial surveys, SCUBA and snorkeling, underwater cameras, submersibles, and ROV's. Understandably, it is impossible to provide much detail on every technique in such a general chapter. However, I found some particulars amusing. The author advises against snorkeling surveys in water less than 0.75 meters deep. My team and I, working in freshwater streams, regularly survey fish in pools and riffles so shallow that we literally have to turn our head/mask sideways to count fish, in depths as shallow as about 20 cm!

Overall, this book is a good introduction to the techniques for which it provides coverage. There are about 400 references in the literature cited. I recommend the book highly to individuals wanting a review of or introduction to general principles of surveys and statistics, or specifics on techniques involving bottom trawling, acoustic surveys, egg/larval surveys and direct counts. It will be most useful to individuals interested in population estimates in large waters, and less so to those interested in fish community studies or studies in small lakes or streams.

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Kim, Ke Chung and Bruce A. McPheron (eds). 1993. Evolution of Insect Pests: Patterns of Variation. John Wiley and Sons, NY. \$89.00. 479 p.

Like fellow population biologists working on other taxa, entomologists have long been interested in genetic variation, but perhaps with a greater sense of urgency. Variation in such traits as pesticide susceptibility and host plant use is often a serious complication to pest management. This was among the stimuli for a series of symposia at the Entomological Society of America meeting in 1986, which led to this book. Like many multiple author compilations, most of the contributions are very good to excellent, but a few suffer from serious errors in fact and interpretation. Each reader will find his own favorite chapters; I'll mention a few of mine.

Only a few of the chapters in this volume actually focus on the evolution of insect pests. Perhaps this is a reminder that we still know little about whether evolution (other than through selection for insecticide resistance) plays much of a role in making pests out of some insects. Are pests made more often as a result of our own practices? J. L. Krysan's contribution clearly describes how both evolution

and human intervention appear to have made corn rootworms (*Diabrotica* spp.) into pests. In contrast, J. R. Bradley suggests that the most costly of our agricultural pests, the bollworms *Heliothis virescens* and *Helicoverpa zea* (for which control costs and losses have been estimated at \$1 billion per year), achieved their status essentially without recent evolution. Four of the 23 chapters, including favorites by M. Anderson and P. M. Kareiva on predator searching and D. A. Andow *et al.* on invasions, hardly touch on the evolution or genetic variation. Most of the chapters describe variation and evolution *in* pests, only some types of which seem clearly to have increased the pest status of these insects. An example is D. P. Pashley's succinct summary of interpopulational differences in host preference in the "polyphagous" fall armyworm: it seems likely that such specialization has occurred independently of (and prior to) our agricultural practices. Nonetheless, as comprehensively summarized by G. G. Kennedy, understanding these kinds of variation is critical to the refinement of pest management programs. In the last chapter, the editors propose the addition of a superscript to the scientific names of species as a formal designation for biotypes. While entomologists will continue to describe genetic variation in pests, I doubt that many systematists or field entomologists will be keen to adopt this idea.

Unfortunately and in spite of the obvious hard work of many of the contributors, I found the book to be already falling out of date and therefore inaccurate in several areas. The project appears to have had a long gestation after the symposia in 1986. The book is generally thin on references cited after 1988, and a quick check of half dozen of the "in press" and "unpublished" citations revealed that four had appeared between 1987 and 1992. At least one author cited his chapter in this book as "in press" in 1989. At least some of the material, such as Pashley's chapter, is now readily available in journals. I learned a lot from this book and found chapters like that by M. D. Rausher on the evolution of habitat preference to be very stimulating. I will certainly cite the book in the near future. Nonetheless, because it is virtually four years old, I cannot strongly recommend *Evolution of Insect Pests* at its listed price.

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Miller, Stephen A. and John P. Harley. 1992. **Zoology.** W. C. Brown Publishers, Dubuque, IA. About \$50.00. 759 p.

This is a multi-functional college text in introductory zoology that begins with basic biological concepts, progresses through a fairly detailed review of the animal-like protists and all the major phyla in the kingdom Animalia, and concludes with a review of body systems, physiology, and behavior and ecology. The length and breadth of the coverage suggests that it is best suited for a two quarter or one semester course in zoology. Using only the taxonomic section, it might be possible to adapt the text to a single quarter animal biology course.

The book is divided into six major parts with 42 chapters. Each chapter begins with an outline, a review of the major concepts and a "Have you ever wondered" section that asks pertinent questions concerning the main points presented. Scattered throughout each chapter are "Stop and ask yourself" question boxes. Additionally, each chapter contains insets that present an in depth review of relevant selected topics. At the end of each chapter is a summary, a list of key terms, a list of critical thinking questions and a suggested reading section.

The first section of the book is entitled "Introduction, Cells, Molecules, and Life." It contains basic information concerning introductory chemistry, cell structure and function, enzymatic pathways and energy transformations. The material is presented in a straightforward manner with liberal diagrams and illustrations. It is followed by "The Continuity of Life" section that contains chapters on mitosis and meiosis, genetics, molecular genetics, and developmental biology. The third section is entitled "Evolution" and contains chapters on historical evolutionary concepts, evolution and gene frequencies, and a chapter on human evolution. These three sections could be omitted if the zoology course has been preceded by an introductory biology course.

Part four consists of 17 chapters beginning with a chapter on taxonomy that presents an overview of the major methodologies used in animal taxonomy including cladistics. The next 16 chapters cover the animal phyla and present a good, thorough overview of each group. As might be expected, the organization of this section is from the animal-like protists to mammals. The authors do an excellent job of explaining the functional role of the increasing morphological and physiological complexity. The text is liberally augmented with photographs and figures depicting the major anatomical and structural features of each group.

The fifth section of the text is entitled "Form and Function" and takes a comparative systems approach in looking at how the major organ systems in the body work. There are chapters covering the muscular and skeletal systems, two chapters on nervous system, a chapter on hormones, one covering circulation, immunity and gas exchange, one on nutrition and digestion, one on temperature and fluid regulation, and a chapter on reproduction and development.

The final section (Behavior and Ecology) consists of three chapters: animal behavior, the ecology of individuals and populations, and the ecology of communities and ecosystems. While the coverage of such broad topics with only a chapter each is very difficult, the authors do a good job of hitting the high points in each of these areas. The diagrams and illustrations are very good.

Overall I found this to be an excellent introductory text to such a broad subject. The authors have accomplished what they set out to do in presenting a text that can be modified to fit into a variety of class formats. I found relatively few typographical errors. There was an error on page 44 in the direction that active transport processes move materials and again in color plate 18 where figure b makes reference to the axolotl as *Ambystoma tigrinum* when it should be *Ambystoma mexicanum*.

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Philip Henry Gosse. 1993. Letters from Alabama (U.S.): Chiefly Relating to Natural History. An Annotated Edition. With an Introduction by Harvey H. Jackson III and Notes by Daniel D. Jones and Ken R. Marion. University of Alabama Press, Tuscaloosa, AL. \$18.95. 324 p.

Philip Henry Gosse arrived in Mobile, Alabama, in 1838, about 60 yrs after William Bartram. While Bartram spent only a few days in southern Alabama, Gosse lived eight months in Dallas County. His views as a naturalist give intriguing insight into the natural history of the developing region as well as into the environmental and social attitudes of the times. The book is an excellent addition to our knowledge of plants, animals, and natural habitats in the 1800's.

Gosse, an Englishman who had lived in Philadelphia, came to Alabama with prospects of being a teacher. His "letters," published as a book in 1859 and now reprinted as part of the Library of Alabama Classics, are notes and sketches based on his observations of the region, its people, and its wildlife.

Gosse mentions more than 300 plants and animals (usually including scientific names), the majority being insects, especially butterflies and moths. He also reports observations of about 50 birds, a dozen reptiles, 35 trees, and more than 50 flowers, shrubs, and vines. His accounts of natural history reveal a keen and observant individual with a background in biology. Most of the descriptions are accurate enough for readers to recognize today's extant species and some that are no longer with us.

For example, Gosse states that on "a ride to Selma . . . I had the pleasure of seeing a flock of Parrots. There were 80 or a 100 in one compact flock, and as they swept past me, screaming as they went, I fancied that they looked like an immense shawl of green satin on which an irregular pattern was worked in scarlet and gold and azure."

On another occasion, during a morning "bird-seeking expedition," he reports his disappointment in finding few birds in the deep woods compared to those seen near the edges. However, "we by-and-by discovered what I thought well worth my trouble, a pair of those splendid birds, the Ivory-billed Woodpeckers. They were engaged in rapping some tall dead pines, in a dense part of the forest, which rang with their loud notes. These were not at all like the loud laugh of the Pileated nor the cackle of the smaller species, but a single cry frequently repeated, like the clang of a trumpet." Later in the passage he states, "we succeeded in shooting both, which I skinned and dissected." This was southern Alabama in the 1830's. We might all gain some lessons in natural history from Gosse's writings.

The annotation (pages 307-324) is a valuable addition for today's readers. Each species mentioned by Gosse is referenced by page number, and current scientific and common names are given. This useful and accurate annotation makes Gosse's descriptions even more enjoyable. Overall, the book is a reflective and informative guide for those interested in the perspectives of a biologist in the South a century and a half ago.

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McFarland, D. 1993. **Animal Behaviour**, 2nd ed. Longman Sci. Tech., Essex, England. \$47.00. 585 p.

The texts for introductory courses in Animal Behavior became more numerous and diverse in the early and mid 1980's, allowing those of us who teach such courses a much wider choice than previously available. Many of these texts are now in their second or third editions. McFarland's first edition of Animal Behavior set out to integrate three distinct lines of thought in the field: psychological, physiological, and zoological. In doing so, he found a niche that other animal behavior texts did not fill at the time. In the second edition, McFarland continues with the same approach he took before, while updating the ethological sections of the book in particular. New chapters on primate social behavior, communication, and animal economics have been added.

McFarland's text is divided into three main parts, "The Evolution of Behaviour," "Mechanisms of Behaviour," and "Understanding Complex Behaviour." Each section within a part is preceded by a profile of a scientist whose work influenced the development of the material that follows, e.g. Mendel, Darwin, and Fisher headline sections in the evolution of behavior, while Lorenz, Tinbergen, von Frisch, and Tolman are presented in the complex behavior part. The attention paid to the pioneers in the field is carried into the chapters. McFarland uses and cites the work of early ethologists and psychologists liberally, providing a feeling of connectedness and history within the text. He achieves his goal of bringing together the three distinct lines of approach to animal behavior well, and the book reads as an integrated whole. Ethological fundamentals, perceptual systems, motivation and learning all are presented, as well as social behavior, altruism, and decision making. The book concludes with an interesting section on language, intelligence and animal awareness. A student certainly will get a broad and good introduction to animal behavior from this text.

Some basic biology is presented in very brief overviews at various points in the book. Mendelian inheritance, genetic variation, and DNA are presented in about eight pages before McFarland delves into development and behavior genetics. Similarly an overview of ecology is found, appropriately, in the section on natural selection, and an overview of neural and endocrine control before the excellent chapters on sensory processes, coordination, and homeostasis. These short sections glide quickly over an array of concepts and terms that an introductory course in biology would spend considerably more time on. They result from the commitment McFarland made to "define and develop each concept without reliance on previous coursework" (from the preface). Frankly, I don't really believe that goal is attainable. In some places the overviews become a list of definitions that are not further developed. Students may find them useful as a review, but they should not count on them for primary information. Nevertheless, they provide useful introduction to the material that follows. For example, I was impressed with how the student is led, in the section on sensory perception, from basic neurobiology to signal perception in the context of stimulus filtering, and signal detection theory, followed by an introduction to the ethological concepts of sign stimuli, IRM and search images, with examples.

The book is well put together. The writing is clear and I found it easy to read. Illustrations appear on nearly every page, there are lots of definitions with keywords bold in the text, and on the order of 900 references. Each chapter is followed by a list of "points to remember" and further reading (often an advanced book). Discussion questions and a glossary of terms are lacking, but might have been helpful.

McFarland's *Animal Behaviour*, 2nd ed., is a good introduction to the complex and broad field of animal behavior.

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Prescott, L. M., J. P. Harley, and D. A. Klein. 1993. **Microbiology**, 2nd ed. Wm. C. Brown Co. Dubuque, IA. \$67.50. 1,056 p.

The recent edition of Prescott, Harley, and Klein is a general microbiology textbook encompassing a broad range of material. It can be used for students of both the various subdisciplines of microbiology and the professions that require knowledge of microbiology. The book is divided into 11 sections, called parts by the authors, totaling 44 chapters. Further it can be purchased as three separate volumes. In the first volume are six parts covering an introduction, growth and metabolism, genetics, control of microbes, viruses and diversity of cellular microorganisms. Medical microbiology is found in the second volume which contains three parts: the nature of symbiosis, fundamentals of immunology and microbial diseases of humans. "Microbiology and the Environment" and "Food and Industrial Mi-

crobiology" are the two parts that compose the third volume. Also, there are five appendices, glossary and index to aid the student. Of special note is that "standard" chemistry and metazoan disease chapters have been relegated to appendices. Overall the book contains the topics one would desire for a general microbiology course.

Within chapters are a variety of pedagogical aids that have become common in college texts. Each chapter begins with quotes, an outline, "Concepts" and a brief introduction. The chapters are replete with tables, figures, key terms in bold type, review questions, cross references, and boxed readings. I found the style of the boxed readings to vary widely from attempts to highlight interesting applications to detailed explanations that could easily have been incorporated into the body of the text (e.g. Box 31.I). At the end of the chapters are summaries, lists of key terms, "Questions for Thought and Review" and lists of "Additional Readings." Thus the book has the form indicative of one written with the student in mind.

The applicability of this book should probably be restricted to a population somewhat less than indicated by the authors. The limitations come from (1) previous knowledge needed by students for comprehension and (2) depth of individual topics covered. In the "Preface" the authors state, "A quarter/semester or two each of biology and chemistry is assumed, and an overview of relevant chemistry is also provided in appendix I." However, here are 2 sentences found on p. 103: "Ferrichrome is a hydroxamate produced by many fungi; enterobactin is the catecholate formed by *E. coli* (Fig. 5.5a, b). It appears that three siderophore groups complex with iron orbitals to form a six-coordinate, octahedral complex (Fig. 5.5c)." The figures show the structures, but I doubt that one or two semesters of chemistry and the appendix could prepare a student for this. Although these sentences are an extreme example, there are too many instances where information is given assuming knowledge either unexpected of many undergraduates or to be given later in the text. I suggest that this book is better considered for upperclassmen or students that have some experience with organic chemistry if not biochemistry.

If the student population is prepared for the general level of the text, the next issue concerns its content. I found some sections well-developed and others wanting. Thus the book's adoption may rest on the course objectives and instructor's idiosyncracies. Topics that I found particularly good include the following. The molecular genetics and immunology chapters appear as current as one might hope for in a text. The importance of molecular biology to microbiology is one of the professed themes of the book. If this is an emphasis in the course, one might give the text special consideration. Second, the chapters on bacterial taxonomy interface quite well the traditional phenetic classification with newer phylogenetic classifications using nucleic acids. Third, Chapter 34 on clinical microbiology is an interesting addition to the human disease section. In this section, disease processes are presented from the taxonomic rather than focus of infection perspective. I found this section and that on food and industrial microbiology to be the better written parts of the book. Unfortunately, the related chapters of control of microbes are cursory.

I realize that my review has not been overly positive. The text is broad-based and yet provides the requisite depth on a variety of topics. It is quite appropriate for an upper level general microbiology course. Perhaps my reservations come from the fact that I have recently used the most student friendly book that I know—*Fundamentals of Microbiology* by I. E. Alcamo. I realize that it does not nearly have the depth of Prescott *et al.*'s book. The two books should not be competitors as they seem to be designed for different courses and different student populations. But I could not review the current text without wondering whether or not students would in fact read it and would turn on to microbiology based on their readings.

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Alcock, John. 1993. **Animal behavior: An Evolutionary Approach**—5th ed. Sinauer Associates, Inc., Sunderland, MA. \$43.95. 625 p.

Alcock's latest revision of *Animal Behavior* will be familiar to those who have read and used his previous editions. The prosaic style enjoyed by readers of his articles in *Natural History* makes the text both enjoyable and lucid. His approach remains that of using actual studies to illustrate how evolutionary theory can help to answer the age-old question of why animals behave as they do. Emphasis is on studies that test alternate explanations which may come from two complementary levels: proximate or mechanistic "how?" questions, and ultimate evolutionary "why?" questions.

The organization of the subject matter in the 17 chapters has changed minimally from the 4th

edition. An introductory chapter on the evolutionary approach is followed by one on genetic and environmental effects on behavioral diversity. The following two chapters expand on the genetics and development of behavior. Then Alcock details how studies of nerve cells and the nervous system can link behavior to ecological differences. Illustrations of ways in which complex behavioral repertoires are kept organized via the nervous and endocrine systems are included in the next chapter. Each of four fundamental problems of finding food and shelter, avoiding predators, and reproducing are the subject of a chapter. These are followed by chapters on the ecology of mating systems and caring for offspring. The ecology and evolution of social behavior are the subject of the last two chapters of the book. The chapter on human behavior is modified from the previous edition; the discussion of warfare is omitted (although primary references are provided) and studies of adoption are used to contrast hypotheses derived from evolutionary theory versus arbitrary culture. Use of human-oriented terms (e.g. rape, adultery, and homosexuality) are de-emphasized and discussed under more generalized concepts (coercive sex, sperm competition, mate choice, competition, and mate guarding). As in previous editions, each chapter is followed with a summary, suggested readings and discussion questions that challenge readers to develop and test their own alternate hypotheses.

Studies of animal behavior have increasingly asked questions of ultimate cause. Alcock's latest edition of *Animal Behavior* continues to show the success of this evolutionary approach. Although most of the text is little changed from the previous edition, the organization and flow of presentation have been improved. There are many new references and examples. The 1,031 citations in this new edition are expanded and updated from the previous 885 (including updates on evolution of bird flight, brain structure and homosexuality, and sexual differentiation in spotted hyenas). Students using this book will have an up-to-date introduction to the study of animal behavior and behavioral ecology, especially to how behavioral science is effectively carried out.

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Inglis, V., R. Robert, and N. Bro. 1993. **Bacterial Diseases of Fish.** John Wiley and Sons, NY. \$89.95. 180 p.

The book *Bacterial Diseases of Fish* is a compilation of papers presented by fish health experts at an international aquaculture conference held in Stirling, Scotland, in 1991. The papers have been purposely formatted as chapters in a text that the editors envision as being useful for students in aquaculture courses, for animal health laboratory personnel that are inexperienced in fish disease diagnosis, and for administrators involved in fisheries management. In my opinion, these objectives of the editors have been realized and the book should be a valuable resource to the above groups. There are 17 chapters: the first 15 deal with specific pathogens or groups of pathogens while the last 2 address more general topics. Although there was no standard set of headings to be used for each chapter, all of the authors did address the important characteristics of the different etiologic agents, the clinical signs and histopathological changes associated with the disease, the diagnostic procedures preferred, the epizootiology of the disease and methods for its control and treatment if available. The chapters are well-illustrated and contain many tables and compilations of information that will be useful both to the novice groups described above and to experienced investigators as well. In addition there are 36 excellent color plates that show the external lesions, the internal lesions, and the histopathologic changes associated with many of the infections.

The book is generally structured around the family taxon with three chapters describing pathogens belonging to the Cytophagaceae, three deal with members of the Vibrionaceae, two are devoted to the Enterobacteriaceae, and one each to the Pasteurellaceae and Pseudomonadaceae. An additional three chapters describe Gram positive fish pathogens and the remaining two review the acid-fast bacteria and rickettsial agents, respectively. Inclusion of a chapter describing the rickettsial pathogens of fish is timely considering the recent spate of papers showing their importance as salmonid pathogens. The chapter on the Clostridia is short, which simply reflects the dearth of information about these bacteria, mainly due to the difficulties inherent in working with anaerobes. Both these groups of organisms have been generally neglected in other fish health texts but their inclusion is now warranted as they appear to be more important in fish diseases processes than was once thought.

The last two chapters deal with general topics. For example, Chapter 16 describes the approaches used in the isolation and identification of bacterial pathogens and contains, in addition to descriptive verbiage about the different groups of pathogens, a variety of useful media formulations and tables that delineate the important cultural and biochemical characteristics that aid in identification. The

last chapter is a well-balanced discussion of the various public health ramifications that can result from the consumption of fish infected with, or contaminated by, bacterial pathogens.

In summary, this book will be a valuable reference for those laboratories involved in fish health surveillance and for persons needing familiarity with the bacterial pathogens of fish. The illustrations are quite good, the contributors have excellent credentials, and the cost is reasonable (\$89.95).

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NEWS OF BIOLOGY IN THE SOUTHEAST

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ABOUT PEOPLE AND PLACES

ALABAMA

The University of North Alabama, Department of Biology. Dr. Francis J. Menapace (Ph.D. Plant Systematics, Southern Illinois University) has been appointed Assistant Professor of Biology. His research interests include vascular plant phylogeny and taxonomy, with particular emphasis on the Cyperaceae.

AUSTRALIA

Department of Zoology, The University of Adelaide. The 10th International Association of Astacology Symposium will be held in Adelaide, Australia, 10–15 April 1994. It will include three and a half days of paper presentations, a mid-conference tour and social functions. It will be followed by post conference tours to crayfish habitats and research and industry centers in various parts of Australia. For further information contact Dr. Mike Geddes, Department of Zoology, The University of Adelaide, South Australia 5005 Australia.

GEORGIA

Wesleyan College, Biology Department. Three new faculty members have been hired. Ronald B. Toll is the Munroe Professor of Life Sciences. Dr. Toll was at the University of the South in Sewanee before coming to Wesleyan. His Ph.D. is in biological oceanography from the Rosenthal School of Marine and Atmospheric Sciences at the University of Miami. He will direct the only live octopus laboratory in the Southeast. Two other faculty will share a position of Assistant Professor of Biology. The husband and wife team of Alstair J. Inman and Anne M. Houtman came to Wesleyan from the University of Toronto. Both received their Ph.D. degrees from the University of Oxford in Zoology.

Armstrong State College, Department of Biology. Dr. Judy Awong-Taylor has joined the faculty to teach microbiology and molecular genetics. She received her Ph.D. from the University of Florida. Her area of expertise is the fate of genetically engineered microorganisms in the environment.

Valdosta State University, Department of Biology. Dr. Carol D. Pappas joined the faculty as an Associate Professor of Biology. Dr. Pappas is relocating her NIH Grant and research on *Aedes albopictus* populations from Peru State College (Nebraska) to Valdosta State.

Savannah State College, Department of Biology and Life Science. Dr. Govindan K. Nambiar, Professor and Acting Head participated in the Summer Research Conference on "S-Adenosylmethionine pharmacology and methylation" sponsored by the Federation of American Societies Experimental Biology at Copper Mountain (Denver) Colorado. His participation was supported by a grant from the Institute of General Medical Sciences. Dr. Chellu S. Chetty joined the department as an Associate Professor. His Ph.D. is in physiology and has more than 40 publications. Dr. Kenneth Sajwan, Associate Professor of Biology, co-edited a book titled, *Trace Elements in Coal and Coal Combustion Residues*, published by Lewis Publications.

KENTUCKY

Georgetown College, Department of Biology. Dr. Charles N. Boehms, Dwight M. Lindsey Professor and Chair of Biology, has been appointed Senior Vice President and Academic Dean. Dr. Barbara Raffall is serving as Acting Chair. Dr. Julie Mann and Dr. Ramona Rice have been appointed as Assistant Professors of Biology. Dr. Mann's Ph.D. is in Reproductive Microanatomy from the Uni-

versity of Kentucky. *Dr. Rice's* Ph.D. is in Mineral Up-take in Algae from the University of Arkansas. *Dr. Mark Johnson* attended a six week summer workshop on Teaching Molecular Biology in Small Colleges at Boston University. *Dr. Rick Kopp* has been appointed Director of the summer science program for high school students.

NORTH CAROLINA

East Carolina University, Department of Biology. *Dr. Donald W. Stanley* was elected secretary of AERS. *Dr. Claudia Jolls* was appointed to the ASB executive committee. *Dr. William Ambrose, Jr.* received a research award in Evaluating the Development of Restored and Constructed Seagrass Ecosystems in the S.E. *Mr. Jerry Freeman*, Stockroom Manager for many years has resigned his position. *Dr. Takero Ito*, a biochemist, has retired. *Dr. Mark Brinson* delivered the keynote address at a workshop in Annapolis, Maryland. He also co-hosted a Wetlands Symposium for the Society of Wetlands Scientists in Edmonton, Alberta. *Dr. Charles Singhas* was awarded tenure, and *Dr. Gerhard Kalmus* and *Dr. Roger Rulifson* were promoted to the rank of Full Professor. *Dr. Hal J. Daniel* joined the department from the Department of Speech-language and Auditory Pathology. *Dr. Susan McDaniel* was appointed Director of Undergraduate Studies for the dept. replacing *Dr. Clifford Knight*. She also won two University awards for excellence in student advising. *Dr. Cindy Putnam-Evans* from LSU was hired for the Biochemist faculty position. Also, *Dr. Thomas R. Jones* from the Univ. of Michigan, joined the faculty with research interests on Systematics and Evolutionary Ecology of vertebrates. *Dr. Stephen Norton*, a Fisheries Biologist is also a new member of the staff. *Dr. William Ambrose* with *Drs. Stanley Riggs* and *Scott Snyder* (both Geology) appeared on *Search* the weekly statewide public TV program on their Sea Floor Studies near Onslow Bay.

Elon College, Department of Biology. *Phillip Mason* (Ph.D. Auburn University, Vertebrate Zoology) is new to the department. He is an Associate Professor of Zoology and the new Chair. His primary interests are ornithology and physiological ecology. Also new to the department is *Michael Ulrich* (Ph.D. Washington University, Molecular Genetics). He will teach general biology and develop courses in molecular and developmental genetics. *Dr. Herbert House*, former Chair of the dept. is returning to full time teaching responsibilities in anatomy and physiology, comparative anatomy, and comparative animal physiology. He has also begun an exploration of computer assisted teaching methods.

North Carolina State University, Department of Zoology. *Dr. Grover C. Miller* has retired after 36 years of service. *Dr. Harold Heatwole* spent much of the summer on studies in Australia and the Great Barrier Reef. *Dr. F. Eugene Hester*, Associate Director of Natural Resources in the U.S. National Park Service, was cited as the Outstanding Alumnus of our college for 1993. Gene is also a former faculty member. *Dr. Peter Bromley* has been promoted to full professor. *Dr. George Barthahnus* was awarded the Alumni distinguished Professorship and assumed Grover Miller's duties as Coordinator of Undergraduate Programs.

VIRGINIA

Virginia Commonwealth University, Department of Biology. *Dr. Russell V. Brown*, former Chairman of the Department, has retired. He served as Chairman of the Department from 1974 to 1981, and after leaving the chairman duties, he was engaged in genetics teaching and research. He is spending much of his retirement time in Alaska and Mexico. Two new staff members have joined the faculty. They are *Drs. William Eggleston* and *Rhodda Perozzi*. *Dr. Eggleston* is a molecular geneticist and was formerly located at the University of Wisconsin, Madison. *Dr. Perozzi* is replacing *Mr. Lewis Payne*, who is now working on his doctorate. She will teach general biology, as she had done previously at Webster College, St. Louis. *Dr. Michael Fine* has recently received funding for a four-year study involving postembryonic neuromuscular plasticity in the oyster toadfish. The department is developing an overseas studies program directed by *Dr. Dan Kimbrough*. Initially, the program will select first year graduate students, who will complete the didactic component of their MS degree at USE Bristol, England, and their research at VCU. *Dr. John Pagels* has been promoted to Professor of Biology and *Dr. Sara McCowen* to Associate Professor of Biology.

MUSEUMS AND BOTANICAL GARDENS

MISSISSIPPI

The Crosby Arboretum, Picayune. *Sue Bond* has assumed the responsibilities of Business Manager and Director of Development. Also, *Nelda Lee* joined the staff this past Spring. *Bob Brzuszek* installed plant labels along the Pond and Arrival Journeys, along with a brochure describing the labeled plants. This will be made available to visitors and anyone requesting a copy by mail. The 2nd annual Founders Day Dinner was held 5 September at the Pinecote Pavilion. Also, nature and wildlife photographer, *Stephen Kirkpatrick*, presented a multimedia program based on his experiences in nature's wild places on 8 October. His new book *Wild Mississippi* was autographed after the program.

Mississippi Museum of Natural Science, Jackson. *Mark Woodrey* is the new staff Ornithologist to replace *Dr. Cheri Jones*, who left Mississippi last year to take the position of Curator of Mammals at the Denver Museum of Natural History in Colorado. Mr. Woodrey is a Ph.D. candidate in biology at the University of Southern Mississippi. His work experience has been with the ecology, behavior, and habitat of trans-Gulf migrants as they arrive and depart from coastal areas. He has published a number of journal papers on nongame and neotropical birds.

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CONTENTS

THE ASB BULLETIN

VOLUME 41, NUMBER 1, JANUARY 1994

News	1
Announcements	22
Reviews	25
News of Biology in the Southeast	35

Cover photo for this issue of the marine leech, *Stilarobdella macrothela*, supplied by the editor Frank J. Schwartz.

Cover photo of the larval horsehair worm, published in the cover of Vol. 40, no. 3, July 1993 was supplied by Dr. Marion R. Wells, Dept. Biology, Middle Tennessee Univ., Murphreesboro, TN.

The *ASB BULLETIN*

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April 1994

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Host of the 55th Annual Meeting, Orlando, Florida

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1996: Claudia L. Jolls, East. Carolina Univ., Greenville, NC

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Society, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, South Atlantic Chapter of the Society of Wetlands Scientists, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1994	April 13-16	University of Central Florida, Orlando, FL
1995	April 19-21	University of Tennessee, Knoxville, TN
1996	April 10-13	Ga. Southern College, Statesboro, GA

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Program of the
55th ANNUAL MEETING of the
ASSOCIATION OF SOUTHEASTERN
BIOLOGISTS

Hosted by
UNIVERSITY OF CENTRAL FLORIDA

at

Clarion Plaza Hotel

Orlando, Florida

SOCIETIES MEETING WITH ASB IN ORLANDO

American Society of Ichthyologists and Herpetologists,
Southeastern Division

Beta Beta Beta

Botanical Society of America, Southeastern Section

Ecological Society of America, Southeastern Chapter

Southeastern Fishes Council

Southern Appalachian Botanical Society

MEETING HEADQUARTERS
CLARION PLAZA HOTEL

GENERAL INFORMATION

Registration - Registration for the 55th annual meeting of the Association of Southeastern Biologists, and purchase of tickets for the banquet, Thursday social, breakfasts, luncheons, and field trips have been arranged through the Center for Continuing Education, University of Central Florida. For information on these and other activities, please call the local arrangements chair, Jack Stout, at (407) 823-2919. Pre-registrants may pick up their registration packet with tickets and other information at the ASB Registration Desk in the Ballroom Foyer of the Clarion Plaza Hotel. The desk will be open from 12:00 to 10:00 p.m. on Wednesday, 13 April, from 8:00 a.m. to 5:00 p.m. on Thursday, 14 April, and from 8:00 a.m. to 12:00 noon on Friday, 15 April. Late registration will be possible at these times; however, tickets for special events will be limited and may not be available. See the January 1994 issue of the ASB Bulletin for pre-registration information. Please bring this copy of the ASB Bulletin to the meeting, as no free copies will be available. Extra copies may be purchased at the ASB Information desk for \$3.50.

Ground Transportation - When approaching from the north (Atlanta) or west (Interstate 10) the easiest routes are Interstate 75, Florida's Turnpike (toll), and Interstate 4. Also from the north (Jacksonville), Interstate 95 and Interstate 4. These routes intersect with exits to International Drive from Interstate 4. The Clarion Plaza Hotel is near the midpoint of International Drive, a hotel-entertainment-commercial strip on the east side of Interstate 4.

Airport Transportation - The Greater Orlando International Airport is a 15-minute drive from the Clarion Plaza Hotel. Car rentals are available at the airport through several national car rental agencies. The regular individual fare via Airport Shuttle to the Clarion is \$20.00 (round-trip).

Parking - There is ample free parking associated with the hotel complex.

Job Placement Message Board - A job placement message board will be made available near the ASB information desk in the Ballroom Foyer (Wednesday), and in the Mezzanine Foyer (Thursday and Friday).

Dining Facilities - Meals are available in the Clarion Plaza Hotel (Jack's Place [A la carte Dining place], Cafe' Matisse, and Lite Bite). Many fine restaurants, ranging from fast food to formal are available along International Drive. Your registration packet will have a list of many of the restaurants in the greater Orlando area.

Social Activities and Special Events - Check your registration packet for tickets to the events for which you have pre-registered. Consult the program schedule for time and place of the various events, meetings, and meals. A limited number of tickets for these may be available at the registration desk for those who did not pre-register.

Thursday Evening Sea World Shows and Buffet Dinner -The Thursday night social will include two shows (Sea Lion and Otter and Shamu "Night Magic") and a buffet supper at Sea World. ASB will have the dinner at the Shamu Pavilion. Dinner will be an all-you-can-eat barbecued chicken/barbecued ribs buffet, and entertainment will be provided by 60's and 70's Rock-n-Roll and Country band. We must give the caterers an accurate count of persons expected in advance so there will be enough food. We strongly recommend purchasing tickets in advance. Transportation will be provided by buses. Buses will depart the Clarion at 5:45 and 6:10 p.m., and return from Sea World between 10:30 and 11:00 p.m.

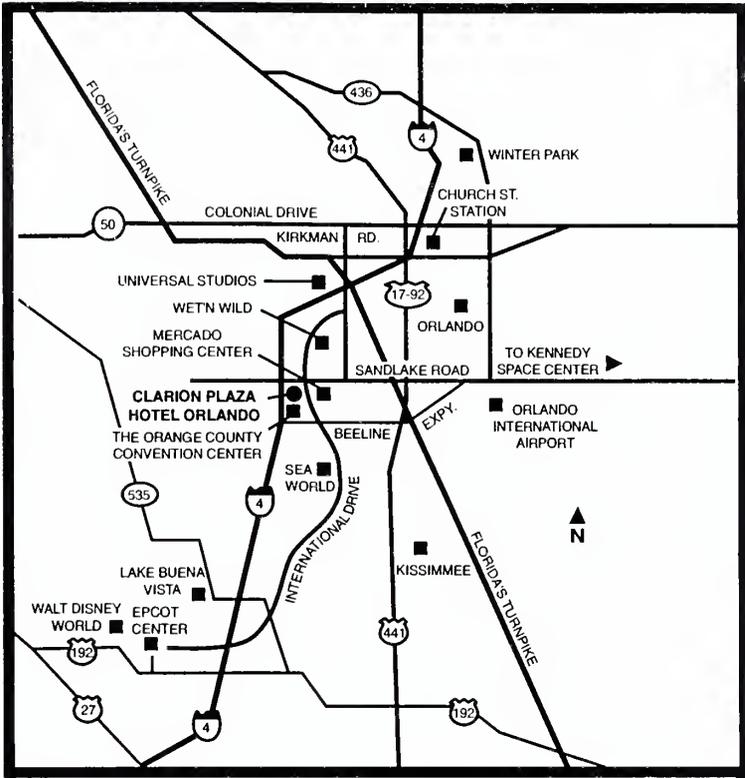
The Sea World social is sponsored in part by ASB.

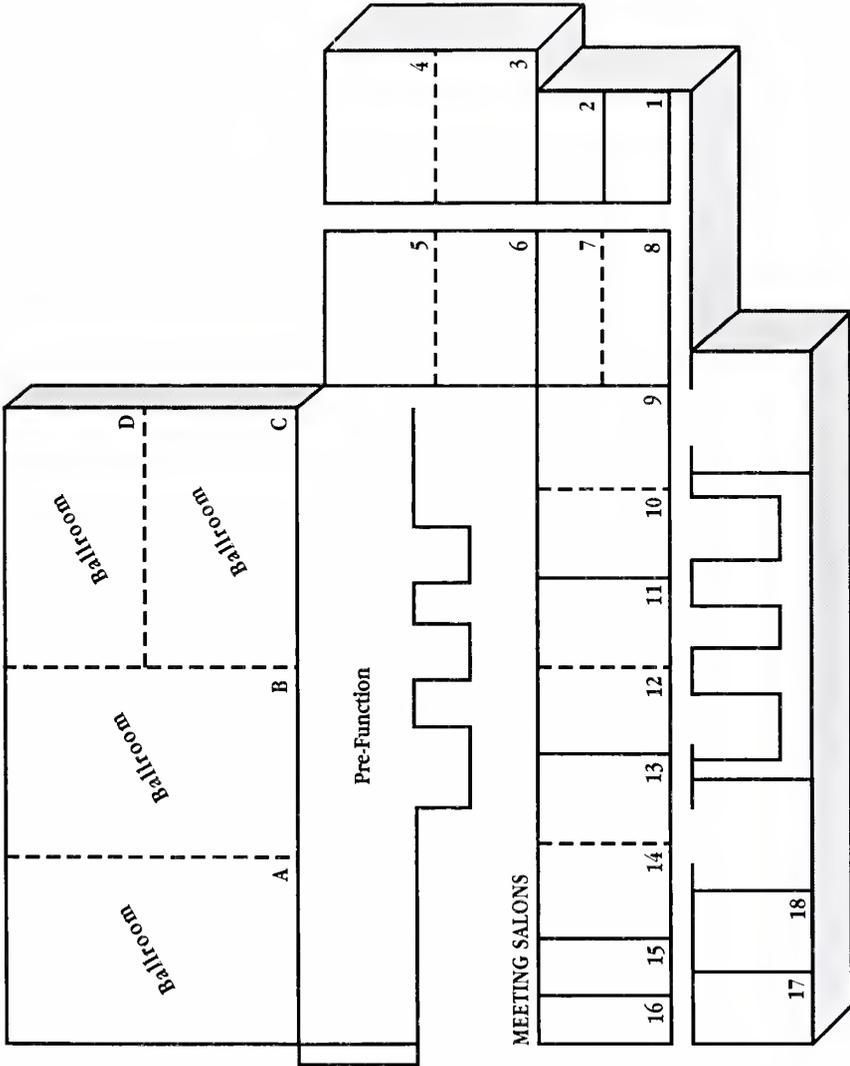
Friday Evening Banquet - The banquet will be held in the Clarion Plaza Hotel (Ballroom C).

Field Trips - All field trips will depart from the Clarian Plaza Hotel and you must pre-register. See details on each trip in the January 1994 issue of the ASB Bulletin.

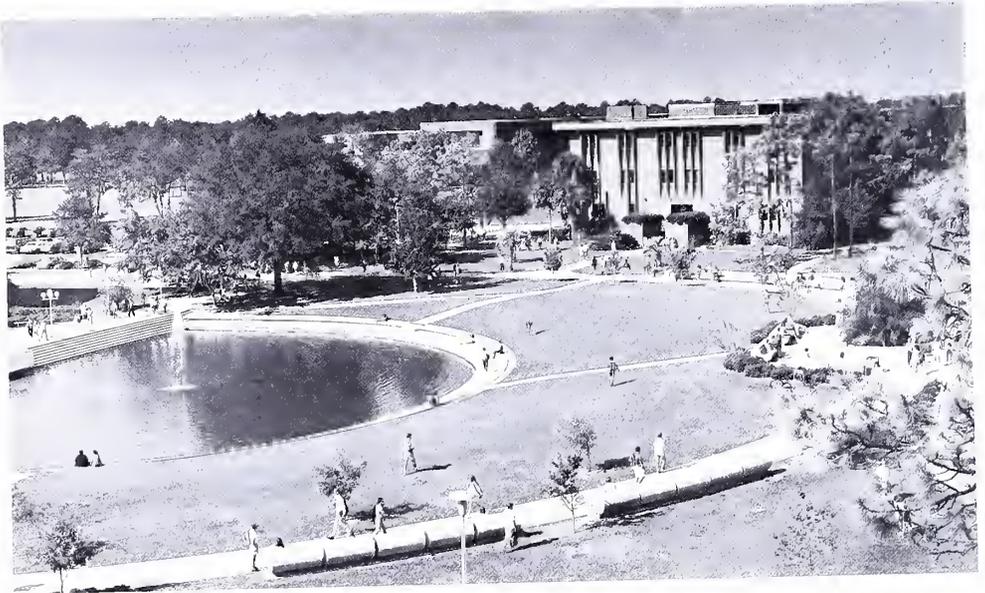
Useful Telephone Numbers - (Area Code 407)

Jack Stout (Local Arrangements and Registration)	823-2919
Buck Snelson (Program)	823-5394
Clarion Plaza Hotel (Reservations) (outside Florida)	1-800-627-8258
(in Florida)	1-407-352-9700
Delta Airlines (Air Transportation)	1-800-241-6760 (code R-1107 for ASB rate)





2nd Floor



University of Central Florida campus.



Clarion Plaza Hotel
meeting site

Program Summary

All events at the Clarion Plaza Hotel except where noted. See map of hotel floorplan in this issue of the Bulletin.

WEDNESDAY, 13 APRIL 1994

- 12:00 P.M. - 10:00 P.M. **REGISTRATION, Ballroom Foyer**
3:00 P.M. - 7:00 P.M. **ASB Executive Committee Meeting, Salon 11**
6:30 P.M. - 9:30 P.M. **Council Meeting, Southern Appalachian Botanical Society, Salon 12**
8:00 P.M. - 10:00 P.M. **ASB Wine and Cheese Social, Salon 7/8**
8:30 P.M. - 10:30 P.M. **Continuation of ASB Executive Committee Meeting (if necessary), Salon 11**

THURSDAY, 14 APRIL 1994

- 7:00 A.M. - 8:00 A.M. **Past President's Breakfast, Salon 1**
7:00 A.M. - 5:00 P.M. **Slide Preview, Salon 2**
7:00 A.M. - 8:30 A.M. **Poster Session Set-up, Salon 7/8**
8:00 A.M. - 5:00 P.M. **LATE REGISTRATION, Mezzanine Foyer**
8:00 A.M. - 5:00 P.M. **Placement Service, Mezzanine Foyer**
8:30 A.M. - 9:45 A.M. **Plenary Session, Ballroom C**
9:45 A.M. - 5:00 P.M. **Exhibits, Ballroom D**

POSTER AND MORNING PAPER SESSIONS

- 10:00 A.M. - 5:00 P.M. **Poster Session, Salon 7/8**
4:00 P.M. - 5:00 P.M. **Presenters with Posters**
10:00 A.M. - 12:00 P.M. **Symposium: Environmental Justice - The EPA Perspective, Location To Be Announced**
10:00 A.M. - 12:00 P.M. **Wetlands Ecology, Salon 9**
10:00 A.M. - 12:00 P.M. **Floristic Studies, Salon 10**
10:00 A.M. - 12:00 P.M. **Aquatic Ecology, Salon 13**
10:00 A.M. - 12:00 P.M. **Plant Ecology, Session 1, Salon 14**

SPECIAL EVENTS

- 1:00 P.M. - 5:30 P.M. **Beta Beta Beta Field Trip to Kennedy Space Center. Bus departs from the Clarion Plaza Hotel.**

AFTERNOON PAPER SESSIONS

- 1:30 P.M. - 3:15 P.M. **Symposium:** Animal Care and Use Guidelines: How They Affect Your Teaching and Research, Location To Be Announced
- 1:30 P.M. - 4:00 P.M. Wetlands and Aquatic Ecology, Salon 4
- 1:30 P.M. - 4:00 P.M. Herpetology, Salon 5
- 1:30 P.M. - 4:45 P.M. Plant Systematics, Salon 6
- 1:30 P.M. - 5:00 P.M. Plant Ecology, Session 2, Salon 9

BUSINESS MEETINGS

- 4:00 P.M. - 5:00 P.M. SE Division, American Society of Ichthyologists and Herpetologists, Salon 5
- 5:00 P.M. - 6:00 P.M. Southeastern Fishes Council, Salon 5

SPECIAL EVENT

- 6:00 P.M. - 10:00 P.M. **Buffet Supper and Entertainment at Sea World of Florida.** Transportation begins at 6 PM from the Clarion Plaza Hotel.

FRIDAY, 15 APRIL 1994

- 7:00 A.M. - 8:30 A.M. **Breakfast and Business Meeting:** Southern Appalachian Botanical Society and SE Section, Botanical Society of America, Location To Be Announced
- 7:00 A.M. - 4:00 P.M. Slide Preview, Salon 2
- 8:00 A.M. - 5:00 P.M. Placement Service, Mezzanine Foyer
- 8:00 A.M. - 12:00 P.M. **LATE REGISTRATION,** Mezzanine Foyer
- 8:00 A.M. - 12:00 P.M. Exhibits, Ballroom D
- 9:00 A.M. - 12:00 P.M. Beta Beta Beta Scrapbook Competition, Location To Be Announced

MORNING PAPER SESSIONS

- 9:00 A.M. - 11:00 A.M. **Teaching Update Workshop:** Isozyme electrophoresis, Hardy-Weinberg, and Plant Mating Systems: A Speedy, Dramatic Lab Exercise on Population Genetics, Location To Be Announced
- 8:00 A.M. - 12:00 A.M. **Symposium:** Aspects of the Biogeography of Florida, Session 1, Salon 4
- 8:30 A.M. - 11:30 A.M. **Symposium:** Biological Aspects of Water-Quality Assessment in Southeastern United States, Salon 9

- 8:00 A.M. - 12:00 A.M. Herpetology and Ichthyology, Salon 6
 8:00 A.M. - 12:00 A.M. Animal Ecology and Evolution, Salon 7
 8:30 A.M. - 10:00 A.M. Teaching Biology, Salon 8
 9:00 A.M. - 12:00 A.M. Plant Ecology, Session 3, Salon 5

BUSINESS AND LUNCHEON MEETINGS

- 10:30 A.M. - 11:30 A.M. **Business Meeting:** Beta Beta Beta, Location To Be Announced
 11:45 A.M. - 12:45 P.M. **Luncheon:** Beta Beta Beta, Location To Be Announced
 11:30 A.M. - 12:30 P.M. **Business Meeting and Election:** ASB, Salon 13/14
 12:30 P.M. - 2:00 P.M. **Luncheon Meeting:** SE Chapter, Ecological Society of America, Salon 12

AFTERNOON PAPER SESSIONS

- 2:00 P.M. - 4:00 P.M. **Special Workshop:** Professional Biologists/Ecologists and K-12 Teachers: A Winning Partnership, Location To Be Announced
 2:00 P.M. - 5:00 P.M. **Symposium:** Aspects of the Biogeography of Florida, Session 2, Salon 4
 1:30 P.M. - 4:45 P.M. Physiology and Development, Salon 9
 1:30 P.M. - 5:15 P.M. Ichthyology, Salon 6
 2:00 P.M. - 5:00 P.M. Forest Ecology, Salon 7
 1:30 P.M. - 4:45 P.M. Microbial, Molecular, and Genetic Biology, Salon 8
 2:00 P.M. - 3:45 P.M. Plant Ecology, Session 4, Salon 5
 1:30 P.M. - 4:30 P.M. Beta Beta Beta, District 1, Location To Be Announced
 1:30 P.M. - 3:45 P.M. Beta Beta Beta, District 2, Location To Be Announced

SPECIAL EVENTS

- 6:00 P.M. - 7:30 P.M. **ASB Mixer** (Cash Bar), Salon 11/12
 7:30 P.M. - 10:00 P.M. **ASB Banquet**, Ballroom C

SATURDAY, 16 APRIL 1994

- 7:00 A.M. - 9:00 A.M. **ASB Executive Committee Breakfast Meeting**, Salon 18
 7:30 A.M. - 4:00 P.M. **Field Trips:** Departure from the Clarion Plaza Hotel. Canaveral National Seashore-Merritt Island National Wildlife Refuge, Wekiva Springs State Park, and The Disney Wilderness Preserve. See January 1994 issue of ASB Bulletin for details and exact times for each trip.



INVITED SPEAKER FOR THE 1994 PLENARY SESSION

CAROL M. BROWNER

Carol Browner became the head of the U.S. Environmental Protection Agency in January 1993. President Clinton, in naming Browner Administrator of the EPA, cited her strong administrative background and her record in building innovative partnerships to protect our environment while also promoting economic growth.

As head of EPA, Browner is charged with protecting the nation's air and water from harmful pollution, overseeing solid and hazardous waste disposal, cleaning up hazardous sites under the Superfund law, and establishing guidelines for pesticide use and food safety. Browner has declared pollution prevention her priority and has vowed to speed EPA decision-making on air, water, and land issues. She hopes to inspire Americans to participate with pride in protecting our environment.

From 1991 to 1993, Browner was Secretary of the Department of Environmental Regulation for the State of Florida, the nation's third largest environmental agency. In that post, she won praise for dealing effectively with complex issues involving wetland protection, hazardous waste disposal, and Everglades cleanup. In a widely lauded agreement, Browner in her Florida post allowed Walt Disney World to develop its property, in return for spending about \$40 million to turn 8,500 acres of endangered wetlands into a wildlife refuge. Browner also helped ban oil and gas drilling off the Florida Keys and played a key role in improving water quality in the Florida Everglades. Under Browner's leadership, a coalition of Florida business leaders worked out a fee structure for major sources of air pollution in

advance of the federal deadline, giving the state a headstart in improving air quality.

From 1986 to 1988, Browner worked for Sen. Lawton Chiles, now Governor of Florida, helping to negotiate a complex land swap that expanded Big Cypress National Preserve. She then served as Legislative Director for Sen. Al Gore, Jr., helping to draft amendments to the Clean Air Act.

Browner grew up in south Florida, where the Everglades were a bike ride away. Her parents, college professors at Miami-Dade Community College, gave her her first lessons in politics and appreciation for the natural wonders around her.

Browner graduated from the University of Florida in 1977 and then earned a degree from its law school. She began working on environmental issues as General Counsel for the Florida House of Representatives Government Operations Committee in 1980. She then worked for Citizen Action, a grassroots consumer group, in Washington, DC, where she met her husband, Michael Podhorzer. They have a son, Zachary, five, and live in Maryland.

ANNOUNCEMENT

Wetlands Ecology—A rigorous, college-level, introductory field/lecture course offering three (3) hours of undergraduate or graduate credit. This 13-day summer course, now in its ninth year, is offered to students who have a background in biology or related field or who have the instructor's consent. Past participants say this course has enhanced their wetlands understanding in regulatory work, private consulting, graduate school studies or careers.

Major course features include identification of wetland vascular plants, wetland soils and hydrology, overview of the nation's wetland ecosystems, wetland field techniques and introductory wetland delineation. Students use a team approach in the solution of wetland field problems. Enrollment is limited to 16.

For further information about the 1994 class scheduled July 24–August 5, write The Division of Public Service, University of North Carolina at Wilmington, 601 South College Road, Wilmington NC 28403-3297, or call (910) 395-3193. Brochures will be mailed in February, 1994.

ASB CANDIDATES FOR OFFICE—1994

The Nominating Committee, composed of Kenneth Shull, Carol Baskin, and Sandra Bowden (Chair), has selected the following slate of nominees for ASB offices to be filled in 1994. Additional nominations will be received from the floor. The election will take place at the Annual Business Meeting in April 1994. Please plan to attend.

- President-Elect:* **Robert R. Haynes** University of Alabama, Tuscaloosa, AL
Jim W. Ross Cumberland College, Williamsburg, KY
- Vice-President:* **Patricia D. Parr** Oak Ridge Nat. Laboratories, Oak Ridge, TN
James W. Wallace, Jr. Western Carolina University, Cullowhee, NC
- Secretary:* **Beverly Collins** Memphis State University, Memphis, TN
Donald P. Hauber Loyola University, New Orleans, LA
- Executive Committee:* **Mary U. Connell** Appalachian State University, Boone, NC
(Two persons) **James F. Matthews** Univ. of NC-Charlotte, Charlotte, NC
Stephen T. Ross Univ. of Southern Mississippi, Hattiesburg, MS
Paul A. Schmalzer The Bionetics Corp., Kennedy Space Center, FL



Robert Haynes



James Ross

Robert R. Haynes—Dr. Robert Haynes is Professor of Biological Sciences at The University of Alabama, Tuscaloosa, Alabama. He earned his B.S. in Botany from Louisiana Polytechnic Institute (Louisiana Tech University), his M.S. in Biology from The University of Southwestern Louisiana, and his Ph.D. in Botany from The Ohio State University. Haynes taught two years at Louisiana State University in Shreveport before moving to Alabama. His research interests are in the systematics of aquatic vascular plants. Techniques utilized for his systematic studies include morphology, phyto-geography, ecology, cytology, phytochemistry, and, more recently, chloroplast DNA sequences. Haynes has been an active member of ASB since 1977 and has served the Association in several capacities.

He currently serves on the Place of Meetings Committee. In addition, he is a long time member of the International Association of Plant Taxonomists, American Society of Plant Taxonomy, Botanical Society of America, and Southern Appalachian Botanical Society. He has served on one or more committees for all of the above organizations except the IAPT. In addition, he was elected as a Fellow of the Linnean Society of London in 1987. Haynes has authored one book and more than 60 publications in scientific journals. He also has prepared one or more aquatic families for many floras, ranging from the American tropics to North America. His research has been funded by several sources, but mostly by the National Science Foundation, from which he has received more than six grants. Haynes is the program director for SERFIS, a computer database that when complete will house label data for most herbarium specimens stored in herbaria of the Southeastern United States.

James W. Ross—Dr. Jim Ross is Professor and Chair of Biology at Cumberland College, Williamsburg, Kentucky. He earned his B.S. and M.S. in Biology from Murray State University, Murray, Kentucky, and his Ph.D. in Biology from the University of Alabama. He was a post-doctoral associate at the University of Hawaii. His teaching interest is in Cell Biology and his research interest is concerned with the role of monogalactosyldiacylglycerol in the chloroplast membrane. His research has been supported by the NIH, the Eli Lilly Foundation, and the University Research Council. He has directed 14 undergraduate researchers, some of whom have presented their work at the annual meetings of the ASB. He holds memberships in the American Society of Plant Physiologists, the American Society for Photobiology, the Kentucky Academy of Science, Sigma Xi, Beta Beta Beta and the Southern Section of the American Society of Plant Physiologists. He has been an active member of the ASB since 1978. He has participated in the annual meetings in paper and poster presentations. His teaching has ranged from General Biology (non-science majors) to General Biochemistry. He has served the society as an at-large member of the Executive Committee, as Chair of the Faculty Research Committee, Chair of the Publications Committee, as a member of the ad hoc Membership Committee and as Vice-President. In 1984, Dr. Ross received the ASB Faculty Research Award.

VICE-PRESIDENT

Patricia D. Parr—Pat Parr has worked in the Environmental Sciences Division of Oak Ridge National Laboratory since 1974. She manages the Department of Energy's Oak Ridge National Environmental Research Park which includes the coordination of rare plant, wetland, and wildlife management programs for the Oak Ridge site. She provides leadership on landuse decisions for the Oak Ridge Reservation, serving on the Resource Management Council and represents Oak Ridge on the Public Affairs Committee of the Southern Appalachian Man and the Biosphere program. She received an award for her development of the Ecological and Physical Sciences Study Center, a precollege education program at Oak Ridge. She received her B.S. in Biology (1974) from Tennessee Wesleyan College, Athens, TN and her M.S. in Ecology (1981) from The University of Tennessee, Knoxville. She has presented numerous papers and chaired sessions at ASB meetings (member since 1978). She has recently completed a term as ASB Treasurer (1990–93).

James W. Wallace, Jr.—Dr. Wallace is Professor of Biology at Western Carolina University, Cullowhee, NC. He earned his B.S. in Pulp and Paper Technology (1962) and M.S. in Botany (1964) at Miami University, Oxford, OH and his Ph.D. in Botany at the University of Texas at Austin (1967). Subsequently he was a post-doctoral fellow at the University of British Columbia (1969) and a National Research Advisory Council Senior Research Fellow in New Zealand (1975–77). He has been a member of ASB since 1977 and has served on the ASB Executive Committee (1990–93). He served two terms as Chair of the Faculty at WCU (1988–92) and was elected as a Fellow of the Explorers Club and the Indian Fern Society. He is a member of the Botanical Society of America and has chaired both the Southeastern Section (twice) and the Phytochemical Section (twice); he was Secretary (1971–74) and Editor-and-Chief (1974–76) of the Phytochemical Society of North America and organized their thirteenth international meeting. He is also an active member of the American Fern Society, Southern Appalachian Botanical Society, Wellington Botanical Society, International Association of Pteridologists, and The Society of Sigma Xi. His teaching bridges both classical and biochemical approaches to the various botanical disciplines at both the undergraduate and graduate levels. His research interests relate to the biogenesis, physiology, and distribution of plant secondary compounds and medicinal

plants of the Southern Appalachians. His current research emphasizes the polyphenolics of filmy ferns and black walnut. He has published 3 books, 37 research papers and has made numerous presentations at regional, national and international scientific meetings during the previous 30 years. He has traveled widely and has presented invited papers on his research in Germany (International Botanical Congress), China, India, and at several universities in the U.S. In addition to his professional activities he has had leadership roles in several community organizations.

SECRETARY

Beverly S. Collins—Dr. Collins received her B.S. in Botany from the University of Kentucky and her M.S. and Ph.D. in Botany and Plant Physiology from Rutgers University. After a postdoctoral appointment at Savannah River Ecology Laboratory (SREL), she joined the faculty of Memphis State University as Assistant Professor of Biology. In 1993 she returned to SREL, where she is currently Associate Research Ecologist. Her research interests focus on mechanisms of plant species coexistence and community dynamics. Ongoing research includes causes and consequences of variation in allometry of *Aristida tuberculosa* seeds, comparison of light quality effects on stem morphology of *Polygonum* congeners, and response of oldfields to frequency and intensity of disturbance. Other interests include philosophy of ecology. Membership in professional societies includes Botanical Society of America, Ecological Society of America, and British Ecological Society. She has been a member of ASB since she returned to the southeast in 1985. Currently, she is secretary of the ecological section of BSA. She is also a member of the ASB committee on minorities, women, and the handicapped in biology and of the BSA SE activities committee.

Donald P. Hauber—Dr. Hauber is an Associate Professor of Biological Sciences at Loyola University, New Orleans, LA. He received his Ph.D. in Botany from Texas Tech University. He earned his B.S. in Cell Biology and his M.A. in Botany from the University of Kansas. His research interests lie principally in plant cytogenetics, particularly the process and control of meiotic chromosome pairing and chiasma formation. He is also interested in the use of cytogenetic analysis in systematic studies of species and hybrids, primarily polyploids. He has published in regional, national, and international journals and co-edited a book on polyploidy. Don has been active in the Genetics section of the Botanical Society of America: he has served on the editorial board of the Plant Genetics Newsletter (1989–91), as secretary/treasurer of the Genetics section (1991–93), and currently as vice-chair of the section, and represents the section on the BSA Council. He was nominated in 1992 for Program Director of BSA. Don has been a member of ASB since 1990 and for the past five years has maintained in the southeastern region an active and close association with TriBeta as a faculty advisor. His other society affiliations include Society for the Study of Evolution, American Society of Plant Taxonomists, and American Association for the Advancement of Science.

EXECUTIVE COMMITTEE

Mary U. Connell—Dr. Connell is a Professor in the Department of Biology at Appalachian State University in Boone, NC. She received her B.S. and M.S. degrees in Biology from Marshall University and her Ph.D. in Biology from Kent State University. In 1974 she joined the faculty at Appalachian State University where she currently teaches Molecular Biology and supervises the graduate teaching assistants. During the 1990–91 academic year she was on sabbatical at the University of Florida in the laboratory of Dr. Robert R. Schmidt working on molecular aspects of inorganic nitrogen metabolism in both the green alga *Chlorella sorokiniana* and the C₄ grass *Pennisetum purpureum*. Her research involved sequencing cDNA clones for glutamine synthetase as well as the construction of a NADP-glutamate dehydrogenase probe system for use in RNase protection assay protocols. She has continued this avenue of research since returning to the ASU campus. In May of this year she was awarded her second NSF-ILI grant that well provided the equipment necessary to add PCR and sequencing techniques to the Molecular Biology laboratory. Dr. Connell has taught a number of NC Biotechnology Center-sponsored Biotechnology workshops to high school biology, chemistry and special education teachers. She is a member of Sigma XI, the Phycological Society of America, ASB and AAAS.

James F. Matthews—Dr. Matthews is Professor and will begin a term (7/1/94) as Chairman of the Department of Biology at the University of North Carolina at Charlotte. His undergraduate degree was in Biology at Atlantic Christian College, M.S. from Cornell University and Ph.D. from Emory University. His research has focused on the species associated with the granitic outcrops, on the biology of endangered and threatened species and on the taxonomy of the genus *Portulaca*. He is Director of the UNCC Herbarium and has overseen the computerization of the 23,000+ specimens. He served on the Executive Committee of ASB from 1980–83, and as President of the Southern Appalachian Botanical Society from 1980–82, during its period of reorganization. Subsequently he has served on the SABS Endowment Committee (1986–90), Long Range Planning Committee (1987–90), Finance Committee (1990–93) and Selection Committee for the Windler Award (1991–93). He also served as an Editor for *Castanea* in 1985–86. He chaired the Local Arrangements Committee for the ASB meeting in Charlotte in 1989.

Stephen T. Ross—Dr. Ross is Professor of Biological Sciences and Curator of Fishes at the University of Southern Mississippi, Hattiesburg, where he has been since 1974. He received his B.A. degree in Zoology from the University of California, Los Angeles, his M.S. in Biology from California State University, Fullerton, and his Ph.D. in Biology from the University of South Florida. His research interests include ecological and evolutionary relationships of fishes, with particular emphasis on the persistence and stability of fish assemblages, ecological responses of fishes to altered environments, and conservation biology of fishes. His publications have spanned habitats from the continental shelf of the Gulf of Mexico to Gulf barrier islands and estuaries, to southeastern, midwestern and western streams. He served ASB as program chair for the 1988 meeting in Biloxi, Mississippi, and is a past-president of the Southeastern Division of the American Society of Ichthyologists and Herpetologists. Currently he is the Ecology/Ethology Editor for *Copeia*.

Paul A. Schmalzer—Dr. Schmalzer is Senior Field Ecologist with the Bionetics Corporation at Kennedy Space Center, Florida. He received his B.A. in Biology from Western Maryland College, Westminster, Maryland (1976) and M.S. (1978) and Ph.D. (1982) in Ecology from the University of Tennessee, Knoxville. His current research interests include: effects of fire on vegetation and soils, distribution, structure, composition, and dynamics of barrier island plant communities, and effects of Space Shuttle launches on vegetation and soils. Previous research included studies of vegetation and flora of the Cumberland Plateau in Tennessee, vegetation of coastal California, and habitat use by gopher tortoises. He is a member of the Ecological Society of America, Association of Southeastern Biologists, Southern Appalachian Botanical Club, and other professional societies. He serves on the Environmentally Endangered Lands Selection Committee for Brevard County, Florida.

ASB PAPER AND POSTER SESSIONS

THURSDAY MORNING, 14 APRIL

PLENARY SESSION - BALLROOM C

- 8:30 **Gary E. Whitehouse**, Provost, University of Central Florida.
Welcoming remarks.
- Ken R. Marion**, ASB President. Response.
- Carol Browner**, Director, U.S. Environmental Protection Agency.
Invited plenary speaker.

POSTERS - SALON 7/8

Presenters with posters 4:00 - 5:00 PM

- 10:00 1 **Almeida, Jean E. and John G. Morris.** (Florida Institute of
Technology) Characteristics of a winter refugial manatee (*Trichechus
manatus*) population at Homosassa Springs, Citrus County, Florida:
1982-1993.
- 2 **Bartsch, Jay J., Shannon E. Ergle, Irene Kokkala, and
James Wetzel.** (Furman University and Presbyterian College)
Development of the lateral line in embryos of the dwarf seahorse,
Hippocampus zosterae.
- 3 **Burke, Patricia M. and John G. Morris.** (Florida Institute of
Technology) A critical habitat analysis: Research on the utilization of
shelter habitats by the Florida manatee, *Trichechus manatus latirostris*,
in Brevard County, Florida.
- 4 **Carrick, Kevin M. and Daniel B. Plyler.** (University of North
Carolina at Wilmington) Interaction of fusicoccin and abscisic acid in
breaking and restoring seed dormancy in *Spartina alterniflora*.
- 5 **Covert, Joseph S., Michael Barnwell, Joel Borden,
Amanda Wrona, Richard G. Wiegert, George R. Cline,
and Frank A. Romano.** (Jacksonville State University and
University of Georgia) Preliminary analysis of summer occurrence of
estuarine benthic macroinvertebrates off Sapelo Island, GA.
- 6 **Detwiler, Kenneth B., Stephen W. Clark, and K. J.
Balak.** (Western Kentucky University) Investigation of regeneration of
chick cochlear sensory epithelium using *in situ* hybridization.

- 7 **Doyle, T. W., L. E. Gorham, and B. D. Keeland.** (National Wetlands Research Center and Johnson Controls World Services) Wind damage relationships of Hurricane Andrew on forested wetlands of southern Louisiana.
- 8 **Gabrielsen, Cynthia A.** (Environmental Sciences Division, Oak Ridge National Laboratory) Formulation of a viable work plan for the assessment of threatened and endangered animal species at the Oak Ridge National Environmental Research Park.
- 9 **Gorham, L. E., B. D. Keeland, and T. W. Doyle.** (Johnson Controls World Services and National Wetlands Research Center) Patterns of primary versus secondary damage caused by Hurricane Andrew in the Atchafalaya Basin of southern Louisiana.
- 10 **Keeland, B. D., L. E. Gorham, and T. W. Doyle.** (National Wetlands Research Center and Johnson Controls World Services) Impacts of Hurricane Andrew on forested wetlands of the Atchafalaya Basin, Louisiana: First year mortality.
- 11 **Kopplin, Constance L. and John G. Morris.** (Florida Institute of Technology) A comparison of the use of different fresh water inputs into the Brevard County section of the Indian River by the West Indian Manatee (*Trichechus manatus*).
- 12 **Lobinske, Richard J.** (University of Central Florida) Qualitative and quantitative estimates of larval chironomid midges in two tributaries of the Wekiva River, central Florida.
- 13 **Marshall, Harold G.** (Old Dominion University) Characterization of phytoplankton composition and abundance in the Chesapeake Bay.
- 14 **Maurakis, E. G. and W. Roberts.** (Saint Paul's College and Belzoni Animal Clinic) Aquatic sciences and aquaculture initiative at Saint Paul's College.
- 15 **McDuffie, James Eric, Richarde Campbell, and Mary Fleming Finlay.** (Benedict College) Analysis of intestinal isozymes with recombinant inbred strains of mice.
- 16 **Miller, Richmond J. and K. J. Balak.** (Western Kentucky University) Comparison of normal and regenerating lateral line hair cell epithelia using immunoblotting methods.
- 17 **Parr, Patricia D.** (Environmental Sciences Division, Oak Ridge National Laboratory) Landuse changes: The decision-making process evolving for the Oak Ridge Reservation.
- 18 **Smetana, R. L., D. C. Forester, and L. P. Mangurian.** (Towson State University) A comparison between prolactin binding sites in the male and brooding female brain of *Desmognathus fuscus*.

- 19 **Smith, Michael E. and Gerry Lanfair.** (Valdosta State University) Effects of preservation on wet-weight biomass of the Asiatic clam, *Corbicula fluminea*.
- 20 **Stankus, Paul T. and Gary R. Wein.** (Savannah River Ecology Laboratory, University of Georgia) Hydrologic effects on species diversity and productivity: a mesocosm approach.
- 21 **Steed, Candy L., Kevin L. Willison, and Marcia Harrison.** (Marshall University) Light-regulated ethylene production during gravitropism in etiolated pea stems.
- 22 **Thomas, Mary Beth, Nancy C. Edwards, and Robert P. Higgins.** (University of North Carolina, Charlotte and The Smithsonian Institution) A previously undescribed marine meiofaunal hydroid.
- 23 **Wagner, Dyonuka, Kimberly James, Mary Fleming Finlay, and George McCoy.** (Benedict College) Effects of chronic exposure to PCBs in two generations of *Peromyscus polionotus* (Old Field Mice).
- 24 **Weaver, Donald J., Kenneth R. Lake, and Karla M. Weidner.** (Furman University) Development of immunohistochemical markers to the endosomal and lysosomal compartments in *Ameba splendens*.
- 25 **Whittier, Henry O. and G. Hale Pringle.** (University of Central Florida) BIOSYS, a program for collecting, manipulating, and reporting large taxonomical, ecological, and biogeographic data sets.
- 26 **Zirkle, Eugene and A. Floyd Scott.** (Austin Peay State University) The herpetofauna of Fort Campbell Military Reservation, Kentucky and Tennessee.

SYMPOSIUM - LOCATION TO BE ANNOUNCED

ENVIRONMENTAL JUSTICE - THE EPA PERSPECTIVE

Organized by *Gerry Twitty*, Howard University

- Presiding: *Clarice Gaylord*, U.S. Environmental Protection Agency
- 10:00 27 **Gaylord, Clarice.** (Office of Environmental Equity, U.S. Environmental Protection Agency) An introduction to Environmental Justice.
- 10:20 28 **Wright, Beverly.** (Center for Environmental Programs, Xavier University) Environmental Justice: Education and outreach.

- 10:40 29 **Banks, Warren.** (Special Assistant to the Administrator, U.S. Environmental Protection Agency) Environmental Justice: Research priorities.
- 11:00 30 **Carroll, Lynda.** (Regional Environmental Equity Coordinator, Dallas, TX) Environmental Justice: The regional agenda.
- 11:20 31 **Regan, Richard.** (Legislative Analyst, North Carolina/Washington, D.C.) Environmental Justice: The congressional agenda.

WETLANDS ECOLOGY - SALON 9

- Presiding: *Kenneth W. McLeod*, Savannah River Ecology Laboratory
- 10:00 32 **Lickey, Edgar B. and Gary L. Walker.** (Appalachian State University) An allozyme analysis of *Taxodium distichum* var. *distichum* and *Taxodium distichum* var. *imbricarium*.
- 10:15 33 **McLeod, Kenneth W., James K. McCarron, and Howard S. Neufeld.** (Savannah River Ecology Laboratory and Appalachian State University) Comparative growth patterns of bald and pond cypress saplings under varying soil water conditions.
- 10:30 34 **Neufeld, Howard S. and Kenneth W. McLeod.** (Appalachian State University and Savannah River Ecology Laboratory) Aspects of the internal water relations of bald and pond cypress trees.
- 10:45 35 **McCarron, James K., Howard S. Neufeld, and Kenneth W. McLeod.** (Savannah River Ecology Laboratory and Appalachian State University) Seasonal water relations and gas exchange patterns of bald and pond cypress saplings under varying soil water conditions.
- 11:00 36 **Neufeld, Howard S., Edgar B. Lickey, Gary L. Walker, James K. McCarron, and Kenneth W. McLeod.** (Appalachian State University and Savannah River Ecology Laboratory) Future research on the genetics and ecophysiology of bald and pond cypress trees.
- 11:15 37 **Wein, Gary R. and Beverly S. Collins.** (Savannah River Ecology Laboratory) Seedbank composition of a constructed wetland.
- 11:30 38 **Fisher, M. A. and F. S. Gilliam.** (Marshall University) Nutrient changes in soils of a created wetland.
- 11:45 39 **Reed, Michael R. and Kenneth W. McLeod.** (Savannah River Ecology Laboratory, University of Georgia) Planting unconsolidated sediments with flood tolerant species.

FLORISTIC STUDIES - SALON 10

- Presiding: *John B. Nelson*, University of South Carolina
- 10:00 40 **Abbott, J. Richard and Ralph L. Thompson.** (Berea College) A floristic survey of Fort Boonesborough State Park, Madison County, Kentucky.
- 10:15 41 **Hill, Steven R.** (Clemson University) Floristic survey of the Washo Reserve, Charleston County, South Carolina.
- 10:30 42 **Huck, Robin and Joan Gill Blank.** (Florida Museum of Natural History and Grapetree Productions Inc.) Historic native flora and early settlement agriculture of Cape Florida, Key Biscayne, Florida.
- 10:45 43 **Jones, Ronald L.** (Eastern Kentucky University) The flora of Cumberland Plateau wetlands of northeastern Alabama.
- 11:00 44 **Kennemore, Douglas E., Jr., John B. Nelson, and David H. Rembert.** (University of South Carolina) A preliminary report on a floristic survey of the Kings Mountain State and National parks.
- 11:15 45 **Nelson, John B.** (University of South Carolina) Final report on a floristic survey of the Tom Yawkey Wildlife Center, Georgetown County, South Carolina.
- 11:30 46 **Anderson, Loran C. and John B. Nelson.** (Florida State University and University of South Carolina) *Chrysopsis gossypina* subsp. *cruiseana*, an endemic golden aster of the Florida panhandle, in South Carolina?
- 11:45 47 **Emrick, Verl R. and Garrett S. Smathers.** (University of North Carolina, Asheville) Phytogeography of the Craggy Mountains: Southern Appalachians.

AQUATIC ECOLOGY - SALON 13

- Presiding: *Bruce C. Cowell*, University of South Florida
- 10:00 48 **Moser, Mary L. and Steve W. Ross.** (Center for Marine Science Research, University of North Carolina at Wilmington) Identification of hard bottom substrate off North Carolina: a protocol for data processing.
- 10:15 49 **Watters, G. Thomas.** (Ohio State University) Towards a standardized qualitative method of collecting freshwater mussels.

- 10:30 50 **Shull, Lonnie N. III and Gary L. Walker.** (Appalachian State University) An allozyme analysis of Brook trout (*Salvelinus fontinalis* Mitchell) along headwater streams of the Blue Ridge Parkway.
- 10:45 51 **Moore, Edward L. and Donald C. Tarter.** (Marshall University) A comparison of the benthic macroinvertebrate populations of similar riffles in dredged and undredged sections of Dry Fork and Gandy Creek, Randolph County, West Virginia.
- 11:00 52 **Yokum, Kevin, Brent Johnson, Clif Tipton, and Donald Tarter.** (Marshall University) Leaf shredding experiments between naiadal *Peltoperla arcuata* and *Tallaperla maria* (Plecoptera: Peltoperlidae).
- 11:15 53 **Skillman, James R. and Frank A. Romano.** (Jacksonville State University) Life history and ecology of the olive nerite, *Neritina usnea* (Röding) in Meaher State Park, Mobile, AL.
- 11:30 54 **Wilson, Jimmy G., Travis S. Thomas, and Safaa H. Al-Hamdani.** (Jacksonville State University) Effect of aquatic humus on chromium toxicity to *Azolla caroliniana*.
- 11:45 55 **Farr, Mark D., Andrew C. Miller, and Barry S. Payne.** (U.S. Army Engineer Waterways Experiment Station) A comparison of mussel communities (Unionidae) from two Mississippi River delta waterways: the Tensas River, Louisiana and the Sunflower River, Mississippi.

PLANT ECOLOGY, Session 1 - SALON 14

Presiding: *L. Katherine Kirkman*, Jones Ecological Research Center

- 10:00 56 **Clements, R. K., J. M. Baskin, and C. C. Baskin.** (University of Kentucky) Effect of soil type on the growth of *Penstemon tenuiflorus* Pennell and *P. hirsutus* (L.) Willd.
- 10:15 57 **Conn, Christine E. and Frank P. Day.** (Old Dominion University) Nitrogen dynamics of root decomposition in response to nitrogen availability gradients.
- 10:30 58 **Cook, R. A. and E. E. C. Clebsch.** (University of Tennessee) Genetic diversity in *Cimicifuga rubifolia* Kearney.
- 10:45 59 **Day, Frank P. and Everett P. Weber.** (Old Dominion University) Effects of elevated CO₂ on root dynamics in a scrub oak-palmetto community in central Florida.

- 11:00 60 **Dilustro, John J. and Frank P. Day.** (Old Dominion University) Aboveground biomass and net primary production along a barrier island dune chronosequence.
- 11:15 61 **Franklin, Scott B., David J. Gibson, Philip A. Robertson, and John T. Pohlmann.** (Southern Illinois University, Carbondale) Parallel Analysis: a method for determining significant factors.
- 11:30 62 **Greene, Michael C.** (Southeastern Louisiana University) The effects of hydrology, herbivory, and smothering by water hyacinths on two species of *Sagittaria*: a two year study.
- 11:45 63 **Hains, Mark J., Robert J. Mitchell, Lindsay R. Boring, and Brian J. Palik.** (Joseph W. Jones Ecological Research Center) Temporal and spatial dynamics of legume populations in a frequently burned longleaf pine-wiregrass ecosystem.

THURSDAY AFTERNOON, 14 APRIL

SYMPOSIUM - LOCATION TO BE ANNOUNCED

ANIMAL CARE AND USE GUIDELINES: HOW THEY AFFECT YOUR TEACHING AND RESEARCH

Organized by *Matthius Sedivec, Kenneth Shull, and Dwayne Wise*, Appalachian State University and Mississippi State University

- Presiding: *Matthius J. Sedivec*, Appalachian State University
- 1:30 64 **Harkness, John.** (School of Veterinary Medicine, Mississippi State University) Animal care and use from the university perspective.
- 1:50 65 **Potkay, Stephen.** (Division of Animal Welfare, National Institutes of Health) Public Health Service policies on humane care and use of laboratory animals.
- 2:10 **Speaker to be announced.** Legal aspects of animal care and use.
- 2:30 66 **Harkness, John.** (School of Veterinary Medicine, Mississippi State University) American Association for Accreditation of Laboratory Animal Care (AAALAC): What it is and how it can help you and your institution.
- 2:50 **Questions and discussion.**
- 3:15 **BREAK**

WETLANDS AND AQUATIC ECOLOGY - SALON 4

- Presiding: *William S. Birkhead*, Columbus College
- 1:30 67 **Burke, Vincent J. and J. Whitfield Gibbons.** (Savannah River Ecology Laboratory, University of Georgia) Evaluating wetland conservation policies with GIS models of habitat use by aquatic turtles.
- 1:45 68 **Emery, Erich B. and Donald C. Tarter.** (Marshall University) Seasonal variation in the benthic macroinvertebrate populations in the Green Bottom Wildlife Management Area, West Virginia, in relationship to the water quality and vegetation types.
- 2:00 69 **Johnson, Brent and Donald Tarter.** (Marshall University) Preliminary observations on the invasion of benthic macroinvertebrates in a new mitigated wetland at the Green Bottom Wildlife Management Area, Cabell County, West Virginia.
- 2:15 70 **Hayes, Tim and Donald Tarter.** (Marshall University) Food habits of a disjunct population of the central mudminnow, *Umbra limi* (Kirtland) in the Green Bottom Wildlife Management Area, West Virginia, in relation to seasonal changes and age class differences.
- 2:30 71 **Mullins, Lee A. and Donald C. Tarter.** (Marshall University) Flight periods of dragonflies inhabiting the Green Bottom Wildlife Management Area, Cabell County, West Virginia, with special reference to territoriality.
- 2:45 72 **Myers, Randell S. and Gary P. Shaffer.** (Southeastern Louisiana University) Isolating wetland vegetation resistant to nutria herbivory and damage.
- 3:00 **BREAK**
- 3:15 73 **Tipton, Clif and Donald Tarter.** (Marshall University) Preliminary observations on the reproductive activities of the grass pickerel, *Esox americanus vermiculatus* LeSueur, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.
- 3:30 74 **Jones, David, Robert B. Atkinson, and John Cairns, Jr.** (Virginia Polytechnic Institute and State University) Factors influencing macroinvertebrate populations in accidental wetlands on surface-mined lands.
- 3:45 75 **Sewalk, Chester J., Gwenda L. Brewer, and David J. Hoffman.** (Frostburg State University and Patuxent Wildlife Research Center) The effects of an aquatic herbicide on Mallard embryos.

HERPETOLOGY - SALON 5

- Presiding: *Llewellyn M. Ehrhart*, University of Central Florida
- 1:30 76 **Britson, Carol A.** (Memphis State University) Preliminary observations on the feeding behavior of three species of hatchling freshwater turtles.
- 1:45 77 **Dodd, C. Kenneth, Jr. and Richard Franz.** (National Biological Survey and University of Florida) Clutch size and frequency of box turtles on a Florida island.
- 2:00 78 **Dunaway, Melissa J.** (Jacksonville State University) A herpetofaunal survey of Little River Canyon in Alabama.
- 2:15 79 **Johnson, Steve A. and L. M. Ehrhart.** (University of Central Florida) Reproductive success of the Florida green turtle at the Archie Carr National Wildlife Refuge, 1985-93.
- 2:30 80 **Kees, Ginger M. and Thomas K. Pauley.** (Marshall University) Seasonal variation in diets of two terrestrial salamanders in the Fernow Experimental Forest, Tucker County, West Virginia.
- 2:45 81 **Krastins, Michele.** (Memphis State University) Comparisons of external morphogenesis and gonadogenesis in the common snapping turtle.
- 3:00 **BREAK**
- 3:15 82 **Marcum, Conley and Thomas K. Pauley.** (Marshall University) Hatching time and larval history for the northern two-lined salamander, *Eurycea bislineata*, in the Fernow Experimental Forest, Tucker County, West Virginia.
- 3:30 83 **Marcum, Conley and Thomas K. Pauley.** (Marshall University) Nesting habitat and larval characteristics for two Desmognathine species in the Fernow Experimental Forest, Tucker County, West Virginia.
- 3:45 84 **McClure, Karen and Thomas K. Pauley.** (Marshall University) Comparisons of historical and current populations of *Pseudacris brachyphona* in western West Virginia.

PLANT SYSTEMATICS - Salon 6

- Presiding: *Richard P. Wunderlin*, University of South Florida
- 1:30 85 **Vajravelu, Rani.** (University of Central Florida) Biosystematic applications in the identification process of certain species complexes in the genus *Chamaesyce* S. F. Gray (Euphorbiaceae).
- 1:45 86 **Allison, James R.** (Georgia Department of Natural Resources) Additional rarities from the "Lost World" in Bibb County, Alabama, including a new species of *Onosmodium* and an "extinct" *Solanum*.
- 2:00 87 **Anderson, Loran C. and Gerald L. Smith.** (Florida State University and High Point University) Carpels and chromosomes of the endangered Harper's Beauty (*Harperocallis flava*).
- 2:15 88 **Knepper, David A., Rebecca D. Bray, Surbala Chaudhary, Cynthia Caplen, and Lytton J. Musselman.** (U.S. Army Corps of Engineers and Old Dominion University) Battle at Passage Creek - *Isoetes lacustris* vs *I. tucermanii*.
- 2:30 89 **Masciangioli, Tina M., James W. Wallace, and J. Roger Bacon.** (Western Carolina University) Separation and identification of flavonoid constituents of *Juglans nigra* L. using high performance liquid chromatography (HPLC).
- 2:45 90 **Matthews, James, Robert Coxe, Jouh Soule, and James Allison.** (University of North Carolina at Charlotte and the Georgia Natural Heritage Program) The status of *Aster geogianus* Alexander.
- 3:00 91 **Murrell, Zack E.** (Harvard University) *Cornus* in Central and South America: Species delimitation and subgeneric relationships.
- 3:15 **BREAK**
- 3:30 92 **Musselman, Lytton J. and Henk P. Medema.** (Old Dominion University and Uitgeverij Medema) Which plant is hyssop in the Bible?
- 3:45 93 **Turrill, Nicole L., Dan K. Evans, and Frank S. Gilliam.** (University of Tennessee and Marshall University) Nondestructive identification of West Virginia members of the *Dentaria* complex (Brassicaceae) using above ground vegetative characters.
- 4:00 94 **Clebsch, Edward E. C. and Alex Sloan.** (University of Tennessee, Knoxville) Life history and population characteristics of the endangered Ruth's golden-aster, *Pityopsis ruthii* (Small) Small.
- 4:15 95 **Coxe, Robert B.** (University of North Carolina at Charlotte) Does the oak-hickory forest exist in the Triassic basins of North Carolina?

- 4:30 96 **Newsome, Catherine Dickson.** (Southeast Botanical Consultants) Notes on work in progress on the species biology of *Cuscuta harperi*, Harper's dodder.

PLANT ECOLOGY, Session 2 - SALON 9

Presiding: *Donald W. Imm*, Savannah River Ecology Laboratory

- 1:30 97 **Frost, Cecil C.** (Plant Conservation Program, North Carolina Department of Agriculture) Presettlement fire regimes in vegetation in the southeastern U.S.
- 1:45 98 **Frost, Cecil C.** (Plant Conservation Program, North Carolina Department of Agriculture) Presettlement vegetation of the southeastern U.S.: Practical approaches and proposal for a symposium.
- 2:00 99 **Hart, Jennifer M.** (University of Tennessee) Impacts of nonpoint source agricultural pollution on riparian plant communities.
- 2:15 100 **Held, Michael E., Donald W. Imm, G. Russell Lumpkin, Patrick M. Griffin, and Barbara P. Moyer.** (St. Peter's College and Savannah River Ecology Laboratory, University of Georgia) Seedling dynamics within ericad patches and the impact of nutrient addition and litter removal.
- 2:30 101 **Hill, Steven R.** (Clemson University) The Ice Pond Community, a proposed new plant community in South Carolina.
- 2:45 102 **Horn, Charles N.** (Newberry College) Notes on the habitat preferences and life history of *Frasera carolinensis* (Gentianeaceae) in South Carolina.
- 3:00 103 **Hull, James C.** (Towson State University) Photosynthetic inductive responses of understory forest herbs.
- 3:15 **BREAK**
- 3:30 104 **Imm, Donald W.** (Savannah River Ecology Laboratory, University of Georgia) Scalar dependence of species-environment relations.
- 3:45 105 **Jolls, Claudia L. and Kristen L. Uthus.** (University of Michigan Biological Station, East Carolina University, and Virginia Commonwealth University) The reproductive ecology of Houghton's Goldenrod (*Solidago houghtonii* T. & G.), a Michigan endemic.
- 4:00 106 **Maclin, Edward and E. E. C. Clebsch.** (University of Tennessee, Knoxville) Responses of *Echinacea tennesseensis* (Beadle) Small to various management treatments.

- 4:15 107 **Mayes, Steven G., Mark A McGinley, and Charles R. Werth.** (Texas Tech University) Clonal population structure of *Quercus havardii* Rydb.
- 4:30 108 **McKenna, Mary A., Monia Bond, and Constance Brown.** (Howard University) Effects of simulated acid rain on growth and reproduction in alpine plant species.
- 4:45 109 **Patrick, Thomas S.** (Georgia Department of Natural Resources) Monitoring the green pitcherplant (*Sarracenia oreophila*) in Georgia.

FRIDAY MORNING, 15 APRIL

SYMPOSIUM - SALON 4

ASPECTS OF THE BIOGEOGRAPHY OF FLORIDA Session 1

Organized by *Richard Franz*, Florida Museum of Natural History and
Paul Moler, Florida Game and Fresh Water Fish Commission

Presiding: *Richard Franz*

- 8:00 110 **Christman, Steven P.** (Florida Museum of Natural History) Introduction to the biogeography of Florida.
- 8:30 111 **Webb, S. David.** (Florida Museum of Natural History) Extinct megafauna and human interactions in the late Pleistocene of Florida.
- 9:00 112 **Skelley, Paul E.** (Florida State Collection of Arthropods) Arthropod fauna associated with the southeastern pocket gopher, *Geomys pinetus* Rafinesque.
- 9:15 113 **Burgess, George H. and David B. Snyder.** (Florida Museum of Natural History and Continental Shelf Associates Inc.) Zoogeography of the St. Johns River ichthyofauna.
- 9:30 114 **Moler, Paul E.** (Florida Game & Fresh Water Fish Commission) Zoogeography of the salamander genera *Siren* and *Pseudobranchius*.
- 9:45 115 **Williams, Norris H.** (Florida Museum of Natural History) Role of the Florida Museum of Natural History in biogeographic and biodiversity studies.
- 10:00 **BREAK**
- 10:30 116 **Williams, James D. and Robert S. Butler.** (National Biological Survey and U.S. Fish and Wildlife Service) Distribution patterns of the freshwater mussels (Family Unionidae) of Florida.

- 10:45 117 **Thomas, Michael C.** (Florida State Collection of Arthropods) The Florida State Collection of Arthropods.
- 11:00 118 **Choate, Paul M.** (University of Florida) *Cicindela highlandensis*: proposal for endangered species status and for cessation of collecting at all known sites.
- 11:15 119 **Edwards, G. B.** (Florida State Collection of Arthropods) Apparent origins of the Salticidae (Arachnida: Araneae) of Florida.
- 11:30 120 **Wilkins, Laurie, Julio Arias, Brad Stith, Robert Belden, and Melody Roelke.** (Florida Museum of Natural History, University of Florida, and Florida Game & Fresh Water Fish Commission) A morphological investigation of the Florida panther, *Felis concolor coryi*, with a comparison to other North American and South American subspecies of cougar.
- 11:45 121 **Auth, David L.** (Florida Museum of Natural History) Analysis of distribution of amphibians and reptiles of the Florida Keys.

SYMPOSIUM - Salon 9

BIOLOGICAL ASPECTS OF WATER-QUALITY ASSESSMENT IN SOUTHEASTERN UNITED STATES

Sponsored by the Southeastern Chapter of the Ecological Society of America and organized by Cliff R. Hupp, U.S. Geological Survey

- Presiding: *Cliff R. Hupp*, U.S. Geological Survey, Norcross, GA
- 8:30 122 **Hupp, Cliff R. and Michael M. Meador.** (U.S. Geological Survey, Norcross, GA and Raleigh, NC) Biological aspects of the National Water-Quality Assessment and the characterization of riparian and aquatic habitats.
- 8:50 123 **Petersen, James C. and Suzanne R. Femmer.** (U.S. Geological Survey, Little Rock, AR and Rolla, MO) Biological aspects of a water-quality assessment of the Ozark Plateaus: with an emphasis on periphyton.
- 9:10 124 **Couch, Carol A. and Byron J. Freeman.** (U.S. Geological Survey, Atlanta, GA and University of Georgia) Patterns in fish distributions in watersheds having various land uses in the Apalachicola-Chattahoochee-Flint River basin.
- 9:30 125 **Moring, J. Bruce** (U.S. Geological Survey, Austin, TX) Biological aspects of water quality assessments in the Trinity River basin, Texas.

- 9:50 **BREAK**
- 10:10 126 **Zappia, Humbert.** (U.S. Geological Survey, Towson, MD)
Preliminary results of ecological surveys at fixed water-quality monitoring stations, Potomac River basin, National Water-Quality Assessment Program.
- 10:30 127 **Ruhl, Peter M.** (U.S. Geological Survey, Raleigh, NC) Intra-site variability of fish community samples collected in the Coastal Plain, Albermarle-Pamlico drainage.
- 10:50 128 **Asbury, Clyde E.** (U.S. Geological Survey, Tallahassee, FL)
Biological aspects of water-quality assessment in the north Florida and Georgia Coastal Plain: fish communities.
- 11:10 **Summary and discussion.**

HERPETOLOGY AND ICHTHYOLOGY - SALON 6

- Presiding: *David C. Heins*, Tulane University
- 8:00 129 **Parkinson, Christopher L.** (University of Louisville)
Relationships of the African Stiletto Snake (*Atractaspis*) as determined by mtDNA ribosomal gene sequencing.
- 8:15 130 **Pauley, Thomas K.** (Marshall University) Effects of habitat disturbances on amphibians.
- 8:30 131 **Schwartz, Frank J.** (Institute of Marine Sciences, University of North Carolina) Natural regeneration time of damaged skin to heal in loggerhead sea turtles, *Caretta caretta*.
- 8:45 132 **Smith, Kelley R., J. Russell Bodie, and Vincent J. Burke.** (Southeastern Louisiana University, University of South Carolina, and Savannah River Ecology Laboratory) Factors affecting variation in nest temperature between two freshwater turtle species.
- 9:00 133 **Tuberville, Tracey D. and Vincent J. Burke.** (Savannah River Ecology Laboratory, University of Georgia) Do flag markers attract turtle nest predators?
- 9:15 134 **White, Colleen and A. Floyd Scott.** (Austin Peay State University) Substrate preference in juvenile alligator snapping turtles, *Macrochelys temminckii*: results of laboratory tests.
- 9:30 135 **Good, John A. and James H. Howard.** (Frostburg State University) Effects of clearcutting on herpetofaunal abundance and diversity in western Maryland.

- 9:45 136 **Maglia, Anne and R. A Pyles.** (East Tennessee State University) Feeding ecology of *Plethodon cinereus*: prey utilization and feeding modulation.
- 10:00 **BREAK**
- 10:15 137 **Buckley, Joseph P. and Henry L. Bart, Jr.** (Tulane University Museum of Natural History) Long term changes in the Alabama River fish community: Separating the signal from the noise.
- 10:30 138 **Amesbury, Elena and F. F. Snelson, Jr.** (University of Central Florida) Spine replacement in a freshwater population of the stingray *Dasyatis sabina*.
- 10:45 139 **Etnier, David A. and Herbert T. Boschung.** (University of Tennessee and University of Alabama) What name(s) should be applied to stonerollers (Cyprinidae, *Campostoma*) from eastern and central North America?
- 11:00 140 **Farr, Mark D.** (Northeast Louisiana University) Reproductive life history of *Cyprinella camura*, the bluntnose shiner, in southwest Mississippi.
- 11:15 141 **Hughes, Mark H.** (University of Tennessee) The spatial and temporal distribution of fishes within the Holston River system.
- 11:30 142 **Machado, Matthew D., David C. Heins, and Henry L. Bart.** (Tulane University) Analysis of streamflow variables and their relationship to runoff in a Gulf Coast river system.
- 11:45 143 **Maurakis, Eugene G., William S. Woolcott, and William R. McGuire.** (Saint Paul's College, University of Richmond, and Saint Christopher's School) Nocturnal reproductive behaviors in *Semotilus atromaculatus*.

ANIMAL ECOLOGY AND EVOLUTION - SALON 7

- Presiding: *Joel C. Trexler*, Florida International University
- 8:00 144 **Bloodworth, Benjamin R., Wade B. Worthen, and M. Bry Hobbs.** (Furman University) The effects of predation and microclimate on mycophagous flies: variation among habitats.
- 8:15 145 **Williams, Ray S. and David E. Lincoln.** (University of South Carolina) Effects of White Oak grown under elevated carbon dioxide on Gypsy Moth fecundity and developmental rate.
- 8:30 146 **Brandt, Laura A., Leonard G. Pearlstine, Craig R. Allen, and Wiley M. Kitchens.** (Florida Cooperative Fish and Wildlife

Research Unit and University of Florida) The Florida Biological Diversity Project: An evaluation of biological diversity in Florida.

- 8:45 147 **Stolen, Eric D.** (University of Central Florida) Movements of Black Vultures between communal roosts in central Florida.
- 9:00 148 **Brewer, Gwenda L.** (Frostburg State University) Use of five species of fruiting trees by birds and mammals at Tikal, Guatemala.
- 9:15 149 **Bergen, Scott and Hilary Swain.** (Florida Institute of Technology) Conservation of habitat fragment; the role of historical fragment distribution.
- 9:30 150 **Zollner, Patrick, Winston Smith, and Leonard Brennan.** (Mississippi State University and Southern Hardwoods Laboratory, U.S. Forest Service) Use of latrine sites by swamp rabbits (*Sylvilagus aquaticus*): Multivariate models and hypotheses.
- 9:45 151 **Audo, Michele C. and Walter J. Diehl.** (Mississippi State University) Effect of environmental stress on the multiple locus heterozygosity-growth rate relationship in the earthworm (*Eisenia fetida*).
- 10:00 152 **Bailey, Ronald R. and Brian C. McCarthy.** (Frostburg State University and Ohio University) Litter macroinvertebrate diversity in the managed forest landscape of western Maryland.
- 10:15 **BREAK**
- 10:30 153 **Tarter, Donald C. and Diane R. Nelson.** (Marshall University and East Tennessee State University) Preliminary list of tardigrades (Phylum: Tardigrada) from mosses and liverworts in the Monongahela National Forest, West Virginia.
- 10:45 154 **Mullins, Lee A. and Donald C. Tarter.** (Marshall University) Density dependent cannibalism in naiadal dragonflies involved in fish exclusion experiments and the impact of fish predation in their abundance and species composition.
- 11:00 155 **Dobson, William E. and Stephen E. Stancyk.** (Appalachian State University and University of South Carolina) Use of ophiuroid vertebral ossicle growth bands as biological markers for population age and sublethal predation studies.
- 11:15 156 **Stratton, Gail E.** (Albion College) Evolution of courtship behavior and acoustic communication in *Schizocosa* wolf spiders: a comparison of 12 species found in the southeastern United States.
- 11:30 157 **Hebets, Eileen A. and Gail E. Stratton.** (Albion College) Habitat and courtship behavior of the wolf spider *Schizocosa retrorsa*.

- 11:45 158 **Stinson, C. Michael.** (University of Louisville) Evidence from the humeral fossa for major songbird radiations and classifications.

TEACHING BIOLOGY - SALON 8

Presiding: *Bob R. Pohlad*, Ferrum College

- 8:30 159 **Shull, J. Kenneth and Jeffrey A. Butts.** (Appalachian State University) Teaching the scientific method in the laboratory.
- 8:45 160 **Cones, Harold N.** (Christopher Newport University) Shortwave radio in environmental science education.
- 9:00 161 **Nelson, Diane R. and Susan B. Cook.** (East Tennessee State University and Harbor Branch Oceanographic Institution) Marine biodiversity of the Indian River Lagoon, Florida.
- 9:15 162 **Swab, Janice Coffey.** (Meredith College) Biology seminar: African environments; Past, present, and future.
- 9:30 163 **Thomas, Carolyn L. and Bob R. Pohlad.** (Ferrum College) Less can be more: Ferrum College's Science 2000 program.
- 9:45 164 **Mills, Edward and James W. Hall.** (Wingate College) An anti-pollution device to counter acid rain production - an exercise for the biology laboratory.
- 10:00 **BREAK**

PLANT ECOLOGY, Session 3 - SALON 5

Presiding: *Paul A. Schmalzer*, The Bionetics Corporation

- 9:00 165 **Heafner, Kerry D. and Gary L. Walker.** (Appalachian State University) The population biology of *Pellaea wrightiana* Hooker (Adiantaceae), a disjunct fern in North Carolina.
- 9:15 166 **McGuire, Robert F. and D. K. Bagga.** (University of Montevallo) Morphology and movements of *Ocillatoria tenuis*.
- 9:30 167 **Winstead, Joe E. and Lytton J. Musselman.** (Western Kentucky University and Old Dominion University) Ecophenic patterns of *Isoetes engelmannii* in roadside and pond habitats of southcentral Kentucky.

- 9:45 168 **Weber, Everett P. and Frank P. Day.** (Old Dominion University) A minirhizotron analysis of the modified phenology of nitrogen fertilized roots in a barrier island dune ecosystem.
- 10:00 169 **Menges, Eric S.** (Archbold Biological Station) Importance of open space for plants endemic to Florida scrub.
- 10:15 **BREAK**
- 10:30 170 **Phillips, Christine V.** (Archbold Biological Station) Changes in density of a rosemary scrub endemic plant with time since fire and open space.
- 10:45 171 **Pauley, E. F., S. C. Nodvin, T. B. Coffey, A. K. Rose, and N. S. Nicholas.** (Savannah River Ecology Laboratory, University of Tennessee, and Tennessee Valley Authority) Vegetation, biomass, and nitrogen pools of a Great Smoky Mountains watershed.
- 11:00 172 **Rae, John G.** (Francis Marion University) Demography of the fragrant prickly-apple cactus, an endangered species in decline.
- 11:15 173 **Roulston, T'ai H. and E. E. C. Clebsch.** (University of Tennessee) Pollination and seed production of the Cumberland Rosemary, *Conradina verticillata* Jennison.
- 11:30 174 **Schildt, Amy and James Fralish.** (Southern Illinois University) A study of presettlement, present, and future forest in the Coastal Plain region of Illinois.
- 11:45 175 **Schmalzer, Paul A.** (The Bionetics Corporation) Using mechanical cutting and prescribed burning to restore long unburned oak-saw palmetto scrub.

FRIDAY AFTERNOON, 15 APRIL

SYMPOSIUM - SALON 4

ASPECTS OF THE BIOGEOGRAPHY OF FLORIDA Session 2

Presiding: *Paul E. Moler*

- 2:00 176 **Gilbert, Carter R.** (University of Florida) Biogeographic analysis of the Florida freshwater fish fauna.
- 2:15 177 **Ashton, Ray E., Jr.** (Water and Air Research Inc.) The distributional and taxonomic problems of mudpuppies (Proteidae) in the southeastern United States.

- 2:30 178 **Cook, David.** (Florida Game & Fresh Water Fish Commission) A blueprint for conserving Florida's biodiversity.
- 2:45 179 **Deyrup, Mark.** (Archbold Biological Station) Jumping geography: grasshoppers reveal patterns in Florida uplands.
- 3:00 **BREAK**
- 3:30 180 **Thomas, Michael C.** (Florida State Collection of Arthropods) Biogeography of Florida Cerambycidae (Coleoptera).
- 3:45 181 **Muller, James W.** (Florida Natural Areas Inventory) Florida Natural Areas Inventory's role in protecting biodiversity.
- 4:00 182 **Walsh, Stephen J. and George H. Burgess.** (National Biological Survey and Florida Museum of Natural History) Ichthyofaunal zoogeography of the Suwannee River drainage.
- 4:15 183 **Franz, Richard.** (Florida Museum of Natural History) Distributional patterns of Florida cave animals.
- 4:30 184 **Harris, Larry D.** (University of Florida) Florida's biodiversity crisis: an abusive disregard for ecology and natural selection.

PHYSIOLOGY AND DEVELOPMENT - SALON 9

Presiding: *David H. Vickers*, University of Central Florida

- 1:30 185 **Arrington, Ryland W. and Celtus M. Sellers, Jr.** (James Madison University) Temperature effects upon selected ventilatory parameters of rainbow trout, *Oncorhynchus mykiss*.
- 1:45 186 **Hogan, G. Richard.** (Saint Cloud State University) Comparative spatial and temporal tissue distribution patterns of four selenium compounds in mice.
- 2:00 187 **Ingram, G. Walter and Frank A. Romano.** (Jacksonville State University) The effects of salinity and temperature on oxygen consumption of *Neritina usnea* (Röding).
- 2:15 188 **Alber, Sean M. and David Morton.** (Frostburg State University) Structural observations of the vascular bundles in the kidney of the common vampire bat, *Desmodus rotundus*, and their functional relevance.
- 2:30 189 **Dabydeen, Simon.** (Frostburg State University) Photosynthetic activity of chloroembryos of two tropical taxa.

- 2:45 190 **Beard, Charles E. and Thomas M. McInnis, Jr.** (Clemson University) Nutrition of *Lagenidium callinectes* Couch in relation to a marine existence.
- 3:00 191 **Thomas, Travis S., Jimmy G. Wilson, and Safaa H. Al-Hamdani.** (Jacksonville State University) Effects of root-zone temperature on invertase activity and carbohydrate accumulation of winter and spring wheat.
- 3:15 **BREAK**
- 3:30 192 **Boone, Michelle D. and James M. Vose.** (Furman University and Coweeta Hydrologic Laboratory) The carbon balance of differing age classes of *Liriodendron tulipifera* and *Quercus rubra*.
- 3:45 193 **Liang, Dali and J. M. Herr, Jr.** (University of South Carolina) Use of the four-and-a-half clearing technique in the study of gymnosperm embryology: *Cunninghamia lanceolata*.
- 4:00 194 **Thomas, Mary Beth, Nancy C. Edwards, Thomas D. Owens, and Lawrence S. Barden.** (University of North Carolina, Charlotte) The role of mesolamella in elongation of the planula larva of *Hydractinia* sp.
- 4:15 195 **Zettler, Lawrence W. and Thomas M. McInnis, Jr.** (Clemson University) The effect of white light on the symbiotic seed germination of an endangered orchid, *Platanthera integrilabia*.
- 4:30 196 **Pollard, A. Joseph and Mahjabeen S. Siddiqui.** (Furman University) Chemical constituents of the stinging trichomes of *Urtica dioica* and *Cnidioscolus texanus*.

ICHTHYOLOGY - SALON 6

Presiding: *Bruce H. Bauer*, Canin Associates, Inc.

- 1:30 197 **McGuire, W. R., W. S. Woolcott, and E. G. Maurakis.** (Saint Christopher's School, University of Richmond, and Saint Paul's College) Relations of neural structure to reproductive epidermal morphology in pebble nest-building minnows (Pisces: Cyprinidae).
- 1:45 198 **Myer, Patrick A.** (University of Tennessee) The systematics of the sculpins (Cottidae, *Cottus*) of the Holston River system.
- 2:00 199 **Peterson, M. S., C. F. Rakocinski, and S. J. Vanderkooy.** (Mississippi State University and Gulf Coast Research Laboratory) Habitat suitability of the bluespotted sunfish in tidal rivers of the Mississippi Gulf coast.

- 2:15 200 **Peterson, Tanya L. and Stephen T. Ross.** (University of Southern Mississippi) Effects of salinity on survival and growth in juvenile hogchokers, *Trinectes maculatus*.
- 2:30 201 **Rakes, P. L. and J. R. Shute.** (Conservation Fisheries, Inc.) Captive propagation of the federally listed blackside dace, *Phoxinus cumberlandensis*, and the duskytail darter, *Etheostoma (Catonotus) sp.* for reintroduction projects.
- 2:45 202 **Schwartz, Frank J.** (Institute of Marine Science, University of North Carolina) Presence, dispersal, interrelationships, and fate of fishes inhabiting freshwater ponds of North Carolina's Outer Banks.
- 3:00 203 **Shute, J. R., P. L. Rakes, and P. W. Shute.** (Conservation Fisheries, Inc. and Tennessee Valley Authority) Population trends and reintroduction efforts for rare southeastern freshwater fishes.
- 3:15 **BREAK**
- 3:30 204 **Shute, Peggy W., Charles F. Saylor, and Charles P. Nicholson.** (Tennessee Valley Authority) The geographical affinities of fish communities in the Tennessee River drainage, with emphasis on rare or sensitive species.
- 3:45 205 **Thompson, Bruce A. and Karsten E. Hartel.** (Louisiana State University and Harvard University) Hybridization between *Percina copelandi* and *P. caprodes semifasciata* with a review of hybridization in *Percina*.
- 4:00 206 **VanderKooy, Steve J. and Mark S. Peterson.** (Mississippi State University) The influence of preservation shrinkage on the determination of gape-limitation in fishes.
- 4:15 207 **Walser, Chris A. and Henry L. Bart, Jr.** (Tulane University) An overview of historical trends in fish diversity and abundance with respect to land usage in watersheds of the Chattahoochee River, USA.
- 4:30 208 **Tennant, Alan and Michael Little.** (Marshall University) Genetic interactions between subspecies of *Rhinichthys atratulus*.
- 4:45 209 **Puckett, Charles and Michael Little.** (Marshall University) Chromosomal NOR phenotypes of two species of Cyprinidae.
- 5:00 210 **Dobson, Terri L.** (Jacksonville State University) An ichthyofaunal survey of Little River drainage in Alabama with notes on *Cyprinella caerulea* (Jordan) (Teleostei: Cyprinidae).

FOREST ECOLOGY - SALON 7

- Presiding: *Eric S. Menges*, Archbold Biological Station
- 2:00 211 **Benjamin, Sharla, Donald W. Imm, and Barbara P. Moyer.** (Duke University and Savannah River Ecology Laboratory, University of Georgia) Nutrient dynamics of hardwood slopes and the influence of composition, topography, and management.
- 2:15 212 **Bertram, Tracy E., Daniel E. Funsch, and John E. Pinder III.** (Savannah River Ecology Laboratory) Deforestation and forest fragmentation in the Upper Coastal Plain of Georgia and South Carolina.
- 2:30 213 **Cappellato, Rosana.** (U.S. Geological Survey) Above-ground cycling of base cations and sulfur in adjacent deciduous and coniferous forests in the Georgia Piedmont.
- 2:45 214 **Grahame, Anthony and Philip Robertson.** (Southern Illinois University) The woody vegetation of six Research Natural Areas (RNA's) in southern Illinois.
- 3:00 **BREAK**
- 3:15 215 **Hickox, Tracey E. and B. Collins.** (Memphis State University and Savannah River Ecology Laboratory) Regeneration in an oldgrowth bottomland hardwood forest.
- 3:30 216 **Robertson, Philip A. and Shanda Wieringa.** (Southern Illinois University) Composition and structure of a disjunct *Quercus prinus* L. stand 18 years after clearcutting.
- 3:45 217 **Snyder, Pam and James Fralish.** (Southern Illinois University) A study of oak re-establishment in clearcut forest at Land Between the Lakes, KY and TN.
- 4:00 218 **Strazzante, Lisa and James Fralish.** (Southern Illinois University) Estimating the rate of development of *Acer saccharum* stands in the oak community of the Illinois Ozark Hills.
- 4:15 219 **Yorks, Thad E. and Simon Dabydeen.** (Frostburg State University) Plant diversity in second-growth hardwood clearcuts of western Maryland.
- 4:30 220 **Young, P. J., R. F. Lide, and R. R. Sharitz.** (Savannah River Ecology Laboratory, University of Georgia) Growth response of loblolly pine to the hydrology of a Carolina bay.
- 4:45 221 **Turrill, Nicole L. and Frank S. Gilliam.** (University of Tennessee and Marshall University) Influence of soil nutrient availability on species niche partitioning of herbaceous and woody herb layer species of a central Appalachian montane hardwood forest.

MICROBIAL, MOLECULAR, AND GENETIC BIOLOGY
SALON 8

- Presiding: *Dwayne A. Wise*, Mississippi State University
- 1:30 222 **Thomson, M. Sue and Angela C. Morrow.** (Auburn University at Montgomery) Electron microscope examinations of the attachment of *Hemophilus somnus* to preimplantation bovine embryos.
- 1:45 223 **Reimers, Daniel B., B. J. Taller, and S. E. Stevens, Jr.** (Memphis State University) Cytokinin production in the thermophilic cyanobacterium *Mastigocladus laminosus* UTEX 1931.
- 2:00 224 **Wubah, D. A. and S. H. Kim.** (Towson State University) Preliminary morphological studies on a new obligately anaerobic zoosporic fungus isolated from a pond.
- 2:15 225 **Coggin, Steven J. and James L. Pazun.** (Catawba College) Dynamical complexity in *Physarum* cytoplasmic streaming.
- 2:30 226 **Sampson, Christopher S., David C. Nieman, and Dru A. Henson.** (Appalachian State University) The immune response to exhaustive anaerobic exercise.
- 2:45 227 **Garner, Marilyn S. and Mary U. Connell.** (Appalachian State University) Restriction mapping of transposon insertion mutants of bacteriophage T4.
- 3:00 **BREAK**
- 3:15 228 **Madigosky, Stephen R., Xavier Alvarez, and Jonathan Glass.** (Widener University and Louisiana State University Medical Center) The effect of zinc on iron handling by human derived Caco-2 cells.
- 3:30 229 **Winkfield, Blonka and Elaine J. Davis.** (Howard University) The origin of transfer region for the conjugative plasmid R64drd11.
- 3:45 230 **Bath, Daniel W.** (Austin Peay State University) Analysis of chromosome morphology using scanning electron microscopy.
- 4:00 231 **Byrd, Pamela B., Dwayne A. Wise, and William Dentler.** (Mississippi State University and University of Kansas) Antibody disruption of spindle function.
- 4:15 232 **Green, Becky L., Dwayne A. Wise, and Nillo Virkii.** (Mississippi State University and Agricultural Experimental Station) Sex chromosome behavior in spermatocytes of *Alagoasa bicolor* L.

- 4:30 233 **Davis, Jennifer and Dwayne Wise.** (Shorter College and Mississippi State University) Causes and consequences of elevated levels of meiotic abnormalities in laboratory colonies of the crane fly *Nephrotoma suturalis*.

PLANT ECOLOGY, Session 4 - SALON 5

Presiding: *I. Jack Stout*, University of Central Florida

- 2:00 234 **Shimp, Jody and Philip A. Robertson** (Southern Illinois University, Carbondale) Ground layer vegetation of three Research Natural Areas (RNA's) in southern Illinois.
- 2:15 235 **Spira, Timothy P., Allison A. Snow, and Dennis F. Whigham.** (Clemson University, Ohio State University, and Smithsonian Environmental Research Center) Effects of pollen competition on offspring vigor in *Hibiscus moscheutos*.
- 2:30 236 **Stalter, Richard.** (St. John's University) Twenty eight years of vegetation change at a Rhode Island utility right-of-way.
- 2:45 237 **Townsend, John F., Richard D. Porcher, and John E. Fairey.** (Clemson University) *Oxypolis canbyi* (Coult. and Rose) Fern. and *Schwalbea americana* L. in Clarendon and Williamsburg counties, South Carolina: A preliminary report on the status of two endangered species.
- 3:00 **BREAK**
- 3:15 238 **Wagner, Lisa K. and Dennis F. Whigham.** (Georgia Southern University and Smithsonian Environmental Research Center) Resource limitation of fruit and seed in *Hibiscus moscheutos*.
- 3:30 239 **Smith, Gerald L., Mark A. Garland, and Walter S. Flory.** (High Point University, Florida Department of Environmental Protection, Wake Forest University) Rediscovery of *Hymenochallis puntagordensis* Traub.

BETA BETA BETA, SOUTHEASTERN DISTRICT 1 LOCATION TO BE ANNOUNCED

- 1:30 240 **Harp, P. I.** (Tau Nu, The Citadel) A laboratory investigation of an oviposition attractant in the golden salt marsh mosquito, *Aedes sollicitans* (Walker).
- 1:45 241 **Henn, C. D.** (Tau Nu, The Citadel) A laboratory investigation comparing the affects of selected factors on the behavior of colonized

forms of the black marsh mosquito, *Aedes taeniorhynchus* (Wiedermann).

- 2:00 242 **Vaile, W. J.** (Tau Nu, The Citadel) A model to test the recommendation that draining an abandoned rice impoundment would effectively reduce a population of salt marsh mosquitoes.
- 2:15 243 **Hannah, Rachael.** (Sigma Psi, Florida Institute of Technology) Phylogenetic conservation of neuroanatomical pathways in catfish electrosensory nuclei.
- 2:30 244 **Krebs, William D.** (Sigma Psi, Florida Institute of Technology) Central projections of electrosensory afferent neurons in the Atlantic stingray, *Dasyatis sabina*.
- 2:45 245 **Kenyon, Lesley.** (Sigma Psi, Florida Institute of Technology) Hormonal induction of sex reversal in African cichlid fishes.
- 3:00 246 **Lee, Dong Won, Roberto Rico-Martinez, and Terry W. Snell.** (Sigma Beta, Georgia Institute of Technology) Copulatory behavior and mate-recognition pheromone binding to male receptors of the rotifer *Brachionus plicatilis* (O. F. Muller).
- 3:15 **BREAK**
- 3:30 247 **Malatesta, Anne.** (Beta Eta, Florida Southern College) Techniques for saving the scrub morning glory, *Bonamia grandiflora*.
- 3:45 248 **Townsend, Howard.** (Beta Rho, Wake Forest University) Habitat selection in Galapagos sea birds.
- 4:00 249 **King, Jennifer.** (Beta Rho, Wake Forest University) Taxonomic boundaries of the genus *Kalmia*.
- 4:15 250 **Pohlmann, Suzanne.** (Beta Rho, Wake Forest University) The role of hydrophobicity in the HN protein of the paramyxovirus SV5.

BETA BETA BETA, SOUTHEASTERN DISTRICT 2
LOCATION TO BE ANNOUNCED

- 1:30 251 **Boyd, Gionetta L., Jennifer A. Wong, and Glen Parsons.** (Beta Kappa, University of Mississippi) Critical swimming speed of schooling fish.
- 1:45 252 **Adkins, Rebecca G. and Diane R. Nelson.** (Phi Delta, East Tennessee State University) A survey of water bears (Phylum Tardigrada) from Greene Mountain, Tennessee.

- 2:00 253 **Tipton-Jones, Elizabeth and Rebecca Pyles.** (Phi Delta, East Tennessee State University) A test of convergence: analysis of dorsal pattern variation in *Desmognathus ochrophaeus*.
- 2:15 254 **Duncan, Rebecca and Diane R. Nelson.** (Phi Delta, East Tennessee State University) Comparison of variety and density of tardigrade populations on White Top Mountain, Virginia, based on forest type and altitude.
- 2:30 255 **Neal, Chris and Froster Levy.** (Phi Delta, East Tennessee State University) Genetic variability in the *Salidago arguta* complex
- 2:45 256 **Speck, Renae R.** (Mu Gamma, Western Kentucky University) Endothelial cell locomotion during wound healing is regulated by inositol (1,4,5) triphosphate and by cyclic (3,5) adenosine monophosphate.
- 3:00 257 **Szeremeta, Brain W.** (Mu Gamma, Western Kentucky University) Studies of the paraflagellar body (PFB) in the euglenoid algal flagellum and its presumed effects on photoreception.
- 3:15 **BREAK**
- 3:30 258 **Sizemore, Jeff.** (Mu Gamma, Western Kentucky University) The induction of manganese super oxide dismutase (Mn SO D) in bovine pulmonary arterial and bovine lung microvascular endothelial cells.



“Manatees: The last generation?”—For centuries, sea-going cultures have worshipped the manatee; time-worn myths and legends have surrounded this peaceful animal. Yet man is responsible for placing the manatee on the brink of extinction. Through a manatee’s eyes, visitors to Sea World of Florida’s newest guest experience, “Manatees: The Last Generation?”, will encounter the perils of everyday manatee life, gaining an appreciation for the docile creature. The attraction, winding through a naturalistic, river-like setting, features several different elements, including a nearly 300,000-gallon manatee habitat. A state-of-the-art presentation puts visitors deep into the underwater world of the manatee. Through education and awareness comes understanding—and hope for future generations of this gentle giant.

Author Index for Paper, Poster, and Abstract Number

Only first authors are indexed

-
- Abbott, J. Richard - 40
Adkins, Rebecca G. -
252
Alber, Sean M. - 188
Allison, James R. - 86
Almeida, Jean E. - 1
Amesbury, Elena - 138
Anderson, Loran C. - 46,
87
Arrington, Ryland W. -
185
Asbury, Clyde E. - 128
Ashton, Ray E., Jr. -
177
Audo, Michele C. - 151
Auth, David L. - 121
Bailey, Ronald R. - 152
Banks, Warren - 29
Bartsch, Jay J. - 2
Bath, Daniel W. - 230
Beard, Charles E. - 190
Benjamin, Sharla - 211
Bergen, Scott - 149
Bertram, Tracy E. - 212
Bloodworth, Benjamin
R. - 144
Boone, Michelle D. -
192
Boyd, Gionetta L. - 251
Brandt, Laura A. - 146
Brewer, Gwenda L. - 148
Britson, Carol A. - 76
Buckley, Joseph P. - 137
Burgess, George H. - 113
Burke, Patricia M. - 3
Burke, Vincent J. - 67
Byrd, Pamela B. - 231
Cappellato, Rosana - 213
Carrick, Kevin M. - 4
Carroll, Lynda - 30
Choate, Paul M. - 118
Christmán, Steven P. -
110
Clebsch, Edward E. C. -
94
Clements, R. K. - 56
Coggin, Steven J. - 225
Cones, Harold N. - 160
Conn, Christine E. - 57
Cook, David - 178
Cook, R. A. - 58
Couch, Carol A. - 124
Covert, Joseph S. - 5
Coxe, Robert B. - 95
Dabydeen, Simon - 189
Davis, Jennifer - 233
Day, Frank P. - 59
Detwiler, Kenneth B. - 6
Deyrup, Mark - 179
Dilustro, John J. - 60
Dobson, Terri L. - 210
Dobson, William E. -
155
Dodd, C. Kenneth - 77
Doyle, T. W. - 7
Dunaway, Melissa J. -
78
Duncan, Rebecca - 254
Edwards, G. B. - 119
Emery, Erich B. - 68
Emrick, Verl R. - 47
Etnier, David A. - 139
Farr, Mark D. - 55, 140
Fisher, M. A. - 38
Franklin, Scott B. - 61
Franz, Richard - 183
Frost, Cecil C. - 97, 98
Gabrielsen, Cynthia A. -
8
Garner, Marilyn S. - 227
Gaylord, Clarice - 27
Gilbert, Carter R. - 176
Good, John A. - 135
Gorham, L. E. - 9
Grahame, Anthony - 214
Green, Becky L. - 232
Greene, Michael C. - 62
Hains, Mark J. - 63
Hannah, Rachael - 243
Harkness, John - 64, 66
Harp, P. I. - 240
Harris, Larry D. - 184
Hart, Jennifer M. - 99
Hayes, Tim - 70
Heafner, Kerry D. - 165
Hebets, Eileen A. - 157
Held, Michael E. - 100
Henn, C. D. - 241
Hickox, Tracey E. - 215
Hill, Steven R. - 41, 101
Hogan, G. Richard - 186
Horn, Charles N. - 102
Huck, Robin - 42
Hughes, Mark H. - 141
Hull, James C. - 103
Hupp, Cliff R. - 122
Imm, Donald W. - 104
Ingram, G. Walter - 187
Johnson, Brent - 69
Johnson, Steve A. - 79
Jolls, Claudia L. - 105
Jones, David - 74
Jones, Ronald L. - 43
Keeland, B. D. - 10
Kees, Ginger M. - 80
Kennemore, Douglas E.,
Jr. - 44
Kenyon, Lesley - 245
King, Jennifer - 249
Knepper, David A. - 88
Kopplin, Constance L. -
11
Kratins, Michele - 81
Krebs, William D. - 244
Lee, Dong Won - 246
Liang, Dali - 193
Lickey, Edgar B. - 32
Lobinske, Richard J. - 12
Machado, Matthew D. -
142
Maclin, Edward - 106
Madigosky, Stephen R. -
228
Maglia, Anne - 136
Malatesta, Anne - 247

- Marcum, Conley - 82,
83
- Marshall, Harold G. - 13
- Masciangioli, Tina M. -
89
- Matthews, James - 90
- Maurakis, E. G. - 14,
143
- Mayes, Steven G. - 107
- McCarron, James K. - 35
- McClure, Karen - 84
- McDuffie, James Eric -
15
- McGuire, Robert F. -
166
- McGuire, W. R. - 197
- McKenna, Mary A. - 108
- McLeod, Kenneth W. -
33
- Menges, Eric S. - 169
- Miller, Richmond J. - 16
- Mills, Edward - 164
- Moler, Paul E. - 114
- Moore, Edward L. - 51
- Moring, J. Bruce - 125
- Moser, Mary L. - 48
- Muller, James W. - 181
- Mullins, Lee A. - 71,
154
- Murrell, Zack E. - 91
- Musselman, Lytton J. -
92
- Myer, Patrick A. - 198
- Myers, Randell S. - 72
- Neal, Chris - 255
- Nelson, Diane R. - 161
- Nelson, John B. - 45
- Neufeld, Howard S. - 34,
36
- Newsome, Catherine
Dickson - 96
- Parkinson, Christopher
L. - 129
- Parr, Patricia D. - 17
- Patrick, Thomas S. - 109
- Pauley, E. F. - 171
- Pauley, Thomas K. - 130
- Petersen, James C. - 123
- Peterson, M. S. - 199
- Peterson, Tanya L. - 200
- Phillips, Christine V. -
170
- Pohlmann, Suzanne -
250
- Pollard, A. Joseph - 196
- Potkay, Stephen - 65
- Puckett, Charles - 209
- Rae, John G. - 172
- Rakes, P. L. - 201
- Reed, Michael R. - 39
- Regan, Richard - 31
- Reimers, Daniel B. - 223
- Robertson, Philip A. -
216
- Roulston, T'ai H. - 173
- Ruhl, Peter M. - 127
- Sampson, Christopher S.
- 226
- Schildt, Amy - 174
- Schmalzer, Paul A. - 175
- Schwartz, Frank J. - 131,
202
- Sewalk, Chester J. - 75
- Shimp, Jody - 234
- Shull, J. Kenneth - 159
- Shull, Lonnie N. III - 50
- Shute, J. R. - 203
- Shute, Peggy W. - 204
- Sizemore, Jeff - 258
- Skelley, Paul E. - 112
- Skillman, James R. - 53
- Smetana, R. L. - 18
- Smith, Gerald L. - 239
- Smith, Kelley R. - 132
- Smith, Michael E. - 19
- Snyder, Pam - 217
- Speck, Renae R. - 256
- Spira, Timothy P. - 235
- Stalter, Richard - 236
- Stankus, Paul T. - 20
- Steed, Candy L. - 21
- Stinson, C. Michael -
158
- Stolen, Eric D. - 147
- Stratton, Gail E. - 156
- Strazzante, Lisa - 218
- Swab, Janice Coffey -
162
- Szeremeta, Brain W. -
257
- Tarter, Donald C. - 153
- Tennant, Alan - 208
- Thomas, Carolyn L. -
163
- Thomas, Mary Beth - 22,
194
- Thomas, Michael C. -
117, 180
- Thomas, Travis S. - 191
- Thompson, Bruce A. -
205
- Thomson, M. Sue - 222
- Tipton, Clif - 73
- Tipton-Jones, Elizabeth -
253
- Townsend, Howard - 248
- Townsend, John F. - 237
- Tuberville, Tracey D. -
133
- Turrill, Nicole L. - 93,
221
- Vaile, W. J. - 242
- Vajravelu, Rani - 85
- VanderKoooy, Steve J. -
206
- Wagner, Dyonuka - 23
- Wagner, Lisa K. - 238
- Walser, Chris A. - 207
- Walsh, Stephen J. - 182
- Watters, G. Thomas - 49
- Weaver, Donald J. - 24
- Webb, S. David - 111
- Weber, Everett P. - 168
- Wein, Gary R. - 37
- White, Colleen - 134
- Whittier, Henry O. - 25
- Wilkins, Laurie - 120
- Williams, James D. -
116
- Williams, Norris H. -
115
- Williams, Ray S. - 145
- Wilson, Jimmy G. - 54
- Winkfield, Blonka - 229
- Winstead, Joe E. - 167
- Wright, Beverly - 28
- Wubah, D. A. - 224
- Yokum, Kevin - 52
- Yorks, Thad E. - 219
- Young, P. J. - 220
- Zappia, Humbert - 126
- Zettler, Lawrence W. -
195
- Zirkle, Eugene - 26
- Zollner, Patrick - 150

ABSTRACTS

1

ALMEIDA, JEAN E. and JOHN G. MORRIS. Florida Institute of Technology--Characteristics of a winter refugial manatee (*Trichechus manatus*) population at Homosassa Springs, Citrus County, Florida: 1982-1993.

Observations of manatees congregating in the Blue Water Run (BWR) of Homosassa Springs were conducted weekly during the winters of 1982 through 1993. Homosassa Springs, BWR has previously lacked the detailed studies necessary to determine if a sanctuary status is warranted. Instead, it has been considered a component of the Crystal River refugium, which is located ten miles north of the site. Scar patterns were used to identify individual animals utilizing this winter refuge area. Observations were made by snorkelers recording scar patterns using underwater photography, videography, and scar drawings. Recorded population parameters included animal sex, activity, age class, scar condition, and location within the BWR. Of the 977 recorded sightings of manatees, 513 were identified and added to the scar catalog database at Florida Tech. Swimming (35.1%) and bottom resting (32.9%) were the most frequently observed activity, while feeding (8.6%) and reproductive behavior (4.2%) were the least frequently observed. Males and females accounted for 43.3% and 49.7% of the population, respectively. The majority of manatees observed in the BWR were adults (52.8%) followed by juveniles (43%) and calves (6%). Resident and transient individuals contributed to 20% and 80% of the population, respectively. Of the individual manatees observed, 26% were recorded in the BWR in more than one year.

2

BARTSCH*, JAY J., SHANNON E. ERGLE*, IRENE KOKKALA*, and JAMES WETZEL. Furman University* and Presbyterian College. Development of the lateral line in embryos of the dwarf seahorse *Hippocampus zosterae*.

Dwarf seahorse *Hippocampus zosterae*, embryos were collected in intervals representing four developmental stages: mid-term, late-term, full-term and adult. Scanning electron microscopy was used to study the time of emergence and distribution of free neuromasts. Neuromasts first appeared on mid-term embryos and continued into the juvenile stage with a decrease of their total number as the embryos matured. Throughout development seven neuromast lines were observed. The supra-temporal line (ST) was noted in the mid-term embryos. The late-term embryos had in addition to the ST, the premaxillary (PM), infraorbital (IO), supra-orbital line (SO), and some free neuromasts in the presumptive location of the post-temporal (PT) line. In full-term embryos all of these lines were visible and two new lines

appeared, the (PT) and the post-cephalic (PC). In the adult specimens some lines disappeared while in others the number of neuromasts was reduced by up to 40%. In addition the trunk lateral line became visible. This was the only line present on the adults. The neuromasts of the trunk lateral line appeared in group of two or three located between calcification spiracles. The development of lateral line canals on the head or trunk was never observed.

BURKE, PATRICIA M. and JOHN G. MORRIS. Florida Institute of Technology--A critical habitat analysis: Research on the utilization of shelter habitats by the Florida manatee, *Trichechus manatus latirostris*, in Brevard County, FL.

The role and importance of shelter habitats as an ecological requirement for the Florida manatee (*Trichechus manatus latirostris*) was investigated over a seven month period from April to October 1993, within the Indian River Lagoon, located on the central Atlantic coast of Florida. Shelter habitats were categorized into four structurally distinct types: the basin, cul-de-sac, archipelago, and land shadow shelter. A total of eight study sites were surveyed, with two representatives from each shelter type. Criteria used to rank each shelter type included: manatee abundance, boat usage, proximity to other key resources (sea grass beds and fresh water), current boat speed limits and restrictions within the sites, and manatee behaviors observed within each study area that are beneficial to the survival of an endangered species. Manatee abundance was obtained by both on water and aerial surveys. A total of 234 manatee sightings were recorded for all shelter sites, with the greatest number of animals being observed in the cul-de-sac shelters (97). A significant difference in the number of manatees present during both on water and aerial surveys was evident between each of the eight shelter sites and among the four categories of shelter. A rank order system that allotted scores for varying levels of each of the above criteria revealed that each of the shelter categories differs in its importance to the ecological needs of manatees. The identification of the role of the shelter habitat in the ecology of the Florida manatee supplements the data base developed by state organizations in assessing the conservation needs of this species.

4

CARRICK, KEVIN M. and DANIEL B. PLYLER. University of North Carolina at Wilmington--Interaction of fusicoccin and abscisic acid in breaking and restoring seed dormancy in *Spartina alterniflora*.

Seeds of *Spartina alterniflora* are dispersed in the fall of the year

but remain dormant until early spring. We have shown previously that germination can be induced in dormant seeds by removing a portion of the scutellum (presumably by allowing a germination inhibitor to leach out). We have also demonstrated that surgically induced germination can be reversed by abscisic acid. In this study, intact and surgically altered seeds were pre-treated with abscisic acid, ABA, (10 mg/l) for 12 hours, and then transferred to petri plates containing 10 ml of distilled water or fusicoccin, FC, (10 mg/l). Seeds, both intact and surgically altered, were also pre-treated with FC for 12 hours, and then transferred to petri plates containing 10 ml of distilled water or ABA. The plates were then incubated in the dark at 26 C. Counts were made daily for 5 days. Our results reveal that ABA is effective in restoring dormancy broken by altering the scutellum, but ineffective in restoring dormancy broken by applying FC. The results suggest to us that ABA and FC are acting at different steps in the dormancy mechanism.

5

JOSEPH S. COVERT¹, MICHAEL BARNWELL¹, JOEL BORDEN¹, AMANDA WRONA², RICHARD G. WIEGERT², GEORGE R. CLINE¹, and FRANK A. ROMANO¹. Jacksonville State University¹ and the University of Georgia²-- Preliminary Analysis of summer occurrence of estuarine benthic macroinvertebrates off Sapelo Island, GA

Benthic samplers were located at the mouth of the Duplin River on the Marsh Landing Dock of Sapelo Island, GA. The sampler consisted of a 2 foot long section of PVC pipe with a nylon mesh screen around it. The sampler was anchored with a 20 lb weight at the base and a float at the top to maintain the sampler in an upright position during the sampling period. The sampler remained for a 24 hr cycle and retrieved during high tide in daylight. Each sample was rinsed 3 times with freshwater and sieved to remove large debris. Specimens were preserved in 70% ethanol and stained with Rose Bengal solution. Specimens were collected from May through August 1993. Specimens were classified and divided into 7 groups: amphipods, isopods, copepods, shrimp, crabs, polychaetes, and unidentified. Temporal variation is readily observed over the summer season. Raw numbers of individuals percent of total individuals captured indicate peaks associated with reproductive activities. Diversity indices were calculated for each week of data and compared. Variation in diversity values are related to ecological and behavioral differences among the groups.

6

DETWILER, KENNETH B., STEPHEN W. CLARK, and K.J. BALAK. Western Kentucky University--Investigation of regeneration of chick cochlear sensory epithelium using in situ hybridization.

The sensory epithelium of the auditory system of vertebrates consists of two cell types: sensory hair cells and supporting cells. In mammals if the hair cells are destroyed, they are not replaced, resulting in permanent hearing impairment. This is not the case in amphibians and birds. If the hair cells are destroyed in young chicks they are replaced by regeneration. Experiments with the amphibian lateral line have shown that the regenerated hair cells are derived from progeny of supporting cell divisions. In this research cDNA probes to the chick beta-actin and glyceraldehyde dehydrogenase mRNAs were used to investigate expression of these mRNAs in normal and aminoglycoside damaged hair cell epithelium using in situ hybridization. One day old chicks were either untreated or given daily injections of gentamicin sulfate at 50 ug/ml. The cochlear duct was dissected and fixed in buffered paraformaldehyde overnight, dehydrated in a graded ethanol series and cleared in xylene. Cochlear ducts were embedded in paraffin, sectioned at 10 um and collected on lysine coated slides. Probes were labeled using random primers.

7

DOYLE, T. W., L. E. GORHAM¹, and B. D. KEELAND. National Wetlands Research Center and ¹Johnson Controls World Services--Wind Damage Relationships of Hurricane Andrew on Forested Wetlands of Southern Louisiana.

On August 26, 1992, Hurricane Andrew struck the Louisiana coastline with sustained winds of 140 mph. Over 51 thousand hectares in southern Louisiana and the Atchafalaya River basin suffered moderate to severe damage. Research was initiated to determine the biological path of Hurricane Andrew using windthrow angles and directions of treefall. A simulation model of hurricane dynamics was developed to reconstruct wind force and vectors across the forested study sites. Wind strength and vectors were correlated with degree and direction of tree damage by site and position to storm center. The model demonstrates that the type of response varies depending on species, stand prescription and distance from storm center. From these data, empirical associations relating the abiotics of hurricanes and their impacts on forested systems offers the ability to generate models that can be used to reconstruct and predict community damage and successional changes to recurrent hurricane events.

8

GABRIELSEN, CYNTHIA A. Environmental Sciences Division, Oak Ridge National Laboratory--Formulation of a viable work plan for the assessment of threatened and endangered animal species at the Oak Ridge National Environmental Research Park.

The Oak Ridge Reservation, an area of 35,300 acres, provides habitat for a number of animal species that are listed by the State of Tennessee or the U.S. Fish and Wildlife Services as in need of management, threatened, or endangered. Defining goals that establish priorities that comply with regulatory and environmental objectives is necessary. Historical data (written as well as verbal) must be compiled and used to identify possible residents, define habitats, and plan field surveys on the basis of this information. Data gathered identifies inhabitants and provides insight into population viability. Mapping of survey data provides a visual reference indicating animal population distribution and can be used to plan future land use. This approach can be applied to formulate work plans for assessing threatened and endangered species at the Oak Ridge Reservation or any other location.

9

GORHAM¹, L. E., B. D. KEELAND and T. W. DOYLE. ¹Johnson Controls World Services and National Wetlands Research Center--Patterns of Primary Versus Secondary Damage Caused by Hurricane Andrew in the Atchafalaya Basin of Southern Louisiana.

Patterns of damage to forested wetlands impacted by Hurricane Andrew were assessed in 68 permanent plots distributed throughout the lower Atchafalaya River basin. A total of 3888 trees >2.5cm dbh were assessed. Initial damage was categorized as primary (trees damaged directly by hurricane force winds) or secondary (damaged by falling trees). Damage patterns varied by community type, species and canopy position. Permanently flooded sites, dominated by *Nyssa sp.* and *Taxodium distichum*, remained intact with less than 5% of the trees suffering major damage. Very little secondary damage occurred in this community type. In comparison, greater than 38% of the trees in bottomland hardwood communities were severely damaged, while up to 85% of these trees in the direct path of the hurricane suffered major damage. Overstory trees, such as *Salix nigra*, *Populus heterophylla* and *Fraxinus profunda* incurred primary damage in the form of major limb-loss, snapped boles and uprooting. Secondary damage was more common in wind-sheltered understorey trees such as *Acer sp.*, *Cornus foemina*, and *Forestiera acuminata*.

10

KEELAND, B.D., L.E. GORHAM¹, AND T.W. DOYLE. National Wetlands Research Center and ¹Johnson Controls World Services--Impacts of Hurricane Andrew on Forested Wetlands of the Atchafalaya Basin, Louisiana: First Year Mortality.

Hurricane Andrew struck the coast of Louisiana on August 26, 1992 with maximum sustained winds of 140 mph, and proceeded north through the Atchafalaya River Basin. Damage to the bottomland hardwood and swamp ecosystems was assessed on 68 study plots, totaling 3.4 hectares, distributed throughout the basin. Species, size, damage class, viability status and location were recorded for each tree greater than 2.5cm DBH. Most trees of all species were defoliated. More severe damage was differentially expressed by species, size class and location. Of 3888 trees examined, 420 (7.8%) had snapped stems, 191 (4.8%) were tipped up (partially uprooted) and 85 (2.2%) suffered major branch loss. Although such severe damage would suggest high mortality, only 15 of the snapped trees and 9 uprooted trees died within the first year after the hurricane. All trees with major branch loss survived. Overall first year mortality was extremely low at 1.26%.

11

KOPPLIN, CONSTANCE L. and JOHN G. MORRIS. Florida Institute of Technology--A comparison of the use of different fresh water inputs into the Brevard County section of the Indian River by the West Indian manatee (*Trichechus manatus*).

As humans increase their activities in aquatic environments the impact upon manatees and their habitat becomes greater. In order to save the manatee from extinction it is necessary to determine which types of habitats are preferred for feeding, reproducing, drinking and resting. This study is a comparison of fresh water drinking areas that either have food in the vicinity (experimental) or lack food nearby (control). Data were collected from a boat at the sites during May through October 1992 and from a plane during the same months in 1993. Manatees were observed during 90% of surveys conducted at the experimental sites. At the control sites manatees were observed during only 25% of the surveys. Manatees were observed in larger groups and showed greater frequency of use to one of the experimental sites than to all other sites. Aerial surveys support this finding. Proximity to feeding areas appears to have a correlation with frequency of use of fresh water input areas by manatees.

12

LOBINSKE, RICHARD J. University of Central Florida--Qualitative and quantitative estimates of larval chironomid midges in two tributaries of the Wekiva River, central Florida.

Chironomid midge (Diptera: Chironomidae) larval densities were determined in two tributaries of the Wekiva River, Rock Springs Run and Blackwater Creek, from February to October 1993. Water quality parameters were determined at same time. Rock Springs Run had a maximum monthly density of 1217/m², mean monthly density of 470/m², and mean biomass of 44.9 g/m². Blackwater Creek had a maximum of 728/m², mean density of 319/m², and mean biomass of 25.4 mg/m². Rock Springs Run had a peak density from May to July: Blackwater Creek had a peak density from April to May. Tribe Chironomini was the most abundant taxon, followed by Tanytarsini, subfamilies Tanytopodinae and Orthocladiinae. 27 genera were found in Rock Springs Run, 25 in Blackwater Creek. Water parameters for Rock Springs Run and Blackwater Creek were, respectively: current 21.9 and 15.3 cm/s, temperature 22.5 and 21.8 °C, turbidity 0.8 and 1.4 NTU, ph 7.5 and 7.3, electrical conductivity 294 and 434 µS/cm, dissolved oxygen 6.3 and 5.9 ppm, and nitrate-N 1.4 and 0.5 ppm.

13

MARSHALL, HAROLD G. Old Dominion University--Characterization of phytoplankton composition and abundance in the Chesapeake Bay.

A species list, which includes seasonal mean concentrations for the phytoplankton of the lower Chesapeake Bay is presented. This record is based on a 25 year data base from water samples analyzed by the author, and includes results from an on-going monitoring program in the Chesapeake Bay, where monthly collections have been made at seven bay stations since 1985. Over 500 species have been recorded for these waters and include representatives from phylogenetic categories which include: Chrysophyta, Pyrrophyta, Cryptophyta, Chlorophyta, Haptophyta, Cyanobacteria, Euglenophyta, and Xanthophyta. These are composed of mainly estuarine and neritic species, many of which are common to the shelf waters off the Bay entrance. There occurs 6-8 phytoplankton assemblages annually, which are composed of ubiquitous and dominant species, and a changing group of background species. These all form distinct seasonal stages during: 1) mid-winter/spring, 2) mid to late spring/early summer, 3) mid to late summer, 4) fall/early winter, and 5) early to mid winter. In addition, warm and cold water species form two broader categories that over-ly the seasonal groupings. The phytoplankton composition and abundance are influenced by a variety of environmental conditions. These include the onset of the spring rains, light intensity, turbidity, nutrient levels, water temperature and salinity, plus the

formation and break-up of the pycnocline. The greatest species diversity comes from the diatoms, dinoflagellates and the chlorophytes. Of note, there were 6 toxin producing species found in the lower Chesapeake Bay, plus a variety of bloom producers. Supported by the Virginia Department of Environmental Quality.

14

MAURAKIS, E. G. and W. ROBERTS. Saint Paul's College and Belzoni Animal Clinic.--Aquatic Science and Aquaculture Initiative at Saint Paul's College.

Saint Paul's College has implemented an undergraduate curriculum in Aquatic Science and Aquaculture. The program stresses national and state initiatives in science and education. The objectives are: (1) prepare students for graduate studies, and for entry level jobs in the aquatic science and aquaculture industry, (2) foster cooperative research projects among governmental agencies, universities, colleges, secondary educational schools, and private corporations; and (3) serve as a regional teaching and working model fish farm for agricultural farmers in southern Virginia. The project is funded in part by Federal Sponsored Programs.

15

MCDUFFIE, JAMES ERIC, RICARDE CAMPBELL AND MARY FLEMING FINLAY. Benedict College--Analysis of Intestinal Isozymes with Recombinant Inbred Strains of Mice.

By starch gel electrophoresis, isozymes have been identified of both murine intestinal leucine aminopeptidase (LAP) and alkaline phosphatase (AKP) which differ in regard to concentration (banded or diffuse), rate of migration or sialation. Developmental regulation is indicated as these variants are not manifest until weaning age. To analyze this complex genetic system, recombinant inbred (RI) lines derived from inbred strains known to differ for these isozymes are utilized. RI strains are produced by crossing two inbred strains: from the F₂ generation randomly mated pairs are perpetuated through over 20 generations of brother-sister mating so that the assemblages of loci are reassorted between strains and fixed randomly for unlinked loci and nonrandomly for linked. All lines have been examined within the RI set BxD, derived from the inbred strain C57BL/6J in which intestinal LAP and AKP are banded and from DBA/2J in which these enzymes are diffuse. RI sets CxB (C57BL/6By x Balb/cBy) and [SWR/J x C57L/J] have also been analyzed. In all sets, strong concordance was found for expression of banded/diffuse, suggesting a processing locus which affects both enzymes. A 1:1 distribution of both isozymes banded or both diffuse supports the idea that a single gene is responsible for this characteristic. Supported by NIH NIGMS Grants GM08387 and GM08117.

15

MILLER, RICHMOND J. and K.J. BALAK.
Western Kentucky University--Comparison of normal and regenerating lateral line hair cell epithelia using immunoblotting methods

The sensory epithelium of the lateral line system of amphibians and the inner ear of birds and mammals consists of two cell types: sensory hair cells and supporting cells. In mammals if the hair cells are destroyed, they are not replaced, resulting in permanent hearing impairment. This is not the case in amphibians and birds. If the hair cells of the cochlea are destroyed in young chicks they are replaced by regeneration. Experiments with the amphibian lateral line have shown that the regenerated hair cells are derived from progeny of supporting cell divisions. The hair cells of the lateral line neuromasts specifically accumulate a fluorescent dye abbreviated DASPEI. When exposed to blue light the DASPEI labeled hair cells are killed by phototoxicity. These hair cell depleted neuromasts will regenerate new hair cells in a process similar to that of the chick cochlea. These experiments use (1) direct protein biotinylation using NHS-Biotin and (2) biotinylated lectins to compare proteins and glycoproteins from normal intact neuromasts and neuromasts depleted of hair cells.

17

PARR, PATRICIA D. Environmental Sciences Division, Oak Ridge National Laboratory--Landuse changes: The decision-making process evolving for the Oak Ridge Reservation.

The process of making decisions related to landuse changes on the Oak Ridge Reservation (ORR) has continued to evolve over the past years as priorities shift. The reservation consists of 35,000 acres of federally owned land in Oak Ridge, Tennessee, and includes three major plant facilities. Competing land uses include new buildings, roads, research areas, protected habitats, monitoring sites, remediation sites, waste management areas, historic sites, security zones, weapons training facilities, educational activities, and public hunting. Requests for landuse changes must be approved through a newly structured Resource Management Organization (RMO). The RMO process provides technical review of the proposal by representatives of 40 different "resources" ranging from site development to public concerns to endangered species. Input is provided from each "resource" to the RMO Council. The RMO Council makes a decision based on guidelines regarding issues such as best use of the land, laws and regulations, health and safety zones, environmental sensitivity, clustering of like uses, future growth, reuse of already disturbed areas, visual consideration, and community relations. This poster will provide an example of a proposed landuse change and its review through the RMO.

18

SMETANA, R.L., FORESTER, D.C., and MANGURIAN, L.P. Department of Biological Sciences, Towson State University--A comparison between Prolactin binding sites in the male and brooding female brain of *Desmognathus fuscus*.

This study was designed to explore the possible influence of prolactin (PRL) in salamander brooding behavior, because prolactin stimulates maternal behavior in rats and doves. Prolactin binding sites have also been detected in the brain of brooding females of *Desmognathus fuscus*, a species which exhibits parental care of their eggs during the brooding season. Localization of PRL binding sites was carried out using in vitro autoradiography. Ovine PRL (oPRL) was radiolabeled with ¹²⁵I by the lactoperoxidase method. Brain frozen sections were incubated with the radiolabeled hormone alone (HOT), with a 500 fold excess unlabeled oPRL (HOT+COLD) and with an equimolar concentration of luteinizing hormone (LH). LH was used to determine the specificity of the observed hormonal binding. Brain sections were apposed to MRF-33 film after incubation. The film was developed and the autoradiograms analyzed using a JAVA image analysis system. PRL binding was observed in the CNS of *Desmognathus fuscus* males and brooding females. Gender differences were observed in the prolactin binding pattern.

This study was supported by a Towson State University (TSU) Faculty Research Grant (L.P.M.), a TSU Student Research Grant and a Student Research Stipend by the TSU Academic/Industrial Partnership (R.L.S.).

19

SMITH, MICHAEL E. and GERRY LANFAIR. Valdosta State University--Effects of preservatives on wet-weight biomass of the asiatic clam, *Corbicula fluminea*. Specimens of *Corbicula fluminea* (Müller) were collected from the confluence of Shellstone Creek and the Ocmulgee River, Bleckley County, Georgia during February, 1993. Two groups of eighteen individuals each were removed from their shells and placed into 70% ethanol and 10% buffered formalin for a 163 day period. There was no significant difference ($P > 0.05$) between live wet-weights of the two groups. Mean weight loss was 41.9% (40.7 - 43.1%; 95% C.I.) and 21.6% (20.3 - 22.9%; 95% C.I.) after 163 days for the ethanol and formalin groups, respectively. Stabilization of mean weight loss occurred at 77 days for the ethanol preserved *Corbicula* and at 99 days for the formalin preserved *Corbicula*. Linear regression equations of the reciprocal of mean cumulative percent weight loss vs. the reciprocal of days preserved were $y = 0.6042x + 0.0434$, $r^2 = 0.9612$ for the formalin group and $y = 0.0690x + 0.0265$, $r^2 = 0.9855$ for the ethanol group. The slopes of the two lines were significantly different ($P < 0.001$). In ecological studies, it is recommended that the regression equations be used to convert preserved wet-weight biomass to live wet-weight; this would be especially true when comparing studies where different preservatives were used. If regression equations are not used, formalin is recommended over ethanol as the preservative for *Corbicula fluminea* based on lower weight loss.

20

STANKUS, PAUL T. and GARY R. WEIN. Savannah River Ecology Laboratory, University of Georgia--Hydrologic effects on species diversity and productivity: a mesocosm approach.

Hydrology can significantly affect plant species composition and productivity in wetlands. We examined the effect of hydroperiod in a mesocosm experiment by subjecting substrate cores from the shoreline of a constructed wetland to three different water regimes: flooded, shallow, and variable. Sediment samples collected at the initiation and termination of the experiment were analyzed for organic carbon, cation exchange capacity, pH and texture. Soil redox, pH, dissolved oxygen, and specific conductance measured at weekly intervals indicate that hydrology does alter the abiotic environment. Species composition, which was determined at the beginning and end of the experiment, indicates no major shifts in dominance among the treatments. Shoot height measurements for Panicum hematomon and Eleocharis quadrangulata, planted in 1987, show that plants in the variable treatment grew taller than the other treatments. At the end of the growing season plants were harvested for above and below ground biomass.

21

STEED, CANDY L., KEVIN L. WILLISON, and MARCIA HARRISON, Marshall University--Light-regulated ethylene production during gravitropism in etiolated pea stems.

In etiolated pea seedlings, a red light treatment prior to gravistimulation shifts the normal gradual locus of curvature to a more restricted zone resulting in a sharp angle along the stem. Addition of ethylene to red-pretreated seedlings changes this pattern of curvature to resemble that of dark-grown controls. Thus, we propose to evaluate the effect of red light treatment on ethylene biosynthesis as it relates to gravitropic curvature. Red light may alter ethylene production by reducing the level of ethylene precursor, 1-aminocyclopropane-1-carboxylic acid (ACC). For this study, we compared tissue ACC oxidase, ACC, and MACC levels in pea epicotylis before gravistimulation and at 30 min intervals thereafter. In addition, we compared seedlings given a daily dim green light treatment to those receiving red-light 18-24 hours prior to experimentation. During gravitropism, there is an overall reduction in the level ACC in both the red and green pretreated stems. However, a parallel increase in MACC levels did not occur during gravitropism or after red-light pre-

treatment suggesting that conversion of ACC to MACC is not acting to reduce ACC levels under these conditions. Preliminary results of ACC oxidase analyses indicate no change during gravitropism or after red light treatment. However, it should be noted that this study did not evaluate differential amounts of ACC oxidase, ACC, and MACC along the horizontal stem. Preliminary studies using tissue prints will be evaluated for their applicability in this system.

22

THOMAS, MARY BETH,¹ NANCY C. EDWARDS,¹ and ROBERT P. HIGGINS.² The University of North Carolina at Charlotte¹ and the Smithsonian Institution²--A previously undescribed marine meiofaunal hydroid.

Specimens of a previously unreported hydroid were collected off the Atlantic coast of Florida from shell-gravel sediments at a depth of 15 meters. The animal bears two pairs of small, palp-like oral tentacles oriented at right angles to one another. A long segment of body column, the proboscis, separates these tentacles from longer, scattered filiform tentacles in the aboral third of the animal. The slender hydroid varies in length from approximately 400µm (contracted) to over 1mm (extended) and creeps by alternate attachment of the oral palps and the basal disc to the substrate. Asexual reproduction occurs by transverse fission, with the appearance of small oral palps marking the site where fission will occur. The cnidome consists of an unusual combination of stenoteles, desmonemes, and microbasic p-mastigophores. The specimens resemble the meiofaunal species *Psammohydra nanna*, although *P. nanna* lacks oral palps and possesses holotrichous isorhizas rather than microbasic p-mastigophores. Microbasic p-mastigophores have been described for species within the family Corymorphidae. Either both species should be included in this family or the new species should be assigned to a genus other than *Psammohydra*.

23

WAGNER, DYONUKA, KIMBERLY JAMES, MARY FLEMING FINLAY AND GEORGE MCCOY. Benedict College--Effects of Chronic Exposure to PCBs in two Generations of Peromyscus Polionotus (Old Field Mice).

To investigate effects of two generations of chronic dietary exposure to PCBs, *Peromyscus polionotus* were fed a diet containing 5 ppm PCBs (polychlorinated biphenyls), persistent, widespread pollutants. Controls received a similar diet without PCBs. Offspring were maintained on the parental regime and paired at maturity with non-sibs in the same group. In the first and second generation offspring, birth and weaning weights were significantly lower in the PCB exposed animals; in the second

generation there also were significantly fewer litters/fertile pair/month, lower percentage fertile, and decreased survival to weaning among exposed mice. These observations suggest that exposure to PCBs depresses fertility, growth and survival and that these effects are enhanced through two generations of exposure. Supported by NIH grant GM 08117.

24

WEAVER, DONALD J., KENNETH R. LAKE, and KARLA M. WEIDNER. Furman University Department of Biology--Development of immunohistochemical markers to the endosomal and lysosomal compartments in *Ameioba splendens*.

Trophoblasts are externalized derivatives of the hindgut that form the embryonic placenta in fishes such as *Ameioba splendens*. Absorptive cells of the trophoblasts take in materials by endocytosis and the nutrients enter into the well-developed endocytotic complex followed by movement into the lysosomal system. N-acetyl-beta-D-glucosaminidase (NAGase) has been identified as a specific endosomal-lysosomal marker. NAGase activity was demonstrated in the endosomal and lysosomal compartments in *Ameioba splendens* using fluorogenic substrates. In an attempt to characterize NAGase from *Ameioba splendens* and to develop immunohistochemical markers for studies of the endosomal and lysosomal compartments, antibodies were developed in mice against bovine NAGase. Due to technical difficulties in obtaining large quantities of purified NAGase from fish, bovine NAGase was utilized as an antigen. Antibodies produced in mice reacted with the fish NAGase in an ELISA and in a western blot, indicating that the fish NAGase had a MW of approximately 145 kD. Additionally, fish NAGase activity in a spectrophotometric assay with p-nitrophenyl-N-acetyl-beta-D-glucosaminide was inhibited by the presence of these antibodies. Work is in progress to develop monoclonal anti-NAGase antibodies which will be tagged with fluorescent markers for visualization of the endosomal and lysosomal compartments in the trophoblast cells of *Ameioba splendens*.

25

WHITTIER, HENRY O.¹ and G. HALE PRINGLE. University of Central Florida Department of Biology--BIOSYS, a program for collecting, manipulating and reporting large taxonomical, ecological and biogeographic data sets.

BIOSYS is a compiled dBASE III™ program created to manage, manipulate and report very large taxonomic data sets. For example one database on Florida Magnoliophyta is approximately 20 megabytes, and contains nearly 5000 family, genus and species records, including memo fields up to ten pages long. Searches can be performed using scientific names, synonyms (11,000 presently), or common names (about 11,000 as well). Reports can be produced for single taxa, by families or genera; for selected

26

ZIRKLE, EUGENE and A. FLOYD SCOTT. Austin Peay State University--The herpetofauna of Fort Campbell Military Reservation, Kentucky and Tennessee.

Fort Campbell is a 42,669-hectare military reservation on the northwestern Highland Rim in southern Kentucky and northern Tennessee. Despite considerable information from surrounding areas, knowledge of its herpetofauna prior to this study was essentially nonexistent. To rectify this, a herpetofaunal survey of the reservation (excluding firing ranges, munitions impact areas, and cantonment areas) was conducted from June 1992 through June 1993. All major habitats were sampled each season using standard collecting techniques. Forty-eight species (25 amphibians and 23 reptiles) representing 13 families and 29 genera were documented. All were expected based on previous studies of surrounding areas. Two state-listed "special concern" taxa, *Hyla gratiosa* and *Ambystoma talpoideum*, were among the amphibians found. *Cryptobranchus alleganiensis* (listed "special concern" in Tennessee and "category 2" by federal authorities) was not encountered, despite one documented historical record. Evidence of intergradation was found in specimens of four species: *Notophthalmus viridescens*, *Agkistrodon contortrix*, *Diadophis punctatus*, and *Elaphe obsoleta*. Results augment existing knowledge of the amphibians and reptiles in the lower Cumberland Basin and provide baseline data useful in long-term trend analysis of environmental changes on the fort.

27

GAYLORD, CLARICE. Office of Environmental Equity, U.S. Environmental Protection Agency--An introduction to Environmental Justice.

No abstract provided.

28

WRIGHT, BEVERLY. Center for Environmental Programs, Xavier University--Environmental Justice: Education and outreach.

No abstract provided

- 29
BANKS, WARREN. Special Assistant to the Administrator, U.S. Environmental Protection Agency--Environmental Justice: Research priorities.
No abstract provided.
- 30
CARROLL, LYNDIA. Regional Environmental Equity Coordinator, Dallas, TX--Environmental Justice: The regional agenda.
No abstract provided.
- 31
REGAN, RICHARD. Legislative Analyst, North Carolina/Washington, D.C.--Environmental Justice: The congressional agenda.
No abstract provided.
- 32
LICKEY, EDGAR B. and GARY L. WALKER. Appalachian State University. An allozyme analysis of *Taxodium distichum* var. *distichum* and *Taxodium distichum* var. *imbricarium*.
An allozyme analysis of bald and pond cypress populations is being conducted to determine the genetic structure of individual populations and to gain better understanding of the taxonomic relationships of these two varieties. Approximately 300 individuals of both varieties were sampled from 13 locations around the southeastern United States. At certain locations, both bald and pond cypress, along with apparent morphological intermediates, were sampled. Measurements of bark thickness and diameter above the buttress (DAB) were taken from most individuals, providing a distinct morphological character by which varietal status can be assigned. Pond cypress has a significantly higher bark thickness to DAB ratio compared to bald cypress. Samples of fresh leaf tissue were also obtained and 13 loci assayed by starch gel electrophoresis. Allozyme frequencies vary significantly between bald cypress and pond cypress populations. Populations of pond cypress generally have higher levels of genetic variation than populations of bald cypress. Intermediates, with few exceptions, correspond to either bald or pond cypress phenotypes for bark thickness to DAB ratios and allozyme frequencies. However, some intermediates do have rare alleles not present in either variety. At present molecular studies are being initiated using RAPD fingerprinting to further characterize the extent of genetic variation between bald and pond cypress.
- 33
KENNETH W. McLEOD¹, JAMES K. McCARRON¹, and HOWARD S. NEUFELD². ¹Savannah River Ecology Laboratory and ²Appalachian State University--Comparative growth patterns of bald and pond cypress saplings under varying soil water conditions.
Research in the early 1980's on the comparative ecophysiology of bald and pond cypress (*Taxodium distichum* var. *distichum* and *T. distichum* var. *imbricarium*, respectively) showed that seedling bald cypress (BC) grew faster than pond cypress (PC), probably due to greater investment in leaf biomass by BC, since photosynthetic rates are actually higher in PC. Also, for adult trees, BC allocated a greater percent of its biomass to branches and leaves, and less to bole than PC. We report here a follow-up study at the Savannah River Ecology Lab, where one year old seedlings were allowed to grow for three seasons in large rhizotrons subjected to three soil water treatments: 1) continuous flooding, 2) seasonal flooding, and 3) drained. Additional trees were grown in 200 liter barrels and subjected to the same treatments. One half of the trees in each treatment in the rhizotron plots were droughted late in the fourth season. After the fourth season, trees in both the barrels and rhizotrons were harvested. For the barrel trees, there were no differences between taxa in either height or diameter, or among treatments within a taxon. As found in the earlier studies, BC allocated proportionally more biomass to branches than PC, while PC allocated more to the bole only in the continuously flooded treatment. Allocation to root biomass was greater for PC than BC, except in the continuously flooded treatment. Treatment effects on root biomass were not significant. In contrast to the earlier studies, PC accumulated more biomass than BC, with the continuously flooded treatments having the most biomass. Continuous flooding also resulted in greater allocation of biomass to the bole in both taxa. These studies show the importance of long term studies of tree growth, and the influence of seasonal and chronic flooding on growth.
- 34
NEUFELD, HOWARD S.¹, and KENNETH W. McLEOD². ¹Appalachian State University and ²Savannah River Ecology Laboratory--Aspects of the internal water relations of bald and pond cypress trees.
Field measurements of transpiration and leaf water potential (ψ_l) conducted in earlier studies showed that bald cypress (BC, *Taxodium distichum* var. *distichum*) often reached a lower ψ_l than pond cypress (PC, *T. distichum* var. *imbricarium*) at equivalent leaf conductances (g). The slope of this relationship has been used as a surrogate for estimating hydraulic conductivity (H) in plants, and our data showed H was higher in PC than BC. BC also experienced a late seasonal decline in estimated H, whereas PC did not, suggesting BC was more prone to cavitation late in the season. In contrast to the field results, estimates of H made on saplings in a greenhouse study showed no differences between the taxa. Therefore, we decided to further study the comparative internal water relations of these two taxa by measuring H directly, using a Sperry hydraulic conductivity apparatus, and to follow cavitation trends resulting from water stress with ultrasonic acoustic emission analyses. Seedlings were planted in 200 liter barrels at the Savannah River Ecology Lab and grown for three seasons under well-watered conditions. H was measured on sections of twigs cut from the trees. Cavitation events as a function of ψ_l were recorded using ultrasonic acoustic sensors. There were no statistically significant differences between taxa in either maximum H or ψ_l at which cavitation was initiated. The threshold for cavitations was between -0.8 and -1.0 MPa in both species. H and acoustic emission data corroborate previous anatomical studies of the xylem showing no apparent differences between the taxa. Discrepancies between field and lab data may result from: 1) inaccurate measurements of either g, or ψ_l , or both, 2) greenhouse growth conditions which obliterate true field differences, 3) ontology (only older trees show differences, or finally 4) that expression of H on total twig cross-sectional area is inappropriate, and should be re-calculated based on conducting area only.

35

JAMES K. McCARRON¹, HOWARD S. NEUFELD², and KENNETH W. McLEOD². ¹Savannah River Ecology Laboratory¹ and ²Appalachian State University--Seasonal water relations and gas exchange patterns of bald and pond cypress saplings under varying soil water conditions.

Seasonal patterns of photosynthesis (A), leaf conductance (g), and leaf water potential (ψ_l) were made on saplings of bald cypress (BC, *Taxodium distichum* var. *distichum*) and pond cypress (PC, *T. distichum* var. *imbricarium*) in their third and fourth growing seasons. Saplings were grown together in large rhizotrons at the Savannah River Ecology Laboratory in organic soils. There were three soil water treatments: 1) continuously flooded, 2) seasonally flooded, and 3) drained. Drought stress treatments were initiated in mid-August of the fourth year by placing rain enclosures over the soil for one half of the saplings in each treatment. Photosynthesis was measured every other hour on detached branchlets using a Li-Cor 6200 system, and ψ_l was measured on additional branchlets using a pressure chamber. Maximum A (between 10-15 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{sec}^{-1}$) was always reached prior to noon for both species, and was somewhat higher for PC than BC, on a projected area basis. Rates generally declined throughout the rest of the day. The pattern and magnitude of A remained nearly constant from mid-August to mid-October, but maximum A declined in late-October. There appeared to be no treatment effects on A either before or after initiation of the drought treatment. Prior to the drought treatment, ψ_l typically declined from a pre-dawn value above -0.2 MPa to afternoon minima between -1.2 to -1.4 MPa. There were no differences in either pre-dawn or afternoon minimum ψ_l between the taxa or among the soil water treatments. Saplings of PC subjected to soil drying showed consistently lower ψ_l , beginning in mid-September, whereas BC did not show any drought stress effects until late-October.

36

NEUFELD, HOWARD S.¹, EDGAR B. LICKEY¹, GARY L. WALKER¹, JAMES K. McCARRON², AND KENNETH W. McLEOD². ¹Appalachian State University and ²Savannah River Ecology Laboratory--Future research on the genetics and ecophysiology of bald and pond cypress trees.

Bald and pond cypress trees (*Taxodium distichum* var. *distichum* and *T. distichum* var. *imbricarium*, respectively) are among the most flood tolerant trees in North America, and the most important tree species in southern forested swamps and wetlands. Logging and draining of wetlands since the late 1800's has reduced the number and geographic extent of these two taxa. Lack of regeneration and reforestation has been attributed to several causes, including altered hydrology, and, subsequent domination of suitable sites by invasive woody species. While the studies described in this meeting have greatly increased our basic understanding of the ecology of cypress, the linkage between ecological genetics and ecophysiology remains poorly understood. Studies of enzyme kinetics may reveal possible correlations with physiological responses, a first step in trying to explain patterns of genetic differentiation, as indicated by allozyme analysis, between the taxa. From an ecophysiological perspective, aspects of the water relations of the taxa remain poorly understood, including 1) whole tree transpiration rates, which can now be estimated using sap flow meters, and 2) seasonal patterns of cavitation in field grown trees. The contrasting growth responses to soil water conditions documented herein suggest that levels and timing of flooding are major factors governing growth

rates. More carefully designed studies of the influence of soil water conditions on growth and physiological responses are needed, including responses to severe drought and soil fertility. Given the potentially drastic alterations in hydrology and nutrient cycling that may occur because of global climate change, these investigations may prove crucial for managing forested wetlands and maintaining cypress in the landscape.

37

WEIN, GARY R. and BEVERLY S. COLLINS. Savannah River Ecology Laboratory--Seedbank composition of a constructed wetland.

Seedbank development on previously unvegetated sites can influence vegetation composition and dynamics. We removed sediment cores from coves, points, and straights, and from planted and unplanted regions of these locations along the shoreline of L-Lake, a created and planted cooling reservoir, to determine whether their seedbank composition differs. Sets of cores were taken from depths up to 1 m, from the waterline, and from 1 m above water, to determine the effects of hydrology on seedbank composition. Cores were split into unstratified samples that were spread on soil in a greenhouse and stratified samples that were kept at 5°C for 120 days before allowing germination in the greenhouse. As they emerged from cores, seedlings were identified or transplanted and left to flower for later identification. Results show that water depth is the primary influence on seedbank composition. Points, coves, and straights did not differ in species richness or number of germinable seeds. Planting did not significantly influence the seedbank and only 6% of species in the seedbank were planted.

38

FISHER, M.A. and GILLIAM, F.S. Marshall University--Nutrient changes in soils of a created wetland

Availability of most nutrients is sensitive to the oxidation-reduction (redox) status of the soil. Thus, soil nutrient changes are potentially substantial under the permanently inundated conditions of wetland formation and creation. The objective of this study was to examine changes in nutrient availability in soils of a created wetland after ~1 yr of inundation in the Greenbottom Mitigation Wetlands Site, Cabell County, West Virginia. Three plots along two transects were established in the mitigation area, formerly a riverbottom old-field site. Two plots of each transect were located below the intended water level (inundated plots) and one plot of each transect was located above this level (control plots). Two additional plots were established in each of two existing wetland areas—one ~4 yr-old wetland created from beaver activity and the adjacent, original Greenbottom Swamp. Soils from each plot were sampled prior to the inundation period to depths of 0-10 cm and 10-20 cm. *In situ* redox potential, soil texture, available N, and extractable

macro- and micronutrients were determined. All plots were re-sampled ~ 1 yr following inundation and the same measurements were made. Redox potentials suggest that the inundated soils of the mitigation site are already approaching redox conditions of the natural wetlands. There were few changes in soil texture after 1 yr of inundation, except for a decrease in sand-sized particles (and an increase in clay particles) in the old-field plots of lowest elevation (i.e., plots of longest inundation period). This appears to result from the breakdown of the larger particles under reducing conditions. Not surprisingly, availability (extractability) of macro- and micronutrients was closely linked to redox potential. Ca became less soluble and Fe became more soluble under the reducing conditions of inundated soils. Available N (extractable NO_3^- and NH_4^+) had a more complex response to changing redox potential. Forms of available N were somewhat equally balanced between NO_3^- and NH_4^+ in the old-field soils. The anaerobic conditions of the inundated soils, however, prevent net nitrification, thus there was little N in the form of NO_3^- in these soils (>98% in the form of NH_4^+). Much higher pools of available N in inundated soils indicate lower plant uptake of N under these conditions. Results after ~ 1 yr of study suggest that soils of the created wetland are rapidly approaching conditions of the natural wetland soils in terms of redox status, texture, and nutrient availability.

39

REED, MICHAEL R. and KENNETH W. MCLEOD. Savannah River Ecology Laboratory, University of Georgia--Planting unconsolidated sediments with flood tolerant species.

Restoration of severely disturbed swamp forests often necessitates the use of innovative methods due to unconsolidated sediments and almost continuous flooding. Methods of restoration must remain simple due to the difficulty of working in this habitat. Therefore, techniques of planting saplings by simple insertion were explored. Three flood tolerant tree species (*Fraxinus pennsylvanica*, *Nyssa aquatica* and *Taxodium distichum*) were root pruned to three severities (moderately root pruned, severely root pruned and cutting) and outplanted into unconsolidated sediments of a severely disturbed delta. Survival was greater than 80% for *T. distichum* and *N. aquatica* when the roots were either moderately or severely pruned, but less than 33% for the cuttings. *F. pennsylvanica* fared poorly with the moderately root pruned saplings having the greatest survival (20%). There was no difference in height and diameter growth between treatments. *T. distichum* and *N. aquatica* can be successfully reestablished by these methods using either moderately or severely root pruned saplings.

40

ABBOTT, J. RICHARD and RALPH L. THOMPSON. Berea College--A floristic survey of Fort Boonesborough State Park, Madison County, Kentucky.

Fort Boonesborough State Park, adjacent to the Kentucky River in northeastern Madison County, Kentucky, was established in 1958 by the Kentucky Department of Parks. The historical Fort Boone, named for Daniel Boone, was one of the earliest frontier sites west of the Appalachian Highlands. The 62 hectare tract lies within the Outer Bluegrass Physiographic Province at the extreme southeastern terminus of the Kentucky River Palisades. Topographically, the park is comprised of an extensive floodplain and of dissected upland ridges, side slopes, and outcrops. Floodplain soils are composed of Quaternary alluvium and Ordovician silty loams. Upland soils are Ordovician silty loams derived from Lexington and Clays Ferry Limestones and Garrard Siltstones. Elevation ranges from 176 m along the river to 274 m on the uplands. Floodplain plant communities include riparian woods and open beach areas. Upland plant communities are a mosaic of western mesophytic forest and follow a topographic-moisture gradient from dry ridgecrests to mesic ravines. Mowed areas, roadsides, and fields constitute an important ruderal community throughout the study area. Important families numerically are the Asteraceae (59), Poaceae (49), Fabaceae (25), Cyperaceae (24), Brassicaceae (22), Lamiaceae (16), Apiaceae (13), and Scrophulariaceae (13). These eight families comprise 49% of the total species. Twelve pteridophytes, one pinophyte, and 445 magnoliophytes were documented from 88 families, 297 genera, and 458 species, of which 131 (29%) are naturalized.

41

HILL, STEVEN R. Clemson University--Floristic survey of the Washo Reserve, Charleston County, South Carolina.

The Washo Reserve, owned by the South Carolina Chapter of the Nature Conservancy, is a 1040 acre tract located within the Santee Coastal Reserve, South Santee, and is dominated by a large fresh-water pond and low ridges, along with associated wetlands with little or no salt influence. A floristic inventory was conducted in the 1992-1993 seasons. Most of the reserve is made up of the following plant communities: Bald Cypress--Tupelo Gum Swamp, Pine Flatwoods, Pond Cypress Pond, and Pine Savannah. Among the results were the location of seven species listed as sensitive in South Carolina. 606 species were found: 11 pteridophytes, 6 gymnosperms, 196 monocots, and 393 dicots. The three largest families were the Poaceae with 85 species, the Asteraceae with 84 species, and the Cyperaceae with 56 species.

42

HUCK, ROBIN and JOAN GILL BLANK. Florida Museum of Natural History and Grapetree Productions Inc.--Historic native flora and early settlement agriculture of Cape Florida, Key Biscayne, Florida. Extensive urbanization and perturbation have obscured the native flora and early settlement agricultural history of Cape Florida, the southern

tip of Key Biscayne, Florida. Following Hurricane Andrew in August, 1992, research work on this Cape revealed that this landform had been covered by about three to five feet of fill in the early 1950's. Early surveyor accounts, diaries, maps and floras provide insights for understanding the native flora and vegetation of Cape Florida in the 1800's and early 1900's. A dune-and-swale topography typical of barrier spits, a fresh-water spring and what appears to be a large mound at the end of the Cape suggest a diverse flora far richer and more tropical than the 116 species documented for the Upper Sandy Keys by J.K. Small in his 1913 Flora of the Keys and the more than 200 species for Key Biscayne by McAllister in 1935-38. The historic vegetation profile can be reconstructed to include beach-dune, coastal strand, maritime hammock and marine tidal swamp communities, with Coccoloba uvifera, Metopium toxiferum, Serenoa repens, Annona glabra, and mangroves, Rhizophora mangle and Avicennia germinans important. In the early 1830's Henry Perrine introduced banana, sisal and mulberry plants to Cape Florida from Yucatan, Mexico, at the start of tropical agriculture in Florida.

43

JONES, RONALD L. Eastern Kentucky University--The flora of Cumberland Plateau wetlands of northeastern Alabama.

The mid-Cumberland Plateau extends into Jackson, Marshall, and Madison Counties in Alabama. A variety of wetland sites occur on the flat to rolling uplands, including forested, scrub-shrub, and emergent. These sites were surveyed during 1992, and the flora was compared with that of similar sites in Tennessee and Kentucky. Overall the sites were very similar, but there were some floristic differences, especially relating to Coastal Plain species. Some southern species were found only on the Alabama portions of the Cumberland Plateau, while others were found in both Alabama and Tennessee, and others in all 3 states. Southern species found in the northeastern Alabama wetlands included Nyssa biflora, Populus heterophylla, Quercus phellos, Polygonum densiflorum, Echinodorus cordifolius, and Zizaniopsis miliacea. Several quite diverse sites were observed and should be considered for protective measures.

44

KENNEMORE, DOUGLAS E., JR., JOHN B. NELSON and DAVID H. REMBERT, JR. University of South Carolina--A preliminary report on a floristic survey of the Kings Mountain State and National Parks.

The Kings Mountain State and National Parks encompass an area of approximately 11,000 acres in

York and Cherokee counties of South Carolina. These two adjacent parks have remained largely undisturbed since the early part of this century. The parks lie in a geophysical province known as the Kings Mountain belt. A continental suture may be partly responsible for the formation of this belt with the predominant rocks being quartz-sericite schists and schistose metavolcaniclastics of the Battleground Formation. The soils derived from these rocks (Tatum-Nason-Manteo series) make it different from the surrounding piedmont. Kings Mountain and its associated ridges represent an unusual geomorphic feature known as a monadnock. The combination of this isolated region of higher elevation with these soils indicates a potential for some unusual plant associations. A two year project was begun in March of 1993 to determine the flora of the parks. The work from this inventory will result in an annotated checklist of all the species found there and a description of the natural communities. Collectively the parks may contain as many as 500 species.

45

NELSON, JOHN B. University of South Carolina--Final report on a floristic survey of the Tom Yawkey Wildlife Center, Georgetown County, South Carolina.

A survey of vascular plant species was conducted over a two-year period, beginning in April 1990, at the Tom Yawkey Wildlife Center. This 20,000 acre tract is located in the lower part of Georgetown County, South Carolina. The various terrestrial, palustrine and estuarine habitats were initially thought to offer the potential for a wide diversity of vascular plants. The final survey list includes 122 families, 366 genera, and 679 species. Of these two (Stachys pilosa and Trichostema nesophilum, both in the Lamiaceae) are state records, and 178 others are county records. In addition, an unusual range extension is indicated for an endemic composite from the panhandle of Florida, Chrysopsis gossypina ssp. cruiseana.

46

ANDERSON, LORAN C. and JOHN B. NELSON. Florida State University and University of South Carolina--Chrysopsis gossypina subsp. cruiseana, an endemic golden aster of the Florida panhandle, in South Carolina?

Extensive fieldwork by Nelson on coastal islands of Georgetown County, South Carolina, yielded an interesting array of golden asters. Some were decumbent with densely woolly rosette leaves and glabrous cauline leaves. These reminded Anderson of the Florida endemic Chrysopsis gossypina subsp. cruiseana. Earlier samples of these South Carolina plants were previously identified as Heterotheca floridana (i.e., C. floridana) in a dissertation; the student noted that this would be a range extension of several hundred miles for that species--known only to the gulf coast of

peninsular Florida. We found that chromosome number and aspects of morphology, particularly in the involucre and achenes, suggest that these dune plants of South Carolina are, indeed, *C. g.* subsp. *cruseana*, and they represent a very significant range extension for that subspecies. Other taxa demonstrating range disjunctions between the Florida panhandle and the Carolinas are noted.

47

EMRICK, VERL R. and GARRETT S. SMATHERS. University of North Carolina Asheville--Phytogeography of the Craggy Mountains: Southern Appalachians.

The goal of this study was to understand the distribution and occurrence of plant communities along an elevational gradient in the Craggy mountains of North Carolina. A series of 34 vegetation plots were sited along the Blue Ridge Parkway, covering a distance of 28 km and an elevational change of 1097 m. As elevation increases, the low elevation successional pine/oak community gives way to extensive oak/hickory forests of the upper slopes and ridgetops. Xeric south facing slopes contain species of the white oak group, whereas mesic north facing slopes have species of the red oak group on them. The mid elevations consist of mesic cove hardwood communities, characterized by deep colluvial soils and a diverse herb layer, interspersed with periglacial boulder field and mesic oak communities. The northern hardwood community type predominates at elevations in excess of 1450 m. The highest elevations of this community exhibit a distinct change in life form structure due to extremes in climate. A small beech (*Fagus grandifolia* Ehrh.) orchard community occurs around 1600 m elevation, in mountain gaps. The highest peaks of the Craggy mountains are occupied by the inexplicable mountain grassy and heath bald communities, while the typical high elevation spruce/fir community is absent.

43

MOSER, MARY L. and STEVE W. ROSS. Center for Marine Science Research, University of North Carolina at Wilmington
—Identification of hard bottom substrate off North Carolina: a protocol for data processing.

Hard bottom substrates on the continental shelf off North Carolina provide critical habitats for commercially and recreationally important reef fishes. Effective reef fish management, particularly designation of

marine reserves, is therefore dependent on accurate identification of hard bottom habitat. We analyzed existing databases which contained either direct visual observation of bottom types (by SCUBA or submersible) or fish trawl collections. Presence of obligate reef species in trawl samples provided indirect evidence for hard bottom. We compared two techniques for analyzing the trawl data: discriminate analysis and a simple presence/absence criteria. Discriminate functions, based on 99 pre-classified stations, successfully classified 96% of the reef stations and all of the non-reef stations. The simpler technique, which required the presence of at least two reef species in a catch to indicate a probable hard bottom, gave the same results as discriminate analysis for over 85% of the stations we compared. The simpler technique was adopted by the Southeast Area Monitoring and Assessment Program (SEAMAP) Bottom Mapping Workgroup for identification of hard bottom substrates in the South Atlantic Bight to the 200 m contour. Using the Workgroup protocol, we analyzed 3089 stations off North Carolina and classified 312 as hard bottom or probable hard bottom sites.

49

WATTERS, G THOMAS Ohio State University--Towards a standardized qualitative method of collecting freshwater mussels.

The great potential of freshwater mussels as biological indicators for ecological metrics (IBI, etc.) has not been realized. A major problem with implementing such a metric is the lack of a standardized method of collecting mussels over a wide range of habitats. Techniques sufficient for collecting in one habitat, such as large rivers, are not effective or possible in others, such as small creeks. Often, collecting mussels for monitoring does not require complete enumeration of the diversity of the fauna, and the rarest species need not be found. Because the diversity of mussels is related to the drainage area of a system, the number of expected species for a site may be estimated if the river mile or drainage area is known. The diversity at 34 sites in three midwestern river systems was completely enumerated from literature and museum records, and personal collecting. The sites ranged from small creeks to large rivers. Rarefaction curves were fit to each site. These were used to construct similar curves for incremental drainage areas. The resulting plot may be used to calculate the number of specimens needed to be collected for a given percentage of the expected fauna for any drainage area. This allows a worker to collect a specified fraction of the total expected diversity at any site for a given drainage area. The method is independent of habitat, collecting technique, or time spent collecting. Tests of this collecting method are now being conducted. Preliminary results indicate that this may be an efficient tool for standardizing collection procedures for biomonitoring metrics.

50

SHULL, LONNIE N. III, and GARY L. WALKER.
Appalachian State University--An allozyme
analysis of Brook trout (*Salvelinus
fontinalis* Mitchell) along headwater
streams of the Blue Ridge Parkway.

Brook trout (*Salvelinus fontinalis* Mitchell) is the only salmonoid native to the Southeastern United States, where they reach the southern limit of the species range. A Southern Appalachian strain of brook trout has been electrophoretically described in other studies. Nineteen streams located within the boundaries of the Blue Ridge Parkway were identified as potential brook trout habitat and surveyed for brook trout by electrofishing. Brook trout were found in thirteen streams. Introduced brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*), were found in 5 streams, none of which contained brook trout. One stream contained no trout at all. A total of 74 brook trout were collected from nine streams representing four major river systems. Eye and muscle tissue were removed, processed and examined electrophoretically. Preliminary results indicate that four brook trout populations contain the CK-a2(100) allele described in the previous studies that identifies the Southern Appalachian strain of brook trout. These four populations are all located in streams that drain to the western side of the eastern continental divide.

51

MOORE, EDWARD L. and DONALD C. TARTER,
Marshall University--A comparison of the
benthic macroinvertebrate populations of
similar riffles in dredged and undredged
sections of Dry Fork and Gandy Creek,
Randolph County, West Virginia.

It has been shown that channelization can have a harmful effect on benthic macroinvertebrate populations in a stream. The channelization of selected sites on a mountain stream in West Virginia prompted this investigation. Seasonal collections of benthic macroinvertebrate populations were made from dredged and undredged sections of Dry Fork and Gandy Creek, Randolph County, West Virginia. Duplicate collections were made with a 1 m² sampling grid. Using the EPA Rapid Bioassessment Protocol III, the following metrics were used to evaluate the data from the dredged and undredged sites: (1) taxa richness, (2) number of individuals, (3) EPT taxa index, (4) ratio of EPT to nonironomid abundance, (5) Hilsenhoff Biotic Index, (6) ratio of scraper and filtering collector functional feeding groups, and (7) ratio of shredder functional feeding groups and total number of individuals. Additionally, the Shannon index of diversity and equitability were calculated for both sites.

52

YOKUM, KEVIN, BRENT JOHNSON, CLIF TIPTON,
and DONALD TARTER, Marshall University--Leaf shredding experiments between naiadal
Peltoperla arcuata and *Tallaperla maria*
(Plecoptera: Peltoperlidae).

Naiads of *Peltoperla arcuata* Needham and *Tallaperla maria* (Needham and Smith) were collected from a first-order tributary of the Elk Lick Run drainage basin in the Fernow Experimental Forest, Tucker County, West Virginia. The experimental forest is in the Allegheny Mountains of the unglaciated Allegheny Plateau. Its elevation ranges from 1750 to 3650 feet (533 to 1112 m). In the laboratory, naiads were placed in containers with aerated stream water at 15 C and several species of autumn-shed leaves (e.g. American beech, black birch, black cherry, dogwood, red oak, red maple, rhododendron, sugar maple, sassafras, sycamore, witch hazel, yellow poplar). Additionally, naiads were exposed to different leaf combinations to determine preferential consumption. After two weeks, the naiads were weighed and ashed in a muffle furnace at 550 C. Leaves were dried in an oven and weighed. Tannin and lignin content of the water was determined after the experiment. The ranking of leaves according to consumption by *Peltoperla* and *Tallaperla* naiads will be discussed along with the tannin and lignin analysis. Finally, the results will be compared to the laboratory leaf shredding of naiadal *Peltoperla tarteri* Stark and Kondratieff and *Tallaperla cornelia* (Needham and Smith).

53

SKILLMAN, JAMES R. and FRANK A.
ROMANO. Jacksonville State
University--Life history and
ecology of the olive nerite,
Neritina usnea (Röding), in
Meaher State Park, Mobile, AL.

The olive nerite is a common estuarine gastropod found along the Gulf of Mexico in bays with rivers flowing into them. Until recently it has been neglected with little quantitative data collected. This study was designed to provide information on its basic life history and ecology. Monthly, 7 - 10 m² quadrats were examined and all *Neritina usnea* collected and preserved. Life histories were then elucidated by morphometric analysis. Six shell dimensions were analyzed using a computerized morphometric program and a Hamamatsu CCD camera. These measurements were then plotted on a frequency histogram which enabled them to be grouped together into size/age classes. These classes were then tracked monthly and growth rate, recruitment, longevity, mortality, and density were calculated from the data. Preliminary results indicate that there appear to be three size/age classes with the two larger classes

merging together in late winter and early spring. This indicates that N. usnea reaches a size in which the non-respired energy is diverted from growth to reproduction. N. usnea lay their eggs from late March through early July and the young of the year are recruited from the planktonic larval stage in November and December in the Northern Gulf of Mexico.

54

WILSON, JIMMY G., TRAVIS S. THOMAS, AND SAFAA H. AL-HAMDANI. Jacksonville State University--Effect of aquatic humus on Chromium toxicity to Azolla caroliniana.

The influence of humic substances on Cr(VI) toxicity to Azolla caroliniana was determined in this study. Azolla was grown for 21 days in diluted Hoagland solution with and without the presence of humic substances and Cr concentrations of 1 and 2 µg/ml. Increased humic substance concentration showed significant increases in chlorophyll concentration, growth, and photosynthetic rates. In addition, the presence of humic substances reduced the toxic effect of Cr at both concentrations.

55

FARR, MARK D., ANDREW C. MILLER, and BARRY S. PAYNE. U.S. Army Engineer Waterways Experiment Station--A comparison of mussel communities (Unionidae) from two Mississippi River delta waterways: the Tensas River, Louisiana and the Sunflower River, Mississippi.

Mussel surveys were conducted in summer 1993 at one location in the Tensas River, Louisiana within the Tensas National Wildlife Refuge and at three locations in the Sunflower River, Mississippi. Quantitative and qualitative data from the densest bed surveyed in each river were used to compare mussel communities. Two to four closely spaced sites near the middle of each bed were sampled using 0.25 m² substratum samples. Total density in the Sunflower bed ranged from 277.2 (Standard Deviation = ±72.6) to 192.8 (±30.7) individuals/m² whereas densities in the Tensas bed ranged from 44.8 (±6.9) to 39.2 (±13.0). Twelve species were collected at the Sunflower bed; total species at the Tensas bed was fourteen. Species diversity was 0.48 at the Sunflower bed and 0.87 at the Tensas bed. Amblema plicata plicata (three-ridge), Plectomerus dombeyanus (banklimber), and Quadrala pustulosa (pimpleback) were the three most abundant species within each bed, but their relative

abundances (A. p. plicata, 90.0% and 26.3%; P. dombeyanus, 3.5% and 23.9%; Q. pustulosa, 3.5% and 18.2% for the Sunflower and Tensas beds respectively) differed substantially between beds. These data will help us better understand and therefore protect mussel resources in southern rivers.

56

CLEMENTS, R.K., J.M. BASKIN, and C.C. BASKIN. University of Kentucky--Effect of soil type on the growth of Penstemon tenuiflorus Pennell and P. hirsutus (L.) Willd. Penstemon tenuiflorus is restricted to sc KY, middle TN, nw AL, and nc MS, while its closely-related congener, P. hirsutus, is widespread in nc and ne US and adjacent Canada. Both species occur primarily on calcareous soils. Effect of soil type on plant growth as a possible factor leading to the relatively restricted range of P. tenuiflorus was investigated. Plants of both species were grown for 147 days in sandstone- and shale-derived soils, limestone-derived soil from a population of each species, and a greenhouse soil mix of limestone-derived topsoil and sand. Oven-dry weights of roots and shoots were determined. Among soil types, both species grew significantly better in greenhouse soil. The only significant differences in growth between the two species occurred in sandstone and greenhouse soils, where P. hirsutus grew better than P. tenuiflorus. R/S ratios varied significantly between soil type within each species but not significantly between species. Plant survival on shale was very low. Soil type per se probably is not a major factor affecting the distribution of these species.

57

CONN, CHRISTINE E. and FRANK P. DAY. Old Dominion University--Nitrogen dynamics of root decomposition in response to nitrogen availability gradients.

In aboveground litter decay, nitrogen immobilization occurs often and may be enhanced in nitrogen limited environments. We hypothesized that similar patterns would occur during belowground decay in a nutrient limited ecosystem. Litter bags containing native roots were buried along a dune chronosequence on Hog Island, a barrier island of the Virginia Coast Reserve Long Term Ecological Research site. Nitrogen availability increased with dune age. Each site was fertilized with 15 g N/m²/year. After 111 days, nitrogen

was immobilized in the oldest 120 year old dune (108% of initial N). A net loss in absolute amounts of nitrogen occurred in the younger 24 and 36 year old dune sites (65-79% of initial N). Absolute amounts of nitrogen stabilized in all sites after 218 days (66-75% initial N remaining) while mass loss continued. In the younger sites, rates of nitrogen release were greater in control plots than in fertilized plots. No differences in percent initial nitrogen remaining occurred between fertilized and control plots in the 120 year old site during early stages of decomposition. Both exhibited net nitrogen immobilization (107-110% initial N after 150 days). Contrary to nitrogen limited aboveground systems, nitrogen immobilization potential was low and was enhanced by increased nitrogen availability.

58

COOK, R.A. and E.E.C. CLEBSCH.
University of Tennessee--
Genetic diversity in *Cimicifuga*
rubifolia Kearney.

Cimicifuga rubifolia Kearney (Ranunculaceae) is a long-lived herbaceous perennial found in the Ridge and Valley region of Tennessee and Virginia with disjuncts in Alabama, Kentucky, Illinois, and Indiana. An electrophoretic study was done as part of a population biology investigation of the species. This information was used both as support for the demographic portion of the study and to gain knowledge of the genetic diversity of this federal C-2 candidate. Leaf tissue was collected from 20 populations. Starch gel electrophoresis was used to assess levels of heterozygosity and polymorphism. Loci used were IDH, SKH, PGM-2, PGI-1, PGI-2, 6-PGD-1, AND 6-PGD-2. Only 1 population was monomorphic at all loci. Mean number of alleles per locus was 1.3 and the mean percentage of polymorphic loci per population was 33.5%. Observed heterozygosity was less than expected in all but two polymorphic populations. A large amount of genetic divergence among populations was indicated by large F_{ST} values (.197-.468). High total F_{IT} values (.271-.602) indicate this is probably due to reproductive isolation of populations. Additionally, many populations appear to be subdivided into small inbreeding subpopulations.

59

DAY, FRANK P. and EVERETT P.
WEBER. Old Dominion University -
- Effects of elevated CO₂ on root
dynamics in a scrub oak -
palmetto community in central
Florida.

Open-top chambers (about 4.5 m²) were used to quantify the effects of elevated CO₂ on the belowground portion of the plants in a scrub oak-palmetto community at Kennedy Space Center, Florida. The experiment included 3 CO₂ enriched chambers (700 ppm CO₂), 3 ambient air chambers. (350 ppm CO₂), and 3 reference plots without chambers. Minirhizotron observation tubes were installed at a 30° angle to a depth of about 1 m in each plot and outside the plots. A minirhizotron color video camera was used to obtain images of the roots 3 times a year to quantify changes in root length density. Elevated CO₂ chambers had greater root length densities than the ambient air chambers in November, 1992 (535 mm/mm² vs. 429 mm/mm²). There was a bimodal distribution of roots by soil depth that appeared to be more accentuated in the elevated CO₂ chambers. Preliminary data suggest that fine root turnover may be more rapid under CO₂ enriched atmospheres. Elevated CO₂ appears to increase root production and affect vertical distribution patterns of fine roots.

60

DILUSTRO, JOHN J. and FRANK P.
DAY. Old Dominion University.--
Aboveground biomass and net
primary production along a
barrier island dune
chronosequence

Aboveground biomass was examined along a chronosequence of dune communities on Hog Island, a Virginia Coast Reserve LTER site. The dominant species are *Ammophila* *breviligulata* and *Spartina patens*. Aboveground biomass was harvested monthly from ten quadrats on dunes 6, 24, 36, and 120 years old. Sampling was conducted from April to November 1993. Biomass values were greater for younger dunes. *Spartina patens* biomass was greater than *Ammophila* *breviligulata* for the 6, 24, and 36 year old dune ridges. It also showed a pattern of decreasing biomass with increasing dune age; in July it ranged from 72 g/m² to 5 g/m². The same month showed less variation in *Ammophila* *breviligulata*; it increased from 17g/m² to 39g/m² across increasing dune age. *Ammophila* *breviligulata* had greater biomass for only the 120 year old dune. There

appeared to be a midsummer decline in biomass due to drought conditions. This variation in production of aboveground biomass across dune age may be controlled by moisture, microclimatic conditions and soil nitrogen levels.

61

FRANKLIN, SCOTT B., DAVID J. GIBSON, PHILIP A. ROBERTSON, and JOHN T. POHLMANN. Southern Illinois University-Carbondale--Parallel Analysis: a method for determining significant factors.

In the past 25 years, numerous ecological studies have used Principal Components Analysis (PCA) or Factor Analysis (FA) as a method of data analysis and reduction. Determining the number of factors to retain is the most critical decision the researcher faces when using PCA or FA. An incorrect choice may lead to the underextraction of components (i.e., a loss of information), but usually results in overextraction. Overextraction attaches meaning to noise and leads to misinterpretation of results. Parallel Analysis (PA) has proven consistently accurate in determining thresholds for significant factors and variable loadings. The eigenvalues from a matrix of random values of p variables and n samples which match those of a collected data set are compared with eigenvalues from the collected data prior to rotation. PCA and FA eigenvalues from the collected data greater than those from random data would be retained. All factors with eigenvalues below this threshold value are likely spurious. We reviewed 51 articles utilizing PCA or FA from 1987 to the present in four ecological journals. PA was applied to each PCA and FA found in the literature. Of the analyses reviewed ($n=70$), 57 (81.4%) considered no threshold rule. According to the PA results, 44 (62.9%) of these analyses overfactored the data. Overfactoring has resulted in widespread, and potentially misleading, interpretation of data.

62

GREENE, MICHAEL C. Southeastern Louisiana University--The effects of hydrology, herbivory, and smothering by water hyacinths on two species of *Sagittaria*: a two year study.

It is known that unvegetated mud flats are prone to erosion and extreme sediment loss, particularly in deltaic environments. Nutria herbivory is thought to play a major role in maintaining this unvegetated state, possibly in conjunction with other stresses. Thirty-six 200 liter aquaria were planted with 10 specimens each of *S. latifolia* and *S. platyphylla* and allowed to acclimate. They were then subjected to the various treatment combinations consisting of differential Hydrology (flooding), Herbivory (clipping), and Smothering (covering by mats of water hyacinths). Aboveground biomass only was collected for the first year while both above- and belowground biomass were collected for the second

year. Illustrating the importance of measuring both above- and belowground biomass when calculating productivity, a marked change was observed in the significance level for the treatments from year 1 to year 2. In year 1 the most significant effect was due to smothering, followed by hydrology and an interaction between hydrology and herbivory. In year 2, the main effect was due to herbivory, followed by an herbivory by species interaction. This would indicate that, although an effect was initially observed due to hydrology, the vegetation became acclimated by the second growing season. In a comparison of above and belowground biomass for year 2, it was found that herbivory exhibited the greatest effect upon aboveground biomass while smothering, followed by herbivory, caused the greatest effect upon belowground biomass. Both above- and belowground biomass shared a significant herbivory by species interaction.

63

HAINDS, MARK J. ROBERT J. MITCHELL, LINDSAY R. BORING, and BRIAN J. PALIK. Joseph W. Jones Ecological Research Center--Temporal and spatial dynamics of legume populations in a frequently burned longleaf pine-wiregrass ecosystem.

Fire influences many facets of *Pinus palustris* forests; including the volatilization of large amounts of N. Legumes may be important contributors to the maintenance of N in these systems. To date, a comprehensive study of legume population dynamics has not been reported. In this study 85 plots were distributed across a hydric-to-xeric gradient and surveyed monthly for legumes by species, % cover, and stem numbers. Patterns in legume populations were then explored with multivariate techniques by relating edaphic factors such as soil nutrients, landform characteristics, and disturbance patterns to the monthly surveys of legume populations. Legume populations were very diverse with about 45 spp. being found at peak abundance in September. As a group, legumes were abundant across a wide ecological amplitude. However, rapid declines in populations were experienced at both the hydric and xeric ends of the gradient. Complex patterns in specific species distributions across the gradient and their relationships to site factors will be discussed. Legumes appear to have the potential to contribute very significant amounts of N to these systems.

64

HARKNESS, JOHN. School of Veterinary Medicine, Mississippi State University--Animal care and use from the university perspective.

No abstract provided

65

POTKAY, STEPHEN. Division of Animal Welfare, National Institutes of Health--Public Health Service policies on humane care and use of laboratory animals.

No abstract provided.

66

HARKNESS, JOHN. School of Veterinary Medicine, Mississippi State University--American Association for Accreditation of Laboratory Animal Care (AAALAC): What it is and how it can help you and your institution.

No abstract provided.

67

BURKE, VINCENT J. and J. WHITFIELD GIBBONS. Savannah River Ecology Laboratory--Evaluating wetland conservation policies with GIS models of habitat use by aquatic turtles.

A variety of organisms are dependent on freshwater wetlands for all or part of their life cycle. In the absence of wetlands both upland and lowland ecosystems support vastly different and often less rich species assemblages. For these reasons, the loss of wetland acreage has become a primary concern in biological conservation. Currently, federal statutes in the United States protect many wetlands by requiring delineation of the wetland/upland border and deterring development within that border. We monitored habitat use by three species of freshwater turtles (*Kinosternon subrubrum*, *Trachemys scripta*, and *Pseudemys floridana*) and created Geographic Information System models to test the adequacy of current wetland boundaries and a commonly proposed 100-foot buffer zone beyond such boundaries. Our results indicate that 100% of nests and terrestrial hibernation burrows ($n = 117$) occurred beyond the federally delineated boundary. A 100-foot buffer zone beyond the federal boundary insulated a minority (44%) of the nests and hibernation sites. We suggest that in the absence of adequate buffer zones, current and proposed wetland policies may postpone, rather than prevent, extirpation of many semiaquatic wetland biota.

68

EMERY, ERICH B. and DONALD C. TARTER, Marshall University--Seasonal variation in the benthic macroinvertebrate populations in the Green Bottom Wildlife Management Area, West Virginia, in relationship to the water quality and vegetation types.

The Green Bottom Wildlife Management Area is located along the Ohio River approximately 26 km northeast of Huntington, West Virginia. The area contains a valuable wetland of approximately 57 hectares. A baseline study of the benthic macroinvertebrates became important when personnel at the U. S. Army Corps of Engineers, Huntington District, proposed a habitat and modification to add marshland by building dykes. The limited ichthyofauna (central mudminnow, bowfin,

crass pickerel, sunfishes) depend heavily on the benthic macroinvertebrates as a food source. Any major changes in the food chain could alter the food habits of fishes. Eight stations were established in the wetland representing various vegetation and substrate types and water depths. Seasonal collections (January, April, July, October) were made at each station. Triplicate samples were taken with an Eckman dredge (1" x 3"). The following physical and chemical parameters were recorded at each station: dissolved oxygen (mg/L), phosphates and nitrates (mg/L), conductivity ($\mu\text{mho/cm}$), turbidity (JTU), depth (cm) and temperature (C). The percentage composition, number of taxa, functional feeding groups, mean number of individuals, and Shannon-Weaver index of diversity were calculated for stations and seasons. Using a SAS program, seasonal differences among stations were analyzed with ANOVA followed by Newman-Keul pairwise comparison procedure.

69

JOHNSON, BRENT and DONALD TARTER, Marshall University--Preliminary observations on the invasion of benthic macroinvertebrates in a new mitigated wetland at the Green Bottom Wildlife Management Area, Cabell County, West Virginia.

The Green Bottom Wildlife Management Area (GBWMA) was established to mitigate impacts to wetlands, wildlife and associated recreation incurred by implementation of the Gallipolis Locks and Dam Replacement Project. The GBWMA (38 35' 35" N, 82 14' 55" W) is located along the Ohio River 26 km northeast of Huntington, West Virginia. The area (ca. 339 ha) contains a valuable wetland habitat (ca. 57 ha) in the southwestern portion of the State. A proposed habitat modification to add marshland by building dykes has prompted this study. A new 100-acre wetland was developed between Green Bottom Swamp and the western boundary of the area. A pumping station was constructed to pump water from the Ohio River into the new wetland area. Green Bottom Swamp will be maintained at its current size through the use of a preservation weir. Bimonthly samples (triplicate) of benthic macroinvertebrates were collected using a modified Gering sampler (18x18x31) and a long handled dredge. Samples were collected from the following habitat guilds (macrophytes): *Juncus effusus* (common rush), *Ludwigia palustris* (Marsh purslane), *Phalaris arundinacea* (reed canary grass), *Polygonum coccineum* (water smartweed), *Polygonum hydropiperoides* (wild water pepper), and *Spartanium eurycarpum* (large burreed). Using a coefficient of community similarity index, benthic macroinvertebrates from the new wetland were compared to a previous study of benthic macroinvertebrates from the old wetland. Additionally, observations were made on species diversity, equitability, and functional feeding groups.

70

HAYES, TIM AND DONALD TARTER, Marshall University--Food habits of a disjunct population of the central mudminnow, *Umbra limi* (Kirtland), in the Green Bottom Wildlife Management Area, West Virginia, in relation to seasonal changes and age class differences.

Seasonal and age group variations in the food habits of the central mudminnow were studied at the Green Bottom Wildlife Management Area, West Virginia. Monthly collections were made in the heavily vegetated, littoral areas of the wetland between August 1989 and December 1992. Point values were assigned to each stomach and were used to calculate percent frequency of occurrence and percent total volume. Twenty-three types of food items were found in the diet. Percent total volume calculations showed that amphipods were a major food source in all seasons except summer. Ostracods and odonates played an important role in the fall and winter diets. Duckweed (*Wolffia* spp.) was utilized in high amounts in the summer and fall when it is abundant in the area. Most items showed a steady frequency of occurrence throughout the year although duckweed, copepods and caldocerans occur less frequently in the diet when they were not as abundant in the water. Diet overlap indices showed a high correlation between similar seasons and a low correlation between dissimilar seasons. Age class comparisons of percent total volume showed that in the younger age classes of mudminnows (0, I) ostracods and amphipods played an important role in the diet. In the Age Classes II and III, duckweed and odonates were the major food items taken. Most food items showed a steady percent frequency of occurrence throughout the age classes. Similarity indices showed that the closer in age fish are the more similar their diets. Mudminnows are omnivorous and highly opportunistic in their feeding habits.

71

MULLINS, LEE A. and DONALD C. TARTER, Marshall University--Flight periods of dragonflies inhabiting the Green Bottom Wildlife Management Area, Cabell County, West Virginia, with special reference to territoriality.

The flight periods of nine species of dragonflies provided the background information on the behavioral ecology of dragonflies inhabiting Green Bottom Swamp in the Green Bottom Wildlife Management Area, Cabell County, West Virginia. The flight periods were recorded for all the species occupying this habitat during the summer of 1993. Territoriality has now been documented in a variety of both dragonflies (Anisoptera) and damselflies (Zygoptera). Each day during the breeding season males go to the water to compete for access to females which visit the water to copulate and oviposit. Oviposition peaked in early afternoon with the females preferring a shallow cove in the farm pond

and the shallow, highly vegetative area of the main swamp. Daily mating success of males was estimated based on the time, place, and duration of territorial behavior. Estimated daily success correlated significantly with wing condition and body length.

72

MYERS, RANDELL S., and GARY P. SHAFFER. Southeastern Louisiana University--Isolating wetland vegetation resistant to nutria herbivory and damage.

Past research on nutria food preferences have focused on stomach and fecal content analysis. Although such data may accurately represent nutria food consumption, they may not reflect the ecological impact imposed by nutria foraging habits. This study was conducted in the Lake Pontchartrain Basin, Louisiana, and relied on 1000 m² wire enclosures and unfenced controls. Results indicate that nutria foraging habits cause damage to consumed and non-consumed plants and that inclusion of non-consumed species (e.g., *Leptochloa fascicularis*) results in a greater than ten-fold increase in loss estimates. Of the nine moderately resistant species, only *Typha latifolia* and *Bacopa monerii* have been noted in previous studies as preferred vegetation. Twelve species were classified as resistant, seven of which were woody shrubs. Of the resistant species, only *Sagittaria lancifolia* is a fleshy, herbaceous plant. It is curious that this species is largely avoided by nutria because two other species of the same genus (*S. latifolia* and *S. platyphylla*) are preferred vegetation. Only one species, *Polygonum punctatum*, was facilitated by nutria. This study indicates that the role of *Polygonum punctatum* and *Sagittaria lancifolia*, as well as several wetlands shrubs, should be explored for their potential in wetlands restoration.

73

TIPTON, CLIF and DONALD TARTER, Marshall University--Preliminary observations on the reproductive activities of the grass pickerel, *Esox americanus vermiculatus* LeSueur, in the Green Bottom Wildlife Management Area, Cabell County, West Virginia.

The grasspickerel is mentioned on the Vertebrate Species of Concern List in West Virginia. The reason for the West Virginia status is that lentic, vegetated areas required for spawning of grass pickerel are limited within the state and are constantly

being reduced by agricultural, residential, and industrial developments. The distribution of the grass pickerel in West Virginia is restricted to four counties along the Ohio River in the southwestern region. Green Bottom Swamp, a naturally occurring wetland of approximately 53 hectares, provides habitat for the grass pickerel. A proposed habitat alteration to add marshland by building dykes has prompted this study. Information from this study will establish a baseline for reproductive activities of the grass pickerel prior to habitat perturbation. Pickerel were collected seasonally by seines, pillow traps, and electroshocking. Attempts were made to determine the duration of the reproductive season by: (1) calculating the seasonal gonosomatic index (GSI); (2) observing spawning in the field and laboratory, and (3) noting the appearance of young-of-the-year individuals. Field observations will be made in the new wetland to determine any reproductive activities during the first year.

74

DAVID JONES, ATKINSON, ROBERT B., and JOHN CAIRNS, JR.. Virginia Polytechnic Institute and State University-- Factors influencing macroinvertebrate populations in accidental wetlands on surface-mined lands

Prior to passage of the Surface Mining Control and Reclamation Act of 1977 (SMCRA, P.L. 95-87), surface mining for coal in mountainous regions left considerable flat, compacted land. Many depressions were left accidentally, filled with water, were colonized by wetland plants, and were a source of water to both upland and wetland wildlife. In order to design wetlands to be constructed in reclamation of surface mined land, functions such as macroinvertebrate-mediated decomposition were characterized using accidental wetlands as models. Macroinvertebrate sampling was performed quarterly using three replicate sweeps of a D-frame net at 14 accidental wetlands in Wise County, Virginia. Samples were picked and identified to the lowest practical taxonomic level. Macroinvertebrate research has focused on species richness of 14 accidental wetlands, and has been compared to wetland age, macrophyte species diversity and biomass, numerous water chemistry parameters, and water level fluctuation. Results indicate that drawdown frequency, drawdown timing, and water quality, i.e., metal concentration, influence macroinvertebrate species richness. With the exception of Plecoptera, all orders of aquatic insects were present.

75

SEWALK, CHESTER J.,¹ GWENDA L. BREWER,¹ and DAVID J. HOFFMAN,² Frostburg State University¹ and Patuxent Wildlife Research Center² --The effects of an aquatic herbicide on Mallard embryos.

Bipyridylum herbicides have been found to produce embryotoxic and teratogenic effects in mammalian, avian, amphibian, and dipteran test organisms. Diquat dibromide, a bipyridylum, is commonly used as an aquatic herbicide, although its effects on wetland birds have not been examined. In this study, Mallard (*Anas platyrhynchos*) eggs were topically exposed to diquat to assess possible reproductive effects. Eggs were treated on the fourth day of incubation with concentrations of 0 (controls), 1.75, 3.5, or 7.0 g/l. After 18 days, 73 embryos were sacrificed and cleared according to Karnofsky (1965) to note skeletal abnormalities and bone length differences. The same exposure protocol was used subsequently to observe the hatching success of 383 embryos. Noted skeletal defects include anencephaly, hydrocephaly, micromelia, exencephaly, amelia, spoonbill, and shorter crown-rump lengths. Abnormalities were noted in the moderately and highly dosed groups, while none were observed in the control group. Hatching success was dose dependent. None of the hatchlings showed any sign of deformity. These results indicate that diquat may adversely affect the reproductive success of wetland birds.

76

BRITSON, CAROL A. Memphis State University--Preliminary observations on the feeding behavior of three species of hatchling freshwater turtles.

Hatchlings of certain species of freshwater turtles have been shown to use aposomatic coloration (associated with a behavioral rather than a chemical or morphological defense) as an antipredator mechanism. As these hatchlings are protected from aquatic predators, they may not, as is commonly assumed, be using the vegetation as a refugia and may use this environment for other activities such as feeding. This experiment was designed to identify possible differences in the feeding behavior and success of hatchling turtles in different aquatic and social environments. Individual and grouped hatchlings of the painted turtle (*Chrysemys picta*), yellow mud turtle (*Kinosternon flavescens*), and common snapping turtle (*Chelydra serpentina*) were observed in three different aquatic environments: shallow (1 cm in depth), sloped (1 cm to 9 cm), and deep (9 cm) water. Using tadpoles as a prey source, the response variables [e.g., number successful attacks, number unsuccessful attacks, pursuit time, and position (in testing chamber) of attack] were recorded for all hatchlings used in the experiment. Cryptic *C. serpentina* hatchlings were more successful in deep water and in a social environment (groups of three hatchlings). Conversely,

the aposomatic C. picta and K. flavescens hatchlings were more successful (i.e., fewer unsuccessful attacks and less pursuit time) in the shallow water regardless of whether hatchlings were in a solitary or social environment. These results show that aposomatic hatchlings may be using the shallow, vegetated shoreline not simply as a refugia but rather to increase feeding success.

77

DODD, C. KENNETH, JR. National Biological Survey AND RICHARD FRANZ University of Florida--Clutch size and frequency of box turtles on a Florida island.

Literature references on the clutch size and frequency of box turtles (Terrapene carolina) in Florida are based on limited information or on data from northern populations of this species. In 1992 and 1993, we began a study of box turtle (T. c. bauri) reproduction on Egmont Key in Tampa Bay. A total of 233 x-rays were taken of 167 turtles. Turtles ranged between 104 and 153 mm CL (\bar{x} = 134.6) and 195 to 605 g in weight (\bar{x} = 461.2). The smallest gravid female measured 124 mm CL (385 g weight) whereas a 131 mm CL turtle weighed the least (355 g) although she contained a clutch of 4 eggs. Clutch size varied between 1 and 4 eggs with 2 the most frequent mode. The frequency distribution of clutch sizes varied among sampling periods. Carapace length was significantly correlated with clutch size whereas plastron length was not. From 21.3% to 54.2% of turtles were gravid in any one month. Mean clutch size varied monthly but not among sampling periods and mean clutch size decreased significantly as the season progressed. Box turtles are gravid at least from April through July. Some females double and probably triple clutch within a year. Additional work is planned to clarify questions concerning these results.

78

DUNAWAY, MELISSA J. Jacksonville State University--A herpetofaunal survey of Little River Canyon in Alabama.

Little River Canyon has recently been designated a national preserve by the National Park Service. With no formal herpetofaunal surveys in northeastern Alabama, there is a need for baseline data. Due to the ruggedness of the terrain, several collection techniques were utilized. Five sites were visited every month for one year, during the day and night. Tributaries

into the canyon were also explored. Twenty-six species of amphibians were collected, including one of special concern, the Green Salamander (Aneides aeneus); this is about 87% of the expected species of the area. Twenty-seven species of reptiles were found. This is only 59% of the expected species. Only 36% of the expected snake species were found. This may be due to the low small-mammal diversity, extermination by local residents, and sampling biases. The most common species were Fowler's Toad (Bufo woodhousei fowleri), Two-Line Salamander (Eurycea cirrigera), Green Anole (Anolis carolinensis), and Eastern Fence Lizard (Sceloporus undulatus). Although herptiles can be found year-round, seasonal observations show that summer was the peak season, with June and July being the peak months. Seasonal abundances were compared across related taxa.

79

JOHNSON, STEVE A and L. M. EHRHART. University of Central Florida--Reproductive success of the Florida green turtle at the Archie Carr National Wildlife Refuge, 1985-93

The Florida green turtle (Chelonia mydas) is an endangered marine turtle which nests along the east-central coast of Florida. The literature is nearly devoid of assessments of hatching and emerging success in natural nests of this species. *In situ* nests were monitored at The Archie Carr National Wildlife Refuge, one of the most important beaches comprising the Florida rookery, from 1985 through 1993. The average emerging success rate ranged from a low of 25.2% in 1989 to a high of 75.2% in 1986. The main predator was the raccoon. The percentage of eggs within the sample nests lost to raccoons each season was low, ranging from 0 - 22.4% and was less than 10.5% in six of the nine years. The overall hatchling emergence rate varies between 50% and 75% annually. Considering this rate and the relatively large number of nests deposited annually it is likely that the Carr Refuge produces more Florida green turtle hatchlings than any other comparable beach in the state. It is clear that the Carr Refuge nesting beach is a keystone element in the recovery of the Florida green turtle stock.

80

KEES, GINGER M. and THOMAS K. PAULEY. Marshall University--Seasonal variation in diets of two terrestrial salamanders in the Fernow Experimental Forest, Tucker County, West Virginia.

Seasonal availability of prey items is an important factor in the assimilation of energy for reproduction in forest salamanders. Two species of terrestrial plethodontid

salamanders, Desmognathus ochrophaeus, the mountain dusky salamander, and Plethodon cinereus, the redback salamander, were studied for three years in the Fernow Experimental Forest to determine shifts in prey items based on seasonal availability. For spring and fall, the major food items taken included ants, flying hymenopterans, dipterans, coleopterans, and lepidopterans. More ants, lepidopterans, and dipterans were taken by both species in the spring. Flying hymenopterans remained a prevalent food item for D. ochrophaeus throughout the year but increased slightly in the fall for P. cinereus. Coleopterans represented a major prey item for P. cinereus throughout the year but decreased notably for D. ochrophaeus in the fall. There was a profound increase in the numbers of empty stomachs in both species in the fall.

81

KRASTINS, MICHELE Memphis State University--Comparisons of external morphogenesis and gonadogenesis in the common snapping turtle.

Stages of embryonic development in the common snapping turtle, Chelydra serpentina have been described as a series of morphological changes (Yntema, 1968) which are not temporally linear. To determine if external morphological development and gonadogenesis and differentiation have similar ontogenic rates at various incubation temperatures, we incubated eggs of C. serpentina at three temperatures (21°C, 26°C, and 31°C) and at a constant water potential (approx 150 KPa). During the time of incubation, samples were taken from each of the three temperature treatments at one, two, and three day intervals. Comparisons between the external morphology at various temperatures and gonadal development at the same morphological stage but at differing temperatures indicates that external morphogenesis is not strongly correlated with gonadogenesis.

82

MARCUM, CONLEY and THOMAS K. PAULEY, Marshall University--Hatching time and larval history for the northern two-lined salamander, Eurycea bislineata, Green, in the Fernow Experimental Forest, Tucker County, West Virginia.

Eurycea bislineata is a semi-aquatic salamander, with an aquatic larval stage. The adult is mainly terrestrial, entering the stream only in late fall and leaving after the breeding season in the spring. A series of larvae were captured during October 1992-October 1993 from Camp Hollow Run in the Fernow Experimental Forest. Hatching time for the larvae was found to be between 20 June and 9 July with the larvae averaging 10.6mm in SVL and 17.8mm in total

length. Four size classes were observed, which leads to the conclusion that the larval period is 4 years in length. However, most of the larvae transform after 3 years with only a small number transforming during their fourth year.

83

MARCUM, CONLEY and THOMAS K. PAULEY, Marshall University--Nesting habitat and larval characteristics for two Desmognathine species in the Fernow Experimental Forest, Tucker County, West Virginia.

Nests of Desmognathus monticola and D. ochrophaeus were found in the Fernow Experimental Forest, Parsons, West Virginia by excavation of stream bank seeps. Profound differences were found in the nesting sites and larvae of the two species. The nesting sites of D. ochrophaeus were found significantly higher above the water table and significantly closer to the surface than were nesting sites of D. monticola. Desmognathus monticola had a significantly higher number of eggs per clutch than did D. ochrophaeus. Each species larvae show distinctive markings. The larvae of D. ochrophaeus have a mean of 4.5 pairs of spots between the fore and hind legs, which is significantly different than the 5.2 averaged in D. monticola. In addition, the spots of D. ochrophaeus larvae are much smaller than those of D. monticola. Approximately half of D. ochrophaeus larvae lost their spots soon after hatching. Desmognathus ochrophaeus larvae also have the characteristic head marking and dorso-lateral stripes characteristic of the adult and are present as early as the late embryo stages. Desmognathus ochrophaeus larvae have a much smaller hatching size than D. monticola larvae and a much shorter larval period (as short as 1-2 weeks) than D. monticola (9-10 months).

84

MCCLURE, KAREN and THOMAS K. PAULEY, Marshall University--Comparisons of historical and current populations of Pseudacris brachyphona in western West Virginia.

Ten populations of Pseudacris brachyphona studied from 1942 through 1949 in Cabell County, West Virginia were re-examined during the spring and summer of 1993 in an effort to determine any changes in population structure. Pseudacris brachyphona was not found in any of these 10 sites. Habitat destruction from development of houses is probably the major factor in the disappearance of these populations. In addition to examining these historical sites, pools containing breeding populations of P. brachyphona were compared with pools without P. brachyphona to determine environmental factors that may be critical for the survival of this species.

85

VAJRAVELU, RANI. University of Central Florida--Biosystematic applications in the identification process of certain species complexes in the genus Chamaesyce S.F.Gray (Euphorbiaceae).

Chamaesyce A.F.Gray (Euphorbiaceae) is a natural and rather weakly defined genus of 250 species distributed worldwide. About 80 species have been reported from North America of which, 23 are from Florida. Mostly considered undesirable weeds and any economic uses unknown, biosystematic study of this group has been neglected until lately. Recent phytochemical research proves the presence of useful chemical compounds in some Asiatic Chamaesyce. Identification of certain species using traditional taxonomic methods in the course of floristic studies proved difficult due to morphological similarities, overlapping characters and possible hybridization among closely related species. An interdisciplinary approach towards solving problems among these species complexes will open up research opportunities in phytochemistry, pollination ecology and cytotaxonomy which, in turn will contribute to biological control programs, agricultural sciences, pharmaceutical research and pharmacognosy. The characters derived from biosystematic studies in conjunction with relevant morphological features will provide a broadened insight into phylogenetic relationships with other genera and will be the basis for a future monograph.

86

ALLISON, JAMES R. Georgia Department of Natural Resources--Additional rarities from the "Lost World" in Bibb County, Alabama, including a new species of Onosmodium and an "extinct" Solanum.

Continued explorations within an area of Bibb County, Alabama with numerous dolomite glades have revealed additional rarities. This is an area already sufficiently rich in undescribed- and other rare species to have been described as a "Lost World" (ASB Bulletin 40(2):109). Almost all of those glades that have formed over Ketona Dolomite support an undescribed species of Onosmodium. The plant resembles O. virginianum, but differs in its extreme pilosity and deltoid corolla-lobes. Both of these characters are suggestive of O. molle ssp. hispidissimum (Mackenzie) Cochrane, but the Bibb County plant differs from the latter in flower color, nutlet morphology, and stature. On April 26, 1993, on one of these glades, the author and Tim Stevens collected a dwarf Solanum in flower, subsequently identified by the author as Solanum carolinense var. hirsutum (Nutt.) D'Arcy. This taxon had not been collected in more than 150 years and was presumed extinct. Subsequent explorations in Bibb County have so far revealed 19 populations of this taxon, all on or near dolomite

glades. When the results of 1993 fieldwork are combined with the results of the previous year, the flora of this dolomite region includes the following rarities: 6 undescribed species, 6 state records (including an Endangered Species and 2 Candidates for listing), 2 other federal Listed Species, 9 other Candidate Species, and 33 other taxa tracked by the Alabama Natural Heritage Program. All told, the "Lost World" region of Bibb County, Alabama supports at least 56 rare species, a truly spectacular number of rarities for an area of less than 20 mi² (32 km²).

87

ANDERSON, LORAN C. and GERALD L. SMITH. Florida State University and High Point University--Carpels and chromosomes of the endangered Harper's Beauty (Harperocallis flava).

The monotypic Harperocallis flava is endemic to a very narrow range in the Florida panhandle. It is thought to be related to Pleea and Tofieldia (P. tenuifolia and T. racemosa both occur within its range). For those two genera, the basic chromosome number is $n = 15$. Harperocallis is distinct chromosomally; it is reported here as $n = 16$ as determined from mitotic root-tip counts. Most populations of Harper's Beauty exhibit polycarpelly: individual flowers have three, four, five, or six carpels. The extra-carpellate flowers outnumber tricarpetate flowers. These populations have been studied for several years, and no correlation exists between wet or dry seasons and numbers of extra-carpellate flowers. The high frequency of flowers with extra carpels appears to have resulted from genetic drift.

88

KNEPPER, DAVID A.¹, REBECCA D. BRAY, SURBALA CHAUDHARY, CYNTHIA CAPLEN, and LYTTON J. MUSSELMAN². U.S. Army Corps of Engineers, Norfolk District¹ and Old Dominion University, Department of Biological Sciences² - Battle at Passage Creek-Isoetes lacustris vs I. tuckermanii.

In 1933, Henry Svenson collected Isoetes macrospora (= I. lacustris) in Passage Creek in the Shenandoah Mountains of northern Virginia. Except for two small populations in Tennessee, this is the only population outside the generally boreal distribution of this quillwort. Isoetes tuckermanii has a similar boreal distribution and a chromosome number of $N=22$. Isoetes lacustris is $N=55$. The ornamentation of the megaspores of the two species is similar although I. lacustris is larger. We have studied the cytology, megaspores, and microspores of the Passage Creek material as well as its putative hybrid with I. engelmannii and compared it with other populations of I. lacustris and I. tuckermanii.

89

MASCIANGIOLI, TINA M., JAMES W. WALLACE, and J. ROGER BACON. Western Carolina University, Cullowhee, NC--Separation and identification of flavonoid constituents of *Juglans nigra* L. using high performance liquid chromatography (HPLC).

J. nigra is most notable for its edible nuts and valuable hard wood. In addition, extracts of this plant have been used medicinally for sedation and mild pain relief, as well as, to treat such ailments as eczema, herpes, and fungal infections. Despite the information that is known, there is still a lack of data on the chemical constituents of *J. nigra*. UV-vis spectroscopy along with thin layer, column, gas, and paper chromatography were used to identify several flavonoids from the leaves of *J. nigra*, including 3-O-glucosides, rhamnosides, and rhamnoglucosides of the flavonols quercetin and myricetin. HPLC was then utilized to survey polyphenolic variation within and among populations of *J. nigra*. HPLC analysis included the use of C_{18} and C_4 columns, an isopropyl alcohol-water-tetrahydrofuran solvent system, and UV detection.

90

MATTHEWS, JAMES,¹ ROBERT COXE,¹ JOHN SOULE,¹ and JAMES ALLISON,² University of North Carolina at Charlotte¹ and The Georgia Natural Heritage Program²--The status of *Aster georgianus* Alexander.

The name *Aster georgianus* Alexander is based on a specimen collected in 1898 by Outhbert near Augusta, GA. It was treated as conspecific with *A. patens* until 1977 when Cronquist proposed it as *A. patens* var. *georgianus*. In 1983 Ronald Jones elevated it to a species. *Aster georgianus* has primarily a Piedmont distribution, having been found historically in 23 counties from NC to AL. Intensive field work in the fall of 1992 and 1993 has been performed in an attempt to accumulate geographical and population data to determine if the species should be listed under the Endangered Species Act. By 1992 Jones was able to document only nine populations. We have expanded this to 45 populations in 14 counties in the four states. Increased awareness of the potential for this species will help in the location of new populations.

91

ZACK E. MURRELL. Harvard University--Cornus in Central and South America: Species delimitation and subgeneric relationships.

Attempts at species delimitation and supraspecific placement have resulted in considerable confusion regarding *Cornus* in South America.

Morphological analysis supports the recognition of a single species, *Cornus peruviana* Macbride. Two new locations for *C. peruviana* are reported from Costa Rica, 1000 km WNW of the closest populations in Columbia. Multivariate analysis, using both flowering and vegetative characters, does not support a north to south gradient in trichome orientation on the calyx, hypanthium, and abaxial leaf surface. A diploid chromosome number, $2n = 22$, is reported for the first time in this species. Based upon leaf and branch orientation, chromosome number, endocarp architecture, and inflorescence structure, *C. peruviana* appears intermediate between subgenera *Kraniopsis* Rafinesque and *Mesomora* Rafinesque. A reinterpretation of relationships supports placement of *C. peruviana* in a new section, *Austrocrania*. Subgenera *Kraniopsis* and *Mesomora* are recognized as sections *Thelycrania* Dumortier and *Bothrocaryum* (Harms) Nakai, respectively, and all three sections are placed within the subgenus *Thelycrania* (Dumortier) Endl. ex Schneider.

92

MUSSELMAN, LYTTON J.¹ and HENK P.² MEDEMA. Old Dominion University, Department of Biological Sciences¹ and Uitgeverij Medema, Vaassen, Netherlands²--Which plant is hyssop in the Bible?

Hyssop is one of the better known plants of the Bible and played an important part in several of the offerings and sacrifices. There has been considerable debate over the identity of this plant. While the passages dealing with the sacrifices and offerings present little difficulty as to which plant was intended, Solomon's description of hyssop as a plant that grows from walls poses a problem. Several botanists suggest that hyssop is caper (*Capparis spinosa*-Capparidaceae) because this shrub often grows on walls. However, our research supports the idea that hyssop is *Origanum syriacum* (Lamiaceae) and that the walls mentioned by Solomon can be interpreted as the rocky ledges where *O. syriacum* is often found.

93

TURRILL, NICOLE L.,¹ DAN K. EVANS,² and FRANK S. GILLIAM,² University of Tennessee¹ and Marshall University²--Nondestructive identification of West Virginia members of the *Dentaria* complex (Brassicaceae) using above ground vegetative characters.

Proper identification of species is crucial to studies of forest herb layer communities. Long term herb layer studies require nondestructive sampling, with species identified by above-ground characters. Spring herb layer communities, however, often contain members of species complexes that show intergradation of characters making identification by

morphology alone difficult. The purpose of this study was to determine the above-ground vegetative characters that best differentiate West Virginia members of Dentana diphylla Michx., D. heterophylla Nutt., and D. laciniata Muhl. ex. Willd. Eleven morphological characters were measured on West Virginia herbarium specimens and data were subjected to canonical discriminant analysis and analysis of variance. Results showed that species fell into three distinct groups with length and width of basal and cauline leaflets as the most important characters for differentiation. D. laciniata was identified by its lack of basal leaves and long, narrow cauline leaflets (length:width 4:1). The basal leaflets of D. diphylla were similar to but larger than its cauline leaflets (basal leaflet width:cauline leaflet width 2:1) where the basal leaflets of D. heterophylla were much wider than its cauline leaflets (basal leaflet width:cauline leaflet width 4:1). This study confirmed that these West Virginia members of the Dentana complex may be identified using above-ground characters. Future studies should test the application of these characters to D. diphylla, D. heterophylla, and D. laciniata samples from other states.

94

CLEBSCH, EDWARD E.C. and ALEX SLOAN. The University of Tennessee, Knoxville--Life history and population characteristics of the endangered Ruth's golden-aster, *Pityopsis ruthii* (Small) Small.

Pityopsis ruthii is known only from the Hiwassee and Ocoee Rivers in TN, where it occurs almost exclusively on pre-Cambrian phyllites. It flowers in late summer and fall, disperses by water and being rolled by wind. Achenes drive themselves into substrates and germinate in December to February. Establishment is mostly in fine cracks in rock. It is a poor competitor and does poorly in less than 50% of full sun. A recovery plan's implementation is being overseen by a multi-agency recovery group. It includes management to reverse population losses shown in 5 year inventory data. Allozyme data reveal both monomorphic and polymorphic loci. Threats include upstream dams, in-growth by woody plants, rafted organic debris, and recreational boating and fishing.

95

COXE, ROBERT B. University of North Carolina at Charlotte--Does the Oak-Hickory forest exist in the Triassic basins of North Carolina?

The Piedmont of N.C. has characteristically been placed in the Oak-Hickory forest type. It had been found previously that the Triassic basins in Virginia had the Oak-Hickory forest in them. Research of the forest types in the Triassic basins of N.C. (Dan River, Deep River, Wadesboro), which occur in the Piedmont physiographic

province, has found that the Oak-Hickory forest does not exist on those sediments that are strictly Triassic in age. On Triassic sediments it has been found that the mixed oak forest as described by Monk, et al with *Quercus alba* predominating in virtually every forest type exists. Some common co-dominants with *Quercus alba* include *Oxydendrum arboreum*, *Acer rubrum*, *Quercus rubra* and *Liquidambar styraciflua*. It has been found that on Iredell soil in the Dan River basin the Oak-Hickory forest does exist. Iredell soil though cannot be considered a Triassic substrate since the parent material is Diabase, an intrusive rock. From the Research it is concluded that the Oak-Hickory does not exist over Triassic sediments.

96

NEWSOME, CATHERINE DICKSON. Southeast Botanical Consultants--Notes on work in progress on the species biology of *Cuscuta harperi*, Harper's dodder.

Cuscuta harperi occurs primarily along Little River on Lookout Mountain in northeast Alabama, the eastern edge of the Cumberland Plateau. Harper's dodder, first described around 1893, was "lost" to botany until rediscovered during a floristic study of Little River. It parasitizes herbaceous plants on flat sandstone outcrops usually along canyon rims but may also be found on outcrops which have direct drainage into creeks. Historic and newly discovered locations, population characteristics, and threats are discussed.

97

FROST, CECIL C, Plant Conservation Program, North Carolina Department of Agriculture--Presettlement fire regimes in vegetation of the southeastern U.S.

Original fire regimes in natural vegetation can be deduced or reconstructed from a synthesis of information about landscape factors such as topography and fire compartment size; historical records; soils; remnant vegetation, and observations of fire behavior in different kinds of vegetation. These methods were used to construct a map of presettlement fire frequency regions. Original fire-return intervals in different parts of the southeastern landscape ranged from nearly annual fires, up

to 300 years, and vegetation types were distributed accordingly along this master gradient. Within a fire frequency region, however, and even on a single site, local fire frequency gradients can be found, with sites that burned every 1-3 years separated from sites that burned at much lower frequencies by only a fraction of a kilometer. The map, which shows the highest potential fire frequency in each region, can be used as a starting point for reconstructing original vegetation of specific natural areas.

98

FROST, CECIL C. Plant Conservation Program, North Carolina Department of Agriculture--Presettlement vegetation of the southeastern U.S.: practical approaches and proposal for a symposium.

With escalating partitioning of the southeastern landscape into domesticated versus natural areas, each state seems likely to have eventually up to 1,000 areas, large and small, with some degree of protection. Site managers throughout the South are being asked to describe the original or "natural" vegetation, and such information is critical for site designs that will prevent extinction of rare species and natural community types. Furthermore, it is now understood that fire played a role in shaping plant communities not only of the Coastal Plain, but also of the Piedmont and Southern Appalachians. New ways of getting at presettlement vegetation for a specific site include consideration of the regional fire frequency and then using more specific methods including landscape and environmental factors, historical methods, and vegetation methods to reconstruct original vegetation. Active participation of the audience will be solicited in suggesting content of a proposed symposium on presettlement vegetation of the South.

99

HART, JENNIFER M. The University of Tennessee--Impacts of nonpoint source agricultural pollution on riparian plant communities.

The USDA-ARS has been very concerned with the high levels of nutrients being loaded into Herrings Marsh Run watershed from extensive hog and turkey production and the use of mineral fertilizers. Over the past five years, a cooperative water quality demonstration project in Duplin County, North Carolina has been successful in developing various management practices to reduce the levels of contamination. There are

two tributaries and riparian communities within this watershed. They are similar in topographical and geological features but differ in intensity of nutrient loading, one being excessive (experimental community) and the other being negligible (control community). In the Summer of 1993 data were collected from both communities to determine if nutrient loading affected community structure and productivity. A total of 363 nested plots were evaluated. Information was collected from a total area of 7,260m² for canopy and subcanopy species, 3,630m² for woody and herbaceous shrubs, and a total of 363m² for groundcover species. The hypotheses tested include: no significant difference in species diversity between the two communities; no significant difference in the number of exotic versus native species between the two communities; a significant increase in canopy biomass and herbaceous shrubs in the experimental community compared to the control.

100

¹HELD, MICHAEL E., ²DONALD W. IMM, ³G. RUSSELL LUMPKIN, ⁴PATRICK M. GRIFFIN and ⁵BARBARA P. MOYER. ¹St. Peter's College and ²Savannah River Ecology Laboratory, Univ. of Georgia--Seedling dynamics within ericad patches and the impact of nutrient addition and litter removal.

Sandhill communities are maintained by periodic burning, which results in a mosaic of ground cover types. Each have slightly different flora and microhabitat conditions. Of these, ericaceous patches provide the least sterile conditions for seedlings. These patches have higher levels of soil OM, nutrients (N, P, and cations), and soil moisture. Ground surface shading and litter accumulation are also higher. Our objective was to consider the impact of biomass removal and nutrient release on tree seedling dynamics within ericaceous patches. Each patch was quartered to include one of four treatments: biomass removed, biomass removed and fertilized, fertilized, and intact. Our results indicate that biomass removal and nutrient addition resulted in the largest increase of xeric oak seedling densities. Biomass removal alone also promotes the release of these oak species; whereas nutrient additions alone result in a very small increase or a decrease in seedling densities as compared to the intact (control) areas. Furthermore, the number of new oak seedlings within each patch and under each treatment decreased with time.

101

HILL, STEVEN R. Clemson University--The Ice Pond Community, a proposed new plant community in South Carolina.

During botanical surveys in the Table Rock Reservoir watershed in 1992-1993, observations were made on a unique vegetation community located at the base of north-facing cliffs of Table Rock in Pickens County, SC. Sheets of ice and rock detach and fall up to 1000 ft and have created small narrow ponds with sand terraces. The ecology is also unique since the community never receives direct sunlight yet is unobstructed by woody vegetation, is cool and wet with seeps, and is at a relatively high elevation in the state. The microclimate produced resembles that of high mountains in North Carolina or farther north. Several plants new to SC were discovered here, including Sanguisorba canadensis, Scirpus caespitosus, and Carex buxbaumii.

were measured in the laboratory. The three species were examined to determine the length of time they would retain photosynthetic induction by moving plants from an inducing light environment into the dark for varying periods of time (1, 3, 5, 10, 15, 30, 60 and 120 min). The return to induced photosynthetic rates of the species were compared. Arisaema triphyllum had the shortest retention and Podophyllum peltatum the longest retention. These results are contrary to those expected based upon the inducibility of photosynthesis in the three species. The ecological implications of the results are discussed.

102

HORN, CHARLES N. Newberry College -- Notes on the habitat preferences and life history of *Frasera carolinensis* (Gentianaceae) in South Carolina.

The ecology and life history of *Frasera carolinensis* is well known as a result of work in Kentucky during the 1970's by P. Threadgill, J. Baskin and C. Baskin. In this study conducted during 1993, four populations were studied within the piedmont of South Carolina. These populations were found on generally eastern facing wooded slopes dominated by a combination of pine (*Pinus taeda*) and a mixture of hardwoods (mostly *Liriodendron tulipifera* and *Quercus alba*). Soils were relatively rich and lacked rocks. Individual plants were found from within one meter of a stream to well up slope (100 meters away). This habitat preference is quite a contrast from populations of Kentucky which were reported to grow best in sunny upland sites in distinctly rocky soils. Study of populations in South Carolina confirmed previous reports on reproduction and development of the species. It is considered a perennial, yet once individuals have flowered they die. During the 1993 study plants initiated growth in mid February, flowering individuals began to bolt by late March, flowers were open in early April, nearly full sized fruits were present by mid June, and vegetative plants had essentially died back by mid July.

103

HULL, JAMES C. Towson State University--Photosynthetic inductive responses of understory forest herbs.

The effects of photosynthetic induction on three understory herbs (*Podophyllum peltatum*, *Arisaema triphyllum* and *Smilacina racemosa*)

104

IMM, DONALD W. Savannah River Ecology Laboratory, Univ. of Georgia--Scalar dependence of species-environment relations.

Vegetational patterning and diversity are strongly influenced by environmental conditions. The importance of individual variables change with scale. For example, climatic features have little influence on local compositional patterns. With increasing scale, environmental heterogeneity increases. Species richness and vegetational heterogeneity also increase with scale as well as environmental heterogeneity. To consider these relationships seven data sets were used that range from local hardwood vegetation patterns along slopes within the Savannah River Site to broad scale patterns of the eastern deciduous forest. Environmental parameters include a variety of geographic, climatic, geologic, topographic, and edaphic features. These relationships were analyzed using multivariate techniques such as DCCA and DCA. At regional scales, thermally related climatic variables and geographic distance are strongly correlated to axis solutions. Moisture regimes and topography are important at local and subregional scales. Nutritional differences and soil texture are important at subregional to local scales. Wide ranging species are most strongly influenced by edaphic features. Those with more restricted distributions are influenced by either geographic, geologic, or climatic features. Others are insensitive to edaphic differences within geographic optimums.

105

JOLLS, CLAUDIA L.¹ and KRISTEN L. UTHUS²
 University of Michigan Biological Station, East Carolina
 University,¹ and Virginia Commonwealth University,²--The
 reproductive ecology of Houghton's Goldenrod (*Solidago
 houghtoni* T. & G.), a Michigan endemic

Houghton's goldenrod is a federal and state listed threatened member of the Asteraceae, with a distribution centered around the circumneutral to basic sands of the Niagara escarpment of the Great Lakes. In Michigan, its distribution on beach flats and intertidal wetlands suggests that seed production and seedling success are important for species preservation; however, little is known of this species autecology. We established two permanent plots 7 x 30 m² at a foredune and a cobble beach to compare the demographics, breeding biology, and reproductive success of this protected taxon. At each site seedlings were censused with a 1 x 30 m² transect to determine seedling density. Forty vegetative adults and eighty flowering individuals were selected without bias to correlate reproductive condition with size. The flowering individuals were assigned to one of four treatments to determine breeding biology: 1) self-compatibility, 2) cross compatibility, 3) autogamy or apomixis and 4) natural pollination success. Insect visitors also were collected. Fruit collected the previous growing season were in a growth chamber pilot to compare germination between the two sites' substrates and two burial depths. Seedling and adult success differed between sites, relative to soil organic matter and water content. Seed set was highly variable and relatively low probably related to reduced insect visitation at these sites and limited autogamy due to floret morphology and capitulum development. Also, not much selfing occurred, perhaps due to pollen removal by insects and/or some sporophytic self-incompatibility as observed for other related taxa. Insect visitors included ants (Myrmecinae), true bugs (Nabidae), flies (Syrphidae, Bombyliidae), bees (Halictidae) and Lepidoptera. Some beetle taxa (Bruchidae, Phalacridae) were significant seed predators. 50% of fruits from the previous year had insect damage. Germination was light dependent and may decline through time, such that seeds which do not germinate the following growing season lose viability. The reproductive ecology of Houghton's goldenrod appears very similar to other congeners. Its limited distribution may be more a function of habitat requirements and availability, as well as limited seed and seedling success, rather than a breeding system atypical for the genus.

106

MACLIN, EDWARD AND E.E.C. CLEBSCH, University of Tennessee Knoxville. --Responses of *Echinacea tennesseensis* (Beadle) Small to various management treatments.

The Tennessee Coneflower, *Echinacea tennesseensis* (Beadle) Small, is a federally listed endangered perennial composite endemic to the cedar glades and barrens of Tennessee's central basin. The species is known from less than a dozen sites, most with areas less than 1000 m². In December of 1991, experimental management treatments were applied to plots at the Vesta Glade coneflower site. These treatments included mowing, discing, burning, combination treatments, and a control for a total of eight types, each of which was set in triplicate. The plots were sampled in July before the treatment imposition and in May and July of the two following years for data on substrate composition, species composition, percent cover for all species present,

and counts of each of the three life stage classes of *E. tennesseensis* (first year seedlings, non-flowering juveniles, and flowering adults,) along with counts of flowering heads per adult. Preliminary analysis of the data shows a statistically relevant difference in treatment effects. No strongly beneficial treatments have been found. Results suggest that optimum conditions for growth and reproduction of *E. tennesseensis* are best maintained by preventing disturbance extremes.

107

MAYES, STEVEN G., MARK A. MCGINLEY, and CHARLES R. WERTH, Texas Tech University -- Clonal population structure of *Quercus havardii* Rydb. *Quercus havardii*, sand-shinnery oak, is a rhizomatous shrub of low stature (≤ 2m tall) occurring on sandy soils in western Texas, Oklahoma, and eastern New Mexico. It often dominates the areas in which it grows, forming continuous growths of numerous hectares in extent, in which *Q. havardii* may form as much as 80% of the ground cover. An investigation was undertaken to determine spatial features of *Q. havardii* clones in a 200m x 200m study grid in Yoakum County, Texas. Ramets sampled at 10m intervals were electrophoresed to determine their allozyme genotypes for 20 loci coding 12 enzymes. A high level of genetic variability was observed, with 75% of the loci (i.e. 15 loci) polymorphic, facilitating discrimination of genetic individuals (genets). Fifty-five genets were detected and their ramets mapped. Clone size varied from about 10m across to more than 100m across, with one large clone dominating the central portion of the grid. Clones were irregular in shape although tending toward circular, and exhibited little fragmentation. The large size of some clones suggests that genets may be long lived. The lack of fragmentation suggests that the population is relatively stable, with low rates of change in spatial patterning and population composition. The effect of clone size and population structure on dynamics of sexual reproduction is a target of future investigations.

108

McKENNA, MARY A., MONIA BOND, and CONSTANCE BROWN, Howard University--Effects of simulated acid rain on growth and reproduction in alpine plant species.

We have carried out a five year study of herbaceous plants at the Glacier Lakes Ecosystems Experiment Site in the Snowy Mountains of Wyoming to examine the effects of simulated acid

rain on vegetative growth and reproduction. We have explored reproductive sensitivity to acid rain in several species through laboratory studies of pollen germination and growth *in vitro*. Most species show a marked decline in pollen germination in media at a pH below 4.5, but variation in sensitivity is evident among species. Detailed studies of vegetative growth and reproduction under simulated acid rain stress have been initiated with two species, *Aquilegia caerulea* (columbine) and *Erythronium grandiflorum* (glacier lily). *Aquilegia* plants exposed to simulated acid rain spray (pH 3.5) throughout the growing season show decreased plant height and crown width compared with plants exposed to simulated ambient rain (pH 5.6) or non-sprayed controls. Individual *Aquilegia* flowers exposed to acid spray before hand pollination produce significantly fewer seeds than flowers sprayed with an ambient rain solution. *Erythronium* demonstrates less sensitivity than *Aquilegia* to low pH in pollen germination studies and in field studies of growth and reproduction under acid rain stress. No significant differences in seed set were found in *Erythronium* flowers following hand pollination after exposure to acid and ambient rain solutions, and a growth study initiated in summer 1993 did not detect any difference in bulb weight of plants exposed to acid and ambient rain treatments.

109

PATRICK, THOMAS S. Georgia Department of Natural Resources--Monitoring the green pitcherplant (*Sarracenia oreophila*) in Georgia.

Few stations remain for the federally endangered green pitcherplant. Formerly, the species ranged across northern Georgia from adjacent North Carolina to the Cumberland Plateau of Tennessee, southward to Alabama's Lookout Mountain and Coosa River Valley. Presently, two disjunct demes exist- one around Lookout Mountain, and one in the Blue Ridge Mountains near the Hiwassee River. A colony of less than 75 individuals at one end of a pasture in Georgia was fenced off in an attempt to restore the population. After three years of cattle exclusion, plants form larger clumps, produce taller and more leaves, and develop flowers and seed. The site remains threatened by construction activities on adjacent lands, removal of plants without authorization, continued ditching of nearby fields, upslope pastures, and natural succession brought about by subtle changes in hydrology. Management by fire to control woody plant invasion may be necessary. Increasing the water table by removal of tile drains in fields or by installation of soaker hoses may be needed. Seedling establishment and continued growth of old-age clumps will be encouraged. Other problems are how to control exotic pasture weeds, and how to enhance associated rare

native species, such as *Buchnera americana*, *Lysimachia terrestris*, *Pycnanthemum virginianum*, and *Rhynchospora rariflora*.

110

CHRISTMAN, STEVEN P. Florida Museum of Natural History--Introduction to the biogeography of Florida Discussion will focus on the historical and ecological biogeography of present day Florida and the significance of the Suwannee Straits, Cuban connections, Ocala islands, Pleistocene shore lines, Gulf Coast corridors, changing sea levels, suture zones, centers of origin, vicariance events, peninsula effects, epeirogenic uplifts, and Disney World.

111

WEBB, S. DAVID Florida Museum of Natural History--Extinct megafauna and human interactions in the late Pleistocene of Florida. The cause of massive megafaunal extinctions, including mammoths, mastodons, horses, ground sloths, giant tortoises and about two dozen others, is widely attributed to either overkill by hunting humans or rapid climate change. Both the arrival of paleoindians and rapid deglaciation occurred throughout North America between 12,000 and 10,000 years ago at the end of the Pleistocene. Submerged sites in Florida produce exceedingly rich records of early humans, extinct megafauna and pollen records which serve as a proxy for climate change. Examples of human and megafaunal interactions through the critical few millennia will be discussed.

112

SKELLEY, PAUL E. Florida State Collection of Arthropods--Arthropod fauna associated with the Southeastern pocket gopher, *Geomys pinetus* Rafinesque.

The Southeastern pocket gopher is a solitary burrowing rodent which seldom comes to the surface. Its burrow system represents a habitat, much like a cave or gopher tortoise burrow, that invertebrates have exploited. An attempt was made to survey this fauna by setting pitfall traps in the burrows. The invertebrates collected represent a distinct fauna with species occupying all trophic levels and showing seasonal activity periods. Many of these invertebrates are undescribed and their ecology unknown. The small amount of survey work completed indicates that some species have restricted distributions within the host pocket gophers range, possibly correlating to geologic history.

113

BURGESS, GEORGE H. and DAVID B. SNYDER. Florida Museum of Natural History and Continental Shelf Associates Inc. -- Zoogeography of the St. Johns River Ichthyofauna

The St. Johns River is Florida's largest river, draining a watershed of approximately 21,630 km².

St. Johns River originated as a lagoonal system situated behind barrier islands during the Pamlico when sea levels were 8-10 m higher than at present. Totals of 58 freshwater species, 8 anadromous-catadromous species, 48 widely-euryhaline marine species, 64 limited-euryhaline marine species, and 3 exotic species have been recorded from the system. The freshwater contingent is derived primarily from stocks that survived on offshore islands during high stands of sea level, from immigrants that entered the developing Oklawaha River (the St. Johns River's major tributary) from a Santa Fe River (Suwannee River drainage) refugium as sea levels subsided, and possibly from subsequent colonization via headwaters of the Santa Fe and St. Marys rivers. Phenetic clustering based on species presence-absence links the St. Johns River freshwater ichthyofauna most closely with those of the Satilla, St. Marys, Aucilla, Suwannee, and Ochlockonee rivers, which are then linked to those of other peninsular Florida drainages including the Everglades, Lake Okeechobee, and the Hillsborough, Withlacoochee, Peace, Alafia, Myakka, Little Manatee, Manatee, and Waccasassa rivers. The widespread and pronounced penetration of fresh waters by typically marine fishes makes the

114

MOLER, PAUL E. Florida Game & Fresh Water Fish Commission--Zoogeography of the salamander genera *Siren* and *Pseudobranchius*.

Siren and *Pseudobranchius* comprise the family Sirenidae. These two genera have undergone parallel radiations which likely resulted from periodic isolation of stocks as a consequence of fluctuating sea levels. Marine transgression of the Suwannee Straits resulted in isolation of mainland and peninsular stocks and led to divergence of species. The central Florida ridge, which extends from near Lake Okeechobee north to the Tifton Upland of Georgia, partially isolates the Atlantic and Gulf coastal lowlands and has also contributed to the radiation of the Sirenidae.

115

WILLIAMS, NORRIS H. Florida Museum of Natural History--Role of the Florida Museum of Natural History in biogeographic and biodiversity studies.

The Florida Museum Natural History in Gainesville maintains large natural history collections that include plants, mollusks, butterflies, fishes, amphibians and reptiles, birds, mammals, and plant, invertebrate and vertebrate fossils. With an estimated 20 million specimens in the collections, the museum is a major resource for studies in biogeography and biodiversity. Large portions of these collections center on Florida, but other parts of the world, particularly the Caribbean Basin countries, are well represented. The museum's collections are available for examination by qualified researchers. For further information, contact individual curators.

116

WILLIAMS, JAMES D.¹, and ROBERT S. BUTLER². National Biological Survey¹ and U.S. Fish and Wildlife Service²--Distribution patterns of the freshwater mussels (Family Unionidae) of Florida.

The river systems of Florida harbor a unionid fauna of more than 60 species belonging to 22 genera. Within this geographic area there are two major faunal regions with a total of 41 endemic species. The Apalachicola Region, encompassing drainages from the Escambia River to and including the Suwannee River, and the Peninsular Florida Region which includes the St. Marys River southward on the Atlantic slope and the Waccasassa River southward on the Gulf slope. There are 58 species of mussels in the Apalachicola Region of which 31 are endemic. In the Peninsular Region there are 17 species of which 5 are endemic. In the two regions 18 species are endemic to a single river system. There are only 11 species that occur in both regions. Two additional species, *Elliptoideus sloatianus* and *Elliptio crassidens*, occur as fossils in the Peninsular Region but are found living in Apalachicola Region today. Most of this relatively diverse mussel fauna was derived from western Gulf drainages with the remainder originating from south Atlantic slope river systems.

117

THOMAS, MICHAEL C. Florida State Collection of Arthropods--The Florida State Collection of Arthropods. The Florida State Collection of Arthropods is the largest insect and terrestrial arthropod collection in the South and one of the ten largest in the United States, with more than seven million prepared specimens. Although the collection is worldwide in scope, its greatest strengths are in Florida, the southeastern United States, the Caribbean, and Central America. It serves as a major repository for types and voucher specimens. As a research collection it fulfills an important role in systematic studies as well as in biogeographical and biodiversity research. Its collection of more than 30,000 bulk samples are a unique and valuable resource.

118

CHOATE, PAUL M. University of Florida--*Cicindela highlandensis*: proposal for endangered species status and for cessation of collecting at all known sites.

The tiger beetle *Cicindela highlandensis* was described in 1984 from Highlands County in central Florida. Since then its attractiveness to collectors has resulted in intense collecting pressure and a marked decrease in known populations. Populations at and adjacent to the type locality have been reduced to the point of extinction, and may in fact no longer exist. This reduction in numbers cannot be attributed to habitat destruction. Numerous recent searches for additional localities have resulted in the discovery of several sites harboring small, allopatric populations in Highlands

and Polk counties. Documented examples of voracious collecting and a belief that this practice will continue lead to the conclusion that if this species is to survive secrecy of site locations and restrictions on collecting must be adopted. Since similar restrictions have been applied to other Florida invertebrates I propose that the official status of endangered species be applied to C. highlandensis. Furthermore, since other organisms found in these scrub sites are undoubtedly equally threatened, additional research on the biodiversity of these sites and simultaneous conservation of these central Florida scrub habitats must be aggressively pursued if these ecosystems are to survive.

119

Edwards, G. B. Florida State Collection of Arthropods--Apparent origins of the Salticidae (Arachnida: Araneae) of Florida.

So far, 93 species of Salticidae (jumping spiders) have been recorded from Florida. The origins of the present fauna are believed to be: north temperate region (46 species), southeastern U. S. (28 species), Caribbean (3 species), Appalachian (1 species), pantropical (2 species), Florida endemics (13 species). Ten of the north temperate species occur rarely in North Florida. Two of the north temperate species and three of the southeastern U. S. species are the northernmost representatives of tropical genera. Two of the Florida endemics occur only in the Keys and are possibly Caribbean. Therefore, as many as 10 species may be neotropical in origin. Eight species are as yet undescribed six of which are Florida endemics, and five species are only recently described.

120

WILKINS, LAURIE¹, JULIO ARIAS², BRAD STITH², ROBERT BELDEN³, and MELODY ROELKE³. Florida Museum of Natural History¹, University of Florida², Florida Game and Fresh Water Fish Commission³--A morphological investigation of the Florida panther *Felis concolor coryi* -with a comparison to other North American and South American subspecies of cougar.

The Florida Panther, *Felis concolor coryi*, has been the subject of considerable ecological and biomedical research, however, no work has been done on the morphology of this subspecies since 1942. The recovery of many specimens unavailable to earlier researchers permitted a thorough review of the morphology of the Florida subspecies. All historic and recent specimens from southeastern US (N=79), were measured for pelage color (with a color spectrophotometer), cranial profile, cranial proportions, and examined for the presence of two newly described traits, a mid-dorsal whorl and kinked tail. These were compared to available North American and South American specimens (N=200 - >600, depending on the character being measured). The characters examined provide a basis on which to describe the Florida population and discriminate between it and other subspecies using statistical methods. Most specimens recovered in the last twenty years exhibit historical *coryi* morphologic features. The cats inhabiting the Everglades region are shown to be significantly different from the rest of the Florida

population in cranial morphology as well as in the near-absence of the whorl and kinked tail. There is no evidence to support a permanent geographic or ecological separation of Florida panthers into two populations, and the differences are attributed to the introduction of captive-release individuals into the Everglades in the 1950's.

121

AUTH, DAVID L. Florida Museum of Natural History--Analysis of distribution of amphibians and reptiles of the Florida Keys.

Specimens of 54 species of amphibians and reptiles were found in 43 museum collections from 54 islands of the Florida Keys. This island by island documentation considerably exceeds that reported by Lazell (1989 Wildlife of the Florida Keys A Natural History). Localities were entered into a dBASE database and illustrated on dot maps. Distributions will be discussed in relation to the geological history of the keys, island size and relative arrangement, species group, environmental constraints, and recency of introduction.

122

HUPP, CLIFF R. and MICHAEL M. MEADOR. U.S. Geological Survey, Norcross, Georgia and U.S. Geological Survey, Raleigh, North Carolina--Biological aspects of the National Water-Quality Assessment and the characterization of riparian and aquatic habitats.

Using multiple lines of evidence, the National Water-Quality Assessment (NAWQA) attempts to assess the status and trends in the Nation's water quality and to develop an understanding of the major factors that affect observed water-quality conditions and trends. Physical, chemical, and biological data are collected at a network of fixed and synoptic sites that represent areas of major natural and human factors thought to control water quality. These sites are located in 60 study units (40 presently active) across the United States, chosen on the basis of hydrologic systems (major river basin or large aquifer). Ecological data are collected on fish, benthic invertebrate, and algal communities, and associated riparian and aquatic habitats. These biological data are compared to and interpreted with spatially and temporally coincident hydrologic, water-and sediment-chemistry data, and tissue-contaminant data. NAWQA includes a fluvial-geomorphically based characterization of riparian and aquatic habitats and associated vegetation. Recent research suggests the riparian zone plays an important role in aquatic ecology. In addition to detailed physical measurements of the fluvial landforms, NAWQA establishes several permanent, leveled cross sections and associated permanent, riparian-vegetation plots, at each site. NAWQA seeks active cooperation and collaboration with academia and other federal, state, and local agencies.

123

PETERSEN, JAMES C., and SUZANNE R. FEMMER. U.S. Geological Survey--Biological aspects of a water-quality assessment of the Ozark Plateaus: with an emphasis on periphyton.

The U.S. Geological Survey's National Water Quality Assessment Program includes a study unit that includes most of the Ozark Plateaus of Missouri, Arkansas, and Oklahoma. As part of this program, water-quality samples are collected at least monthly at 13 sites in the study unit. At each of these sites, habitat and fish, benthic invertebrate, and periphyton community data are collected. Fish communities are sampled in late summer using electrofishing and seining methods. Invertebrates are sampled in late summer/early fall from riffles, pools, and available micro-habitats. Samples are collected using kick nets, stove-pipe type samplers, and other appropriate methods. At the same time, periphyton samples are collected from rocks in riffles and pools. Because of the abundance of cobble-sized rock in Ozark streams, a sampler constructed of an O-ring cemented to the end of a syringe barrel is used to isolate discrete areas of periphyton. A brush attached to a plastic rod is used to remove the periphyton from the rock. A separate qualitative periphyton sample composed from available microhabitats is also collected. Qualitative sampling, or quantitative sampling of other substrates more common in some other study units, may require use of other brushing, scraping, or suctioning methods.

124

COUCH, CAROL, A. and BYRON J. FREEMAN. U.S. Geological Survey-- Patterns in fish distributions in watersheds having various land uses in the Apalachicola-Chattahoochee-Flint River basin.

As part of the U.S. Geological Survey's National Water Quality Program, ecological surveys of fish distribution and abundance are being used to assess water quality in a variety of environmental settings. Patterns in the distribution of aquatic biota in the Apalachicola-Chattahoochee-Flint River basin in Georgia, Florida and Alabama are being examined in watersheds influenced by forest, row-crop agriculture, poultry farming, suburban, and urban land uses. In June 1993, a preliminary survey of fish communities was conducted in streams in 6 watersheds representing a variety of land uses. These stream basins included 1 forested basin, 2 row-crop agriculture basins, 1 poultry farming basin, 1 suburban basin, and 1 urban basin. Fish were collected using electrofishing and seining in stream reaches of 150 to 300 meters in length. A habitat assessment was also conducted in each stream reach sampled. Species richness among the 1993 samples ranged from 8 species in the suburban basin to 19 species in a row-crop agriculture basin in the Coastal Plain. The Brillouin Index of Diversity ranged from 0.83 in the urban basin to 2.35 in a row-crop agriculture basin. In 1994, fish community surveys will be expanded to 4 basins within each land use category. The resulting fish community data will be correlated with habitat and water-quality data using multivariate techniques and compared to historic fish survey data from university natural history museum collections. Similarity in fish communities among watersheds having various land uses will be evaluated using data from the sites to be sampled in 1994.

125

MORING, J. BRUCE. United States Geological Survey--Water Resources Division--Biological aspects of water quality assessments in the Trinity River Basin, Texas.

The Trinity River Basin is one of 60 hydrologic systems chosen for study as part of the National Water Quality Assessment (NAWQA) Program. The Trinity River Basin drains approximately 18,500 square miles and extends from the prairies and cross timbers of north-central Texas to the eastern woodlands and coastal prairies of southeastern Texas. Anthropogenic factors that directly influence water quality and stream biota in the basin include urban nonpoint runoff and wastewater effluent, 22 medium to large reservoirs, and agricultural activities in more than half the basin. Biological assessments include single- and multiple-reach surveys of algal, invertebrate, and fish communities at 12 ecological stations. Differences in fish community structure are best predicted by variations in segment-level and reach-level habitat characteristics and regulated flow practices. Because every major tributary and sub-basin is influenced by regulated flow, urban runoff, and agricultural practices, it is important to assess natural or largely undisturbed conditions in community structure as a reference for hypothesized contaminant induced differences.

126

ZAPPIA, HUMBERT. U.S. Geological Survey, Towson, MD-- Preliminary results of ecological surveys at fixed water-quality monitoring stations, Potomac River basin, National Water-Quality Assessment Program.

No abstract provided.

127

RUHL, PETER M. U.S. Geological Survey, Water Resources Division, Raleigh, North Carolina--Intra-site variability of fish community samples collected in the Coastal Plain, Albemarle-Pamlico drainage.

Multiple-reach sampling of fish communities in coastal plain streams was used to provide information about the magnitude of intra-site variability that might be encountered. This information is important for evaluating inter-site differences that are observed during water-quality assessments. At selected sites fish community samples were collected from each of three stream reaches located within larger, relatively homogenous stream segments. Each of the sampling reaches were selected based on fluvial geomorphology. Intra-site variability was evaluated by comparing species richness, percent similarity, and rank concordance.

128

ASBURY, CLYDE E. U.S. Geological Survey, Tallahassee, FL--Biological aspects of water-quality assessment in the north Florida and Georgia Coastal Plain: fish communities.
No abstract provided.

conducted to monitor the colonization of pond-dwelling amphibians in 23 ponds constructed in a clearcut area. Five species were found to inhabit these ponds in the first year. In addition, studies were conducted in the New River Gorge National River to determine the use of road puddles, roadside ditches, and abandoned coal mines by amphibians. Eleven species of amphibians were found to breed in road puddles and roadside ditches, and five species of salamanders were found to inhabit old coal mines.

129

PARKINSON, CHRISTOPHER L. University of Louisville--RELATIONSHIPS OF THE AFRICAN STILETTO SNAKE (*Atractaspis*) AS DETERMINED BY mtDNA RIBOSOMAL GENE SEQUENCING.

The phylogenetic relationship of the genus *Atractaspis* is not known. The genus has traditionally been allied with the vipers (Family Viperidae), but other workers have grouped it with the burrowing and venomous snakes of the subfamily Aparallactinae (Family Colubridae). Cadle's (in press) immunological work suggests a relationship between *Atractaspis* and the basal colubrid-elapid split. He suggests that "the Elapidae and *Atractaspis* appear as derivatives of the basal radiation, and not as clades separate from the colubrids" (p.22). The relationships of the genus *Atractaspis* are investigated using weighted parsimony analysis of mitochondrial ribosomal DNA sequences for representatives of major groups of advanced snakes and *Atractaspis*, using *Boa constrictor* as the outgroup taxon. Preliminary results suggest an elapid/*Atractaspis* clade, with the genus *Coluber* as the sister taxon. These results may be due to sampling bias. Results of additional analyses with the inclusion of additional taxa will be discussed.

131

SCHWARTZ, FRANK J. Institute of Marine Sciences, University of North Carolina--Natural regeneration time of damaged skin to heal in loggerhead sea turtles, *Caretta caretta*. Wild and captive loggerhead sea turtles, *Caretta caretta*, often exhibit, other than loss of a limb or part of the body, skin loss or damage following attacks by sharks, fishes, or other turtles. Flippers, nape, face, and head are the usually affected areas. Skin damage is most severe, often penetrating into the muscles, following attempts to mate. During mating attempts males bite a female's nape skin in order to help while mounting or grasps a female's entire head during the premating behavior, peeling face and head skin as she attempts to escape. Regeneration, repigmentation, and healing, even for most extensively damaged areas, occurs within 50-60 days, depending on location and severity of the abrasion (face, mane, flipper). Following regeneration only small white scars may develop to give evidence of the violence a sea turtle's skin can or did endure.

130

PAULEY, THOMAS K. Marshall University--Effects of habitat disturbances on amphibians.

Three studies were conducted in West Virginia to determine the effects of different habitat perturbations on the survival of amphibians. In the higher elevations of the Monongahela National Forest, four sites were examined to determine the effects of gravel roads, hiking trails, and a ski slope on terrestrial salamander populations. Roads and trails were found to be barriers that possibly separate populations of salamander species. Large-scale disturbances such as ski slopes were potentially detrimental to terrestrial salamanders. Studies were also

132

SMITH, KELLEY R., J. RUSSELL BODIE, and VINCENT J. BURKE. Southeastern Louisiana University, University of South Carolina, and Savannah River Ecology Laboratory--Factors affecting variation in nest temperature between two freshwater turtle species.

Incubation temperature affects many aspects of turtle egg development including sex determination, duration of embryogenesis, and embryonic mortality. We investigated the relationship between nest depth and nest temperature by comparing 24-h temperature profiles of the shallow nesting mud turtle (*Kinosternon subrubrum*) and the deeper nesting Florida cooter (*Pseudemys floridana*) in South Carolina. We also monitored moisture levels and exposure to sunlight (in lux) for each of 27 mud turtle and six cooter nests. We created a null model comparing soil temp-

eratures in the same nesting locations and the mean nest depths for each species which predicted that mud turtle nests would be cooler during the night and warmer during the day than cooter nests. After comparing the nest profile for each species to the null model, we found that the actual nest temperatures of mud turtles were lower than cooter nest temperatures during the night, as predicted, but were equal to cooter nest temperatures during the day. Moisture levels were not significantly different between the nests of the two species, but analysis of lux levels indicated that mud turtles avoid excessive temperatures by nesting in partially shaded locations as opposed to the more open field nesting of cooters.

133

TUBERVILLE, TRACEY D. AND VINCENT J. BURKE. Savannah River Ecology Laboratory--Do Flag Markers Attract Turtle Nest Predators?

Plastic flagging is commonly used to mark turtle nest sites in studies that monitor nest fate. Although it is possible that flagging may attract mammalian predators to turtle nests, no previous studies have examined this issue. We tested the effects of wire stake flags on potential turtle nest predators at Ellenton Bay, a 10 ha marsh on the Savannah River Site. Potential mammalian predators included skunks, gray fox, and raccoons. Three methods were used to detect the presence of predators at both flagged and unflagged sites: 35 mm cameras with electric eyes, trackboards, and bait stations. For each method, 20 unmarked sites were paired with 20 sites marked with two wire stake flags. Tests were conducted in areas where actual turtle nests were marked with two wire stake flags. Nest predation on flagged nests was commonly observed immediately preceding our study. Visitation rates between flagged and unflagged sites were not significantly different at $\alpha = .05$ (Fisher's exact test). Our data indicate that mammalian nest predators did not form an association between the flags used to mark nest sites and the prospect of locating turtle eggs.

134

WHITE, COLLEEN and A. FLOYD SCOTT. Austin Peay State University--Substrate preference in juvenile Alligator Snapping Turtles, *Macrochelys temminckii*: results of laboratory tests.

Juvenile Alligator Snapping Turtles, *Macrochelys temminckii*, were tested in the laboratory to determine 1) if they would choose equally or unequally from among a variety of substrates, and 2) whether the addition of cover would alter their initial choice of substrates. To answer the first question, 18 second-year individuals were placed, one at a time, in the center of a circular arena containing equal areas

of mud, sand, fine gravel, and coarse gravel. Then, at the end of a 10-minute acclimation period and every 5 minutes thereafter for 20 minutes, the substrate supporting each turtle was noted. This entire procedure was performed four times. To answer the second question, the first experiment was repeated (using 16 of the original 18 turtles) with artificial cover (a small, green, plastic flower pot) placed on a different substrate throughout each trial. Chi square analyses of the results indicate that, under controlled laboratory conditions, juvenile *M. temminckii* 1) exhibit a significantly disproportionate ($P < 0.05$) affinity for the substrates tested (with coarse gravel topping the list), and 2) that the presence of cover significantly influences their choice of substrate. Funding for this project was provided by The Center for Field Biology, Austin Peay State University.

135

GOOD, JOHN A. and JAMES H. HOWARD. Frostburg State University--Effects of clearcutting on herpetofaunal abundance and diversity in western Maryland.

An array of sampling units, consisting of aluminum flashing, funnel traps, and pitfalls, was used to sample herpetofauna in Green Ridge State Forest, Allegany County, Maryland. Three treatment types (clearcuts, pole stands, and mature stands) were selected and each treatment was replicated three times for a total of nine sites. At each site, three sampling units were included for a total of 27 sampling units. Herpetofaunal populations were sampled through three 6-week seasons (spring, summer, and autumn, 1993). A total of 131 animals including 17 species (10 amphibian and seven reptilian) were collected. More than twice as many animals were collected in clearcuts ($n = 58$) compared to mature stands ($n = 25$). Kolmogorov-Smirnov 2-sample t -tests indicate that clearcuts had significantly ($P < 0.05$) more herpetofauna than mature stands, but no statistically significant differences in herpetofaunal abundances were discovered between clearcuts and pole stands. Shannon-Wiener and Brillouin diversity indices were higher for clearcuts than for pole stands or mature stands though not significantly different. The higher abundances and diversities in recent clearcuts may be attributable to the relatively small size of the clearcuts and the ability of herpetofauna to effectively forage in these areas. Additionally, some species captured in clearcuts may have been migrating through these areas on their way to breeding or overwintering sites.

136

MAGLIA, ANNE and R.A. PYLES. East Tennessee State University--Feeding ecology of *Plethodon cinereus*: prey utilization and feeding modulation.

Investigation of diets among size/age classes in *Plethodon cinereus* shows that even large adults ingest

a significant amount of small-sized (<1.0 mm) prey. Stomach contents were obtained by flushing stomachs of anesthetized specimens (N = 289; SVL range 15.1--51.4 mm); prey items were identified and measured using an ocular micrometer. The predominance of small prey in diets of adults refutes the typical assumption that large individuals shift to primarily larger-sized prey. This result concurs with Greene's assertion (1993) that unsupported dogma about diets adds confusion in studies of morphology, community ecology and conservation. Lab tests were conducted to investigate how individuals are able to feed effectively on prey of different sizes. Stop-frame video analyses were completed to determine whether prey size significantly impacts feeding mechanics. Juvenile, subadult, and adult *P. cinereus* were placed on a mirrored platform with a grid (2.5 mm²) background and filmed (30 frames/sec) during capture and ingestion of prey of various sizes. Comparison shows that feeding kinematics can vary significantly with prey size, even for the same individual. Peak gape and tongue protrusion increase during feeding on small prey, when tongue protrusion is utilized. During feeding on medium-sized prey, gape and tongue protrusion are reduced and the approach and strike orientations of the head increase, as a shift to simple inertial feeding occurs. Adults shift between the two feeding modes and can modulate particular aspects (e.g., angle of upper jaw excursion) of capture mechanics for different feeding events. Although peak gape and head dimensions are positively associated with body size, the effect of prey length determines the method of prey capture. The diversity of prey sizes and ability to modulate feeding mechanics strongly suggest that feeding ecology is not a basis for resource partitioning in *P. cinereus*.

137

BUCKLEY, JOSEPH P. and HENRY L. BART, Jr.
Tulane University Museum of Natural
History--Long term changes in the Alabama
River fish community: Separating the
signal from the noise.

For the past 30 years, the Tulane University Museum of Natural History has been the repository for specimens and data obtained in quarterly and bi-annual surveys of fishes in several southeastern rivers. Though much taxonomic work has been accomplished with the specimens, little use has been made of the data. The Alabama River survey was begun in September of 1969 and is ongoing. To date, the material from this survey consists of 359,908 catalogued specimens in 9,407 lots, the result of 847 collections. Recent computerization of the data from the Alabama River survey has allowed this preliminary analysis of changes in the fish community in relation to stream change. Factors confounding the analysis include effects of stream changes on standardization of sampling effort and the time of day the collections were made. Using the Alabama River survey as an example, and with the cooperation of many of those who participated in the collecting, an approach is formulated for using specimen data to investigate changes in stream fish community structure and composition over time.

138

AMESBURY, ELENA and F. F. SNELSON, JR.
University of Central Florida--Spine
replacement in a freshwater population of the
stingray *Dasyatis sabina*.

Dasyatis sabina is a small stingray distributed in coastal habitats from Chesapeake Bay to Campeche, Mexico. It is broadly euryhaline and individuals often stray into fresh water. The only well-known population to reside permanently in fresh water occurs in the St. John's River, Florida. We studied the pattern of caudal spine replacement in this population to see if it differed from previous reports for a marine population. Monthly samples totaling 181 adults were taken from Lake Monroe near Sanford from November, 1990 to May, 1992. Spine replacement began in May with the appearance of a primordial bud. A calcified replacement spine was present in 45 percent of June specimens and in 95 percent of July and August specimens. Replacement spines were present in only 20 percent of specimens taken in September and October, indicating that replacement was completed in most individuals by late summer or fall. Replacement spines grew rapidly from an average length of 6 mm in June to 28 mm in August. The primary spine exfoliated when the replacement spine reached about 50-60 percent of its definitive length. The replacement spine reached its definitive length, averaging 60-65 mm, by the early winter. Definitive spine length was strongly correlated with body size. In all cases the replacement spine originated posterior to the primary spine. Spine replacement and growth patterns in this population are similar to those in the population from the eastern Gulf of Mexico.

139

ETNIER, DAVID A. and HERBERT T.
BOSCHUNG. University of
Tennessee, and University of
Alabama--What name(s) should be
applied to stonerollers
(Cyprinidae, *Campostoma*) from
eastern and central North America?

In their description of *Campostoma pauciradii* in 1983, Burr and Cashner stated that "a form related to the largescale stoneroller, *C. oligolepis* Hubbs and Greene, inhabits the upper Green, Cumberland, lower Tennessee, and Escambia river systems and the Mobile Basin". Since then there has been considerable confusion over what name or names should be used for stonerollers from much of eastern North America. We analyze geographical variation in nuptial tubercle pattern, anal fin pigmentation of nuptial males, and several scale counts from stonerollers from this region in an effort to determine more precisely the geographical limits of *Campostoma a. anomalum* (type locality Licking River, Ohio River drainage, KY) and *C. oligolepis* (type locality Wisconsin River drainage, central WI).

140

FARR, MARK D. Northeast Louisiana University--Reproductive life history of *Cyprinella camura*, the bluntface shiner, in southwest Mississippi.

A lack of life history information concerning southern populations of *Cyprinella camura* prompted an investigation into the reproductive biology of this species. Once or twice a month, from February to November 1991, bluntface shiners were collected in Morganfork Creek, a second order stream in the Homochitto River drainage, Franklin County, Mississippi. Examinations of mean oocyte diameter (OD), female mean relative gonadal mass (RGM), ovarian condition and male secondary sexual characteristics indicated that bluntface shiners spawned from early April through mid-August. Mean oocyte diameter and RGM increased and decreased along with both temperature and daylength. Clutch sizes in females 36.4-55.6 mm SL ranged from 76-363 ($\bar{x}=168.3$, $SD=\pm 57.8$), and individual mean mature oocyte diameters ranged from 0.94-1.19 mm ($\bar{x}=1.08$ mm, $SD=\pm 0.06$). Relative gonadal masses of mature females ranged from 7.6-23.8% ($\bar{x}=14.5\%$, $SD=\pm 3.3\%$). These findings are similar to those reported for *Cyprinella venusta* in Mississippi. However, due to the low number of comparable datasets from other studies, few direct comparisons of data from other populations and species are possible.

141

HUGHES, MARK H., University of Tennessee--The spatial and temporal distribution of fishes within the Holston River system.

Anthropogenic changes have led to the degradation of the aquatic environment in North America. This study considered as a unit the Holston River system, a headwater tributary of the Tennessee River drainage in North Carolina, Tennessee, and Virginia. The objective of this investigation was to gather chronobiological information, describing the occurrence of fishes within the Holston River system both spatially and temporally. The distributional information of fishes was compiled and was used to determine the "status" of the Holston River system. Records of catalogued specimens of fishes housed in museums, as well as reports and field notes of ichthyologists were used as a data base for this investigation. This study is in effect a history of the ichthyology of the Holston River system.

142

MACHADO, MATTHEW D., DAVID C. HEINS, and HENRY L. BART. Tulane University--Analysis of streamflow variables and their relationship to runoff in a Gulf Coast river system.

In the southern United States, there is a strong, positive correlation between egg size of the blacktail shiner, *Cyprinella venusta*, and the discharge parameter mean annual runoff (MAR), which was hypothesized as having resulted from selection for larger egg size due to greater streamflow variation or a greater number of floods in streams with higher runoff (Heins and Baker, 1987). To study the relationship of MAR to environmental fluctuation, the temporal patterns of streamflow and flow-mediated disturbance regimes were compared for streams with different MAR from the Pascagoula Drainage, Mississippi, using average daily discharge data from the USGS. Measures of predictability (Colwell, 1974) were calculated for three aspects of streamflow: monthly average flow, monthly low flow and monthly high flow. Monthly coefficients of variation in daily discharge and the monthly number of extremely high and extremely low flows were determined as measures of variation and disturbance, respectively. Statistical analysis showed that variation in most of the predictability, variability and disturbance measures was strongly associated with stream size; however, increased flows in the winter and spring and more floods in the late summer were strongly associated with increased runoff. Our results suggest that streams with higher runoff in the Pascagoula Drainage represent a more harsh environment due to late summer floods and high flows in the winter and spring.

143

MAURAKIS, EUGENE G., WILLIAM S. WOOLCOTT, and WILLIAM R. MCGUIRE. Saint Paul's College, University of Richmond, and Saint Christopher's School--Nocturnal Reproductive Behaviors in *Semotilus atromaculatus*.

Nocturnal behaviors in *Semotilus atromaculatus* were recorded from above the surface of the water with a television camera operated at a light gain of 18 decibels in 1991 and 1993. Illumination was provided by two incandescent lights (1×10^5 candlepower each) in 1991, and two halogen lights (1×10^6 candlepower each) equipped with rheostats in 1993. Four reproductive activities were analyzed: breeding male in pit position, nest-building, agonistic displays/combat, and spawning. Each activity was expressed as a percent of time of all activities. The percent of each nocturnal reproductive activity was comparable to its corresponding diurnal activity. Night videotaping techniques, significance of other sensory systems that may be involved

in reproductive behaviors, and breeding colors in male *S. atromaculatus* are discussed. The study was funded in part by Richard and Carolyn Gwathmey Memorial Trust, University of Richmond, and Saint Paul's College.

144

BLOODWORTH, BENJAMIN R., WADE B. WORTHEN, and M. BRY HOBBS. Furman University--The effects of predation and microclimate on mycophagous flies: variation among habitats.

Mushrooms are used as a larval food resource by flies from several families. Previous research showed that both predation by ants and soil moisture (microclimate) affect larval survival. In this experiment, we examined the consistency of these effects across habitats. Mushrooms were placed on dry, moist, or wet soil in ant-access and ant-exclusion treatment cups. Eighteen cups were placed in each of 6 sites (four dry ridge, two moist ravine) for 7 days, each week for eight weeks during the summer of 1993. The mushrooms were collected and the number of fly metamorphs that emerged were analyzed (ANOVA). Predation and soil moisture had significant direct and interactive effects on fly abundance. However, these effects varied between habitats. On dry ridges, flies were generally rare and predation had no effect. Soil moisture was important, however; with only the wet treatments producing flies. In ravines, abundances were higher and predation had a dramatic effect, reducing metamorph abundance by 50-75%. Soil moisture was less important. Flies emerged from all treatments, with the greatest number of metamorphs emerging from moist soils. This experiment clearly demonstrates that predation and microclimate are influenced by climatic variability at larger spatial scales.

145

WILLIAMS RAY S. and DAVID E. LINCOLN. University of South Carolina--Effects of White Oak grown under elevated carbon dioxide on Gypsy Moth fecundity and developmental rate.

Foliage of White Oak seedlings, *Quercus alba*, in their fourth season grown under either ambient or one of two elevated levels of CO₂, were fed to larvae of the Gypsy Moth, *Lymantria dispar*, from first instar through pupation. Mean developmental rates, pupal dry

weights, larval growth rates, and gross consumption of leaf material were determined from 10 colonies per CO₂ treatment. We hypothesized that insects feeding on elevated CO₂ grown leaves would have a comparably poorer food source and thus respond with potentially lower fecundity, longer developmental rates and greater consumption. In spite of slightly lower female pupal weights for insects feeding on elevated CO₂ grown plants, there were no significant differences among the treatments. The mean time to pupation was very similar across all treatments for both males and females. Larval growth rates remained similar while gross consumption by the larvae was unaffected by treatment. This study suggests that this plant/insect interaction, involving an important hardwood tree species and a major herbivorous pest, may not be altered under future elevated atmospheric CO₂ concentrations.

146

BRANDT, LAURA A., LEONARD G. PEARLSTINE, CRAIG R. ALLEN, and WILEY M. KITCHENS. Florida Cooperative Fish and Wildlife Research Unit and University of Florida--The Florida Biological Diversity Project: An Evaluation of Biological Diversity in Florida.

The loss of biological diversity is one of today's critical ecological issues. In 1989 the United States Fish and Wildlife Service initiated a program called Gap Analysis to address the issue of National Biodiversity. The approach involves mapping vegetation, delineating species distributions and protected areas, and analyzing the resulting maps for areas of high species richness that are not within protected areas. The Florida Biological Diversity Project, a part of this national effort, is also attempting to make the resulting products useful for resource managers at state, regional, and local levels. Our approach is to map the state's vegetation at 30 m resolution using satellite imagery, existing land use/land cover data, wetlands maps from the National Wetlands Inventory, and soils information. Potential habitats for vertebrates and selected invertebrates will be mapped. Historic data and consultation with experts will be used to model species habitat relationships for all species. These models along with the map delineating protected areas will be used to examine the distribution and protection of biological diversity in Florida.

147

STOLEN, ERIC D. University of Central Florida--Movements of Black Vultures between communal roosts in central Florida

One hindrance to understanding the use of nocturnal communal roosts by the Black Vulture (*Coragyps atratus*) is a lack of data on the movements of the birds between roosts. Patterns of roost-use by Black Vultures have been studied for over three years in central Florida. Four-hundred-fifteen Black Vultures were fitted with patagial wing tags between May 1990 and April 1992 at two communal roosts in Orange County, Florida. Over 1200 resightings have been recorded since January 1991 at 19 communal roosts in central Florida. One-hundred-ninety-one birds were resighted at least once. Three different patterns of roost-use can be recognized based on distance between observations. There were no significant differences between the use of roosts by adults and juveniles among 218 birds whose ages were recorded at the time of tagging. Over 50 of the tagged Black Vultures have been sighted at roosts at least 40 miles from where they were tagged. Of these 12 birds were later seen back at one of the study site roosts. One of these birds was observed at a roost 98 miles from the study site.

148

BREWER, GWENDA L. Frostburg State University--Use of five species of fruiting trees by birds and mammals at Tikal, Guatemala

The increasing use of tropical forest and its subsequent degradation continue to threaten biodiversity in these unique habitats. To assess the impacts of human activities and to plan for sustainable use, information on the use of forests by tropical species is necessary. In this study, feeding activity was observed at five species of fruiting trees to begin to assess potential impacts of harvesting these trees or their products. Over 35 hours of observations were made July 20-31, 1993 in Tikal National Park, Guatemala. During early morning and late afternoon periods, species, length of feeding bouts, and group sizes were noted at bread nut, pacaya palm, allspice, cecropia, and strangler fig. A total of 18 species of birds and 2 species of mammals were observed feeding on the fruits of these trees at several study sites. Strangler fig attracted the greatest diversity of species (n=12), including spider monkey, crested guan, toucans, and smaller birds. Cecropia fruits also attracted a diverse group of species (n=10), including tanagers, toucans, woodpeckers, and blackbirds. Eight species fed on bread nuts, and pacaya palm and allspice were each utilized by 3 species. Keel-billed toucans, crested guan, and collared acaris used most of the 5 species, while brown-hooded parrots fed inten-

sively on allspice fruits. Individuals spent most time overall in bread nut and strangler fig, but feeding bouts were longest in allspice trees.

149

BERGEN, SCOTT and HILARY SWAIN. Florida Institute of Technology--Conservation of habitat fragments; the role of historical fragment distribution

The topic of habitat fragmentation has been interpreted widely within the context of species area relationships and the theory of island biogeography. Analysis of habitat fragmentation in light of these theories offers a limited view from which to base management strategies. Although factors such as the degree or temporal length of isolation and fragment area has been shown to predict species numbers. The historical context within which fragmentation occurs has not been considered in previous studies of fragmentation. This study will characterize the historical changes that have occurred in scrub habitats in Brevard County, Florida, which are naturally and anthropogenically fragmented. This presentation will discuss the implications of changes in total area, mean fragment size, nearest neighbor distances and spatial distribution of scrub habitats for conservation biology and reserve design.

150

ZOLLNER, PATRICK.,¹ SMITH WINSTON,² and BRENNAN LEONARD.¹ Mississippi State University.¹SouthernHardwoods Lab, U.S.D.A. Forest Service.² USE OF LATRINE SITES BY SWAMP RABBITS (*SYLVILAGUS AQUATICUS*):MULTIVARIATE MODELS AND HYPOTHESES.

Three hardwood forest habitats in central Arkansas were surveyed for swamp rabbit (*Sylvilagus aquaticus*) latrines. Swamp rabbits deposited 91% of their fecal pellets on logs. Length, height, diameter, decay class, and percent moss coverage of logs where latrines were found and of an equal number of randomly-selected logs that showed no evidence of use were recorded. Logistic regression was used to develop equations that predicted likelihood of a log being used as a latrine site based on these characteristics. Increasing decay class, percent moss coverage, and diameter were correlated with log use as a latrine in all models. Next an experiment was conducted to test the hypothesis that swamp rabbit (*S. aquaticus*) deposition of fecal pellets on logs was related to improved vigilance. Contrary to expectation, in three of four monthly surveys number of pellet groups deposited inside portions of logs treated with visual+physical obstructions was not significantly different from the number of pellet groups deposited inside portions of logs that were treated with physical obstructions. Finally, it is proposed that log latrines may serve as territorial markers. Clumped

spatial distribution of latrines and increased use during peak breeding season provide equivocal support for this alternative hypothesis.

151

AUDO, MICHELE C. and WALTER J. DIEHL. Mississippi State University--Effect of environmental stress on the multiple locus heterozygosity-growth rate relationship in the earthworm (*Eisenia fetida*).

Multilocus heterozygosity (MLH), the number of heterozygous loci out of a set of polymorphic loci, has been correlated with growth in many species of plants and animals. Correlations between MLH and growth were tested on a population of juvenile earthworms (*Eisenia fetida*) subjected to environmental stresses: low temperature, and moderate and low soil moisture. Controls were subjected to optimal temperature and moisture. Weights were measured weekly for 4 weeks, and 8 polymorphic enzyme loci were examined by starch gel electrophoresis and used to compute MLH. The MLH-growth curve grew stronger the longer the stress was sustained through the experimental stress period in the moderate moisture treatment. This produced stronger MLH-growth relationships than more severe moisture stress. Even though low moisture and low temperature depressed growth to the same extent, the former produced MLH-growth relationships whereas the latter did not. Thus both environmental quantity and quality dictate the degree of advantage associated with heterozygosity. Supported by Sigma Xi Grant in Aid of Research to MCA and NSF grant DEB-9221094 to WJD.

152

BAILEY, RONALD R. and BRIAN C. MCCARTHY. Frostburg State University and Ohio University--Litter macroinvertebrate diversity in the managed forest landscape of western Maryland.

The hardwood forest landscape of the central Appalachians represents a mosaic of even-aged patches in varying stages of development after clearcutting. This study will provide an important link between studies done previously in the northern and southern Appalachians. Pitfall trapping was used to determine the effects of forest development stage on litter macroinvertebrate diversity. Twelve stands, in four discrete development stages (clearcut, pole, mature, and overmature), were studied in the Savage River State Forest (Garrett Co.). In each stand, pitfall traps were placed in two previously established 25 x 50 m permanent plots. Sampling was done in two microsites--under a log and in the open forest floor. Samples were collected in May, June, July, and August of 1992 and all specimens were identified to the lowest possible operational taxonomic unit (OTU). Brillouin's diversity index (HB) was used to determine all relevant diversity indices. Stand development stage was found to have a highly significant effect on Brillouin's diversity (ANOVA $P < 0.0001$). Clearcuts had the greatest average diversity (HB = 4.07) relative to pole (HB = 3.80), mature (HB = 3.36), and overmature (HB = 3.59) stands. However, each of the development stages did have its own set of unique fauna, suggesting that all of the stages are important in the forested landscape. The effect of microsite, while exhibiting a strong trend, did not have a significant effect on overall diversity patterns (ANOVA $P < 0.0648$). This trend may be intensified through forest management practices by increasing the structural heterogeneity of the forest ecosystem (i.e., coarse woody debris).

153

TARTER, DONALD C.¹ and DIANE R. NELSON². Marshall University¹ and East Tennessee State University²--Preliminary list of tardigrades (Phylum: Tardigrada) from mosses and liverworts in the Monongahela National Forest, West Virginia.

The Monongahela National Forest (MNF) stretches over 830,000 acres of the Allegheny Mountain Range. Mosses and liverworts were collected on the ground, rocks, and trees from the following areas between 1988-1993: Seneca Rocks (2400'), a 1,000-foot quartzite formation, (2) Dolly Sods (4000'), a tundralike region that forms the eastern section of the Allegheny Plateau, (3) Spruce Mountain (2800'-4800'), a region of wind-blown red spruce and rock outcrops, and (4) Cranberry Glades (3400'), a land covered with a bog, bog forest and shrubs. Twenty-four species of tardigrades, including one new species, representing ten genera (*Diphascos*, *Hyechiniscus*, *Hypsibius*, *Isohypsibius*, *Itaquascos*, *Macrobiotus*, *Milnesium*, *Minibiotus*, *Pseudechiniscus*, *Ramazottius*), were identified from the MNF. The most common species were *Hypsibius convergens* (Urbanowicz), *Macrobiotus hufelandi* Schultz, *M. richtersi* Murray, *Milnesium tardigradum* Doyere, *Minibiotus intermedius* (Plate), and *Ramazottius oberhaeuseri* (Doyere). Five species (*Hyechiniscus gladiator*, *Pseudechiniscus sullius*, *Macrobiotus occidentalis*, *Hypsibius maculatus*, *Diphascos scotium*) were found only at the low altitude of 2800 feet. *Hypsibius oberhaeuseri* and *D. prorsirostre* were collected only at the highest altitude of 4800 feet.

154

MULLINS, LEE A. and DONALD C. TARTER, Marshall University--Density dependent cannibalism in naiadal dragonflies involved in fish exclusion experiments and the impact of fish predation in their abundance and species composition.

The hypothesis that two species of dragonflies, *Erythemis simplicicollis* and *Pachydiplax longipennis* differ in vulnerability to predation from bluegill (*Lepomis macrochirus*) was tested. Predators and prey were collected from Tom's Pond and Green Bottom Swamp, both areas are contained within the Green Bottom Wildlife Management Area, Cabell County, West Virginia. *E. simplicicollis* and *P. longipennis* coexist together to be the most abundant naiadal dragonflies in the Green Bottom Wildlife Management Area. In laboratory experiments with bluegill as predators, *E. simplicicollis* naiads were more vulnerable to predation than *P. longipennis*. Combining the data from five trials, 11 out of 25 *E. simplicicollis* survived compared to the 10 *P. longipennis* that survived. This proved to be significant, $p=0.021$ at the 0.05 confidence level. In trials involving only one species of dragonfly at a time, there was a 40 percent survival for both species. In fishless trials involving intraspecific competition, it was

illustrated that dragonflies exhibit cannibalism. The mechanism of competition seems to be predation by larger naiads on smaller naiads. No evidence of either exploitation or interference competition was found in the interspecific competition trials (100% survival), due to the naiads being of the same size class or instar.

155

DOBSON, WILLIAM E. and STEPHEN E. STANCYK. Appalachian State University and University of South Carolina -- Use of ophiuroid vertebral ossicle growth bands as biological markers for population age and sublethal predation studies.

Growth bands have been found in the vertebral arm ossicles of many brittlestars. Although the periodicity of these bands is not known, they are thought to be age related. Experiments were carried out to determine whether these bands could be used as biological markers in population growth and partial predation studies. Individual brittlestars incubated for 24 h in 500 ppm calcium in natural seawater incorporated a fluorescent mark onto the surface of their vertebral arm ossicles. The position of the fluorescent mark relative to subsequently deposited growth rings can be used to verify band number to age relationships. Microscopic observation of growth rings in partially predated arms indicate that the number of rings on ossicles in the regenerated portion was invariably smaller than on the nonregenerated ossicles. If the periodicity of growth bands can be quantified, growth band analysis can provide a method of quantifying the frequency of arm cropping and regeneration rate, especially when predation scars are not readily visible.

156

GAIL E. STRATTON. Albion College-- Evolution of courtship behavior and acoustic communication in *Schizocosa* wolf spiders: a comparison of 12 species found in the southeastern United States.

Courtship behavior and acoustic communication have been recorded for 12 of the 24 species in the wolf spider genus *Schizocosa* including 6 species in the *S. ocreata* species group (*S. ocreata*, *S. crassipes*, *S. rovneri*, *S. floridana*, *S. stridulans*, *Schizocosa* sp. nov.), 3 species in the *S. saltatrix* species group (*S. duplex*, *S. saltatrix*, and *Schizocosa* sp. nov.), and in three more distantly related species (*S. retrorsa*, *S. mccoiki*, and *S. avida*). Males of all members of the genus have a stridulatory organ located on the palpus. All members of the *S. ocreata* species group make some of the sounds by stridulating; *S. floridana* also makes a sound by bobbing the abdomen. In the *S. saltatrix* group, sounds are produced by a combination of stridulation (in *S. saltatrix* and *S. duplex*) and by unknown mechanisms (*Schizocosa* sp. nov.). There is a correlation between species that

have conspicuous secondary sexual characteristics in the form of bristles or dark pigment on the first pair of legs, and conspicuous movements of the legs during courtship. A preliminary phylogeny of the genus is presented.

157

EILEEN A. HEBETS AND GAIL E. STRATTON. Albion College-- Habitat and courtship behavior of the wolf spider *Schizocosa retrorsa* (Araneae: Lycosidae).

The habitat and courtship behavior of the wolf spider *Schizocosa retrorsa* (Banks) are described here for the first time. The range of this spider is the eastern United States; this study extends the range of *S. retrorsa* to include lower Michigan. This species is a cursorial ground dwelling spider; it was found to be locally abundant in northern Mississippi, particularly in highly disturbed and exposed habitats. This study focused on these populations. Specimens were collected on sand, in lichens or on pine needles in open pine woods or in "borrow pits". The courtship of *S. retrorsa* was studied by videotaping 23 pairs of spiders. Of these, 7 pairs copulated. In 5 out of the 23 pairings the females attacked and sometimes killed the male. Several behaviors are unique to *S. retrorsa*: male courtship consisted of a "push-up" behavior and an extended leg wave, each of which produced audible sounds. These displays were shown intermittently throughout the male's palpal drumming display. Female courtship behavior consisted of a slow, seemingly "deliberate" approach and orientation towards the male. Females also displayed double leg lifts which were not unique to this species.

158

STINSON, C. MICHAEL. University of Louisville-- Evidence from the humeral fossa for major songbird radiations and classifications.

I examined the condition of the pneumatic fossa in humeri from numerous genera of oscine passerines (songbirds) in order to test the claim that the distribution of the states of this character is highly correlated with a classification of the birds based on DNA-DNA hybridization. The humeral fossa evidence has been cited as support for a division of the songbirds into two major groups, one of which radiated in Australia much as did the marsupial mammals. After scoring the states, I compared their distribution to the groups in the Sibley-Ahlquist-Monroe (SAM) classification, which is based on DNA-DNA hybridization, as well as to those of two other major classifications. The

distribution was found to correspond more closely to the SAM sequence than to the others, though there are major exceptions. The utility of this character in studies of avian systematics has previously been limited by oversimplified definitions of its states.

159

SHULL, J. KENNETH AND JEFFREY A. BUTTS. APPALACHIAN STATE UNIVERSITY. Teaching the Scientific Method of Investigation in the Laboratory.

Students are usually taught the scientific method of investigation in lecture by listing the parts of the scientific method and, maybe, receiving an example of how it is used. Because the scientific method includes revising a hypothesis and testing the new hypothesis when the first hypothesis is incorrect, it is sometimes difficult to demonstrate the method in a short laboratory period. In this laboratory exercise each of these experiments can be completed, the data analyzed and a new experiment planned, in 15-20 minutes. Students are given the 6-carbon sugar fructose, which is also a ketose, the 5-carbon sugar ribose, which is an aldose, and a suspension of yeast. They mix the yeast and one of the sugars in a fermentation tube or similar device, and the yeast and the other sugar in another fermentation tube. They observe that a gas (CO_2) is evolved in the yeast-fructose suspension, while it is not in the yeast-ribose suspension. They are given the structural formulae for the two sugars and asked to write a hypothesis to explain what the enzymes of the yeast are recognizing in one of the sugars, but not the other. They are provided with six other sugars, arabinose (5C), galactose (6C), glucose (6C), sorbose (6C), and xylose (5C). They choose two of these to test their hypothesis and repeat the experiment. If their hypothesis is incorrect, they revise their hypothesis and retest; if their hypothesis is correct, they choose two more sugars and repeat the experiment to verify their hypothesis. This is done until all eight sugars have been tested. At the end of the tests, they are left with four equally-likely hypotheses and are asked to design an experiment that would distinguish between the four. The time to complete the entire laboratory is about 2 hours and 40 minutes.

160

CONES, HAROLD N. Christopher Newnort University--Shortwave radio in environmental science education.

It is difficult for students to understand trans-national environmental problems when they often understand little about what lies just over the horizon. A shortwave listening exercise was devised to enhance geography and world event literacy among college students taking environmental science. The exercise introduces students to an alternative way of obtaining information that is generally unknown and unused in this country and results in a broadened general knowledge base that

facilitates understanding world political and environmental problems. Student feedback enthusiastically testifies to the relevance and value of this unusual and innovative exercise.

161

NELSON, DIANE R. and SUSAN B. COOK. East Tennessee State University and Harbor Branch Oceanographic Institution--Marine biodiversity of the Indian River Lagoon, Florida.

The Indian River Lagoon is located in a transition zone between the warm temperate biogeographic zone to the north and the subtropics to the south. With more than 4315 species of plants and animals in the region, the Lagoon is the highest diversity estuary in the continental United States. During a course on "Subtropical Marine Environments" taught through the Harbor Branch Oceanographic Institution, June 1993, marine invertebrates were collected from a variety of environments, including seagrass beds, mangroves, open beaches, mudflats, oyster bars, rock jetties, and sabellarid worm reefs. Students in the class learned to observe, collect, and identify marine invertebrates and to associate them with these habitats. The course will be offered again in June 1994, with an extension to the Florida Keys to examine high latitude coral reef communities.

162

SWAB, JANICE COFFEY. Meredith College--Biology Seminar: African Environments: Past, Present, and Future.

A one-semester biology junior-senior seminar provided an opportunity for the author to share experiences from Fulbright teaching experiences in Africa. Slides, videos, tapes, charts, maps, short projects, and weekly reading/writing assignments were used to focus the students' learning. They came away with an understanding of this continent that can be generally applied to the study of other world regions. During the weekly one-hour seminar the students and the instructor shared their findings on the assigned topic under consideration. Although the large number of students (38) prevented the in-depth sharing that one prefers from seminars, the likelihood of several students finding the same information spurred some to seek out lesser-known sources and to come up with more creative ways to deal with the topic under consideration. Experience gained from teaching this seminar can be applied to planning future ones. Examples of seminar activities will be shared in the presentation.

163

THOMAS, CAROLYN L. and BOB R. POHLAD. Ferrum College--Less can be more: Ferrum College's Science 2000 Program.

Ferrum College's Science 2000 Program uses innovative topics and pedagogy to provide an alternative to traditional Biology, Chemistry, and Physical Science survey courses. For non-science majors, the general education science requirement represents the capstone of a student's science education, not a comprehensive introduction to a scientific discipline. As a result of this realization, in 1990 the Ferrum College science faculty developed an approach to preparing students to be scientifically literate citizens in the next century. Unlike other attempts at developing non-majors biology classes, the Science 2000 courses are not watered-down versions of standard introductory courses. Each course is a half semester (seven weeks) in length and focuses on one or two topics which are of immediate and direct interest to students, such as extinction, biotechnology, global climate change, healthy houseplants, and the diseased human body. Rather than starting with the theory and then trying to apply it, these classes start with specific problems and then work to develop the information needed to address the problems. Finally some generalizations (the theory) about the subject and the process are drawn. Fundamentally we are attempting to teach students how to deal independently with scientific issues which will confront them as active, concerned citizens.

164

MILLS, EDWARD and JAMES W. HALL. Wingate College--An anti-pollution device to counter acid rain production - an exercise for the biology laboratory.

A quick and inexpensive exercise for general biology, environmental/earth science classes that demonstrates anti-pollution devices to counter acid rain can easily be constructed. Bituminous coal burned in ignition tubes produces gases that can be bubbled through a model of the current wet scrubber technology. Then, smokestacks (glass tube) from coal-burning plants (ignition tube) may release gases into the atmosphere. Some wet scrubbers can remove up to 95% of the sulfur oxides, but may fail to remove nitrogen oxides. Students determine pH by standard titration with sodium hydroxide, and measure sulfate by reaction with barium chloride. This procedure uses distilled water in the

scrubber design, and may be adapted for use with various seed germination and plant growth experiments to test the effects of scrubbers and coal-generated "acid rain".

165

HEAFNER, KERRY D., and GARY L. WALKER. Appalachian State University--The population biology of *Pellaea wrightiana* Hooker (Adiantaceae), a disjunct fern in North Carolina.

Since A.E. Radford's 1956 discovery of *Pellaea wrightiana* Hooker in Alexander County, North Carolina, a second population has been discovered in Stanly County, approximately 200 miles south of the other site. Both populations occur on dry, granitic outcrops that support plant communities of similar composition. These two populations of *P. wrightiana* are disjuncts of southwestern United States populations. Both long distance dispersal and vicariance events have been proposed as origins of these eastern populations. Allozyme analyses of the two eastern populations are being conducted in an attempt to determine their natural history. Eighteen enzyme loci have been assayed using four buffer systems. Preliminary data indicate that individuals from both populations are monogenic and fixed at all loci. Observed allozyme banding patterns are consistent with those previously reported for fertile tetraploid pteridophytes.

166

McGUIRE, ROBERT F. and DAVINDERJIT K. BAGGA. University of Montevallo--Morphology and Movements of *Oscillatoria tenuis*.

Oscillatoria tenuis (Cyanobacteria) consists of unbranched trichomes and a very thin sheath. The purpose of this investigation was to identify and describe the morphology and movements of *O. tenuis*. *Oscillatoria* trichomes reproduce by fragmentation (hormogonia) while individual cells reproduce by fission (amitosis). The presence of gas vacuoles may be demonstrated by hammering a cork into the top of the culture vial and observing two hours later the sinking of the trichomes to the bottom of the culture; in a control culture without the cork, the trichomes will remain floating. The major photosynthetic pigments are chlorophyll a, phycocyanin allophycocyanin, phycoerythrin, and beta carotene, with the stored food reserves of Cyanophyceean starch and polyglucose (a glycogen-like compound). Different types of trichome movements include gliding motions parallel to the long axis with spontaneous reversals, oscillating motions, sudden jerking movements, and coiling and uncoiling. The rate of movement is influenced by temperature, pH,

and medium viscosity. Safranin staining stops all movement and stains cell walls and the sheath while breaking the trichomes at sharp angles. *O. tenuis* may be cultured in Allen's Blue-Green Algal Medium.

167

WINSTEAD, JOE E.,¹ and LYTTON J. MUSSELMAN,² Western Kentucky University¹ and Old Dominion University²--Ecophenic patterns of *Isoetes engelmannii* in a roadside and pond habitat of southcentral Kentucky.

Morphotypes of the quillwort *Isoetes engelmannii* in a fluctuating or variable habitat in regard to water levels show morphology similar to *I. melanopoda*. SEM study of the spores and chromosome counts of living tissue confirm this as a species which shows flexibility of growth and development in response to environmental factors and rejects an earlier hypothesis that hybrid forms (*I. engelmannii* x *I. melanopoda*) have developed in this southcentral Kentucky habitat. Individuals of the two growth forms show chromosome numbers of $2N = 22$. Spore patterns add to the difficulty of precise identification when comparing the two species of this primitive aquatic plant.

168

WEBER, EVERETT P. and FRANK P. DAY. Old Dominion University.--
A minirhizotron analysis of the modified phenology of nitrogen fertilized roots in a barrier island dune ecosystem.

Little work has been done on the phenology of root growth and senescence largely due to methodological difficulties. The application of minirhizotron technology has enabled tracking of individual roots through an entire growing season. As a result, direct measures of turnover, root growth, and senescence are possible. Small plots on a 36 year old dune on Hog Island, a barrier island in the Virginia Coast Reserve Long Term Ecological Research Site, were fertilized with nitrogen. Minirhizotron tubes were installed in each fertilized and control plot. Each tube was sampled monthly for nine months, March through November. Preliminary results showed an increase in root length density (RLD) from March to June with fertilized plots showing a higher RLD than unfertilized plots for both May ($200\text{mm mm}^2 / 110\text{mm mm}^2 = 182\%$ greater) and June ($440\text{mm mm}^2 / 190\text{mm mm}^2 = 232\%$ greater). The rate of root loss decreased from March through June with June root losses at 25% for the unfertilized roots and 37% for the fertilized roots. In addition, new roots contributed most to each sampled months total RLD. Analysis of RLD by depth showed that the fertilized RLD was higher than the unfertilized roots throughout the profile and that both treatments showed a peak in density at 16.5 - 22.1 cm. The minirhizotron method allows a high resolution perspective of the belowground environment and direct monitoring of phenomena which previously were obtainable only through indirect measures.

169

MENGES, ERIC S. Archbold Biological Station--
Importance of open space for plants endemic to Florida scrub.

Many endemic plants of Florida scrub are herbaceous or short-statured woody species that co-exist with the larger woody shrub dominants. Species distributions, abundances, and demographic parameters suggest that they specialize in open habitat patches and often are favored by conditions in the first few years following stand-replacing fires. Many endemics are found in xeric rosemary scrub, which is a relatively favorable environment for small-statured plants that recover populations via seedling establishment after fires. In contrast, most species of scrubby flatwoods resprout and spread clonally following fires. In rosemary scrub, the narrow endemic *Eryngium cuneifolium* shows increasing mortality, growth, and fecundity with time since fire, with mortality highest near shrubs, especially those with putative allelopathic potential. Another endemic of rosemary scrub, *Polygonella basiramia*, is sensitive to open space but not to time since fire per se. A third endemic, *Dicerandra frutescens*, is found in microhabitats with lower litter cover, litter depth, canopy coverage, and woody species dominance than expected by chance. This species occurs in dense oak-hickory scrub, and populations decline rapidly in long-unburned areas, but appear viable in recently-burned or periodically-disturbed areas. The open space necessary for these scrub species can be provided by fire management and other habitat manipulations.

170

PHILLIPS, CHRISTINE V. Archbold Biological Station--
Changes in density of a rosemary scrub endemic plant with time since fire and open space.

Appropriate fire intervals may be the key to maintaining populations of endangered plants in scrub communities. The rosemary phase of sand pine scrub, for example, is dominated by Florida rosemary (*Ceratiola cricoides*), a seeder adapted to fire return intervals of between 15 and 60 years. Little is known, however, about the relationship of time since fire to the abundance of various herbaceous endemics in rosemary scrub. One such species, *Polygonella basiramia*, is listed as endangered by the federal government with a range restricted to the Lake Wales, Winter Haven, and Bombing Range ridges of central peninsular Florida. An obligate seeder, this short-lived perennial herb is killed by fire and must recolonize burned areas either through seeds stored in the soil or dispersed from other populations. Although one would expect *P. basiramia* to peak in

density soon after burning, there was no correlation of density with time post-fire. Instead, plant density was found to be directly proportional to the amount of open sand at a sight ($r=0.81$, $p<0.001$). In addition, *P. basiramia* experienced low densities on certain soil types and in oak-dominated sites. Although fire periodically re-creates the open sand habitat necessary for *P. basiramia* to survive, the degree of openness over time changes according to site-specific conditions of soil, elevation, and species composition.

171

PAULEY¹, E.F., S.C. NODVIN², T.B. COFFEY², A.K. ROSE², and N.S. NICHOLAS³ ¹Savannah River Ecology Laboratory, ²University of Tennessee, and ³Tennessee Valley Authority--Vegetation, biomass, and nitrogen pools of a Great Smoky Mountains watershed

Unlike most plant communities, *Picea rubens-Abies fraseri* forests of the Great Smoky Mountains appear to be saturated with nitrogen (N), much of which is anthropogenic. Also, most *Abies* have been killed by an exotic insect pest, possibly further reducing N uptake. Previous studies of N cycling in Smokies *Picea-Abies* forest have been carried out in small plots. To expand N cycling data to a landscape scale, N input and output have been monitored since 1991 in an unlogged 17.4 ha watershed. This study documents overstory composition, biomass, and standing N pools in that watershed. *Abies*, although once abundant, is now a minor overstory component, consisting mostly of small individuals confined to the highest elevations. *Picea* comprises 77% of live basal area, 48% of live density, and 79% of total live biomass. *Picea* shows no evidence of unusual mortality and appears relatively healthy. *Picea* biomass is high on south-facing slopes but shows sporadic peaks throughout the watershed. *Betula alleghaniensis* biomass is high on low-elevation east-facing slopes near streams. *Picea* contained 71% of the total live overstory N, while *Abies* contained less than 2%. Although *Picea* foliage comprised <6% of total live biomass, 37% of the total N content was in *Picea* needles. The spatial distribution of overstory N corresponded strongly to peaks of *Picea* and/or *Betula*. Overall, some species distributions reflected well-known landscape patterns (e.g., increasing *Abies* importance with elevation), but distributions of other species (e.g., *Picea* and *Betula*) more closely reflected smaller-scale topographic and possibly disturbance-oriented patterns. Spatial variations in biomass and N distributions were large, illustrating the highly patchy structure of the overstory vegetation. Thus, the watershed is large enough to encompass landscape-scale vegetation patterns as well as stand-level patterns, both of which will influence N cycling processes.

172

RAE, JOHN G. Francis Marion University--Demography of the Fragrant Prickly-apple Cactus, an endangered species in decline.

The Fragrant Prickly-apple Cactus, *Cereus eriophorus* var. *fragrans*, is a federally endangered cactus endemic to a relic sand dune in coastal St. Lucie County, Florida. Two populations were monitored for demographic changes from 1987 to 1993 through annual surveys. The dynamics of both popula-

tions were similar. Over the five year period, populations one and two declined by 41.8 and 41.3 % respectively. If that rate were to continue, each population would be extirpated in the year 2000. The mean recruitment rates for populations one and two were 1.3 and 0.6 %/yr. respectively, with no recruitment in three of the years for either population. Mean mortality rates for the populations were 11.3 and 10.1 %/yr. Survivorship, based on estimated seed production and size-at-death data, produced exaggerated Type III curves, indicating high seed mortality. After seedling establishment however, the chance of death did not change with size of plant. One contributing factor to the decline of the species is that scrub oaks have been overgrowing these ecotonal plants. Cacti growing in the shade were found to be less robust, produced far fewer flowers and fruits, and had higher mortality than plants growing in the sun.

173

ROULSTON, T'AI H. and E.E.C.CLEBSCH. University of Tennessee--Pollination and seed production of the Cumberland Rosemary, *Conradina verticillata* Jennison.

The Cumberland Rosemary is a rare, endemic, woody, mint of the Cumberland Plateau of eastern Tennessee and southeastern Kentucky. It grows along swift rivers on sand and gravel bars which are seasonally inundated for several days to weeks at a time. Although seed is produced abundantly, seedlings are rare and reproduction is primarily asexual. Lab tests of wild seeds produced only 2% germination; subsequent tests revealed that only 4% of all collected seeds contained endosperm and a fully-developed embryo. Although the species is self-compatible, insects are necessary for seed formation. Many different groups of insects visit the flowers but the main pollinators appear to be medium to large bees of the genera *Bombus* (both queens and workers), *Anthophora*, *Tetralonia*, and *Apis*. Butterflies, syrphid flies, and halictid bees are common visitors but do not appear to be effective pollinators. Effectiveness was estimated by rate of visitation, behavior on the flowers visited, distribution of *Conradina* pollen on the visitor, and, for some groups, single visit deposition of pollen on virgin stigmas. Seed production does not appear to be limited by pollinator abundance since supplemental hand pollinations did not have a positive effect. Pollen viability and germination on stigmas is high. It is not known what restricts endosperm and embryo development within the maturing seed.

174

Schildt, Amy and James Fralish. Southern Illinois University, Carbondale--A study of presettlement, present and future forest in the Coastal Plain Region of Illinois.

Witness tree data from the 1806-7 original land survey records were

used to reconstruct forest community patterns in the Gulf Coastal Plain region which extends approximately 35 Km into the southern tip of Illinois. Using topographic maps, section and quarter-section corners were classified by aspect and slope position. Species importance values and stand density and basal area were calculated for each site type (ridgetop, high south slope, low south slope, high north slope, low north slope and terrace. *Quercus alba*, *Quercus velutina* and *Carya* spp. were the major species of most upland sites but a low density of mesophytic species occurred on moist north and low sites. Tree data from 0.04 ha plots indicate that *Q. alba* and *Q. velutina* remain the dominant species on many mid to high south slopes; however, in stands where *Quercus* was selectively cut, *Carya* has become the major component. On north and low slopes, *A. saccharum* now dominates the forest overstory. Seedling and sapling density values from 0.05 and 0.025 ha plots, respectively, show that *A. saccharum* strongly dominates the understorey and will be the major component of the compositional stable forest.

herbs e.g., *Cyperus retrorsus* and *Bulbostylis ciliatifolia* appeared more common in cut/burned scrub which may relate to minor soil disturbance. Vines (*Smilax auriculata*, *Vitis rotundifolia*) present along some edges also resprouted rapidly and may require other controls.

176

GILBERT, CARTER R. University of Florida--Biogeographic analysis of the Florida freshwater fish fauna.

The freshwater fish fauna of Florida is impoverished compared with those of adjacent states, comprising only about 175 native species. Of these, ca. 60 have marine affinities and enter fresh water on a regular or occasional basis. Since the fauna is enriched by a number of species limited to the western panhandle, the peninsular fauna is especially poor. Despite this, Florida is unusually rich in numbers of sunfishes (Centrarchidae) and killifishes (Cyprinodontidae) (40 of 71 total eastern North American species), and also demonstrates the same peninsular endemism seen in other animal and plant groups. Peninsular Florida had its origin during the Oligocene epoch, when there was a pronounced drop in world sea levels resulting from isolation of the Antarctic continent and consequent formation of the Antarctic ice cap. Uncertainty has existed regarding timing of sea-level rises leading to isolation of the peninsula, this usually having been attributed to Pleistocene rises in sea level. Evidence is presented to suggest that this isolation instead occurred during the Pliocene epoch, lasted ca. 3 million years, and resulted in subspecific differentiation of such fishes as the largemouth bass and bluegill. It is further speculated that an earlier (early Miocene) rise in sea level may have been responsible for isolation and differentiation of various killifishes, the endemism of which is at a higher (i.e., species) level than for other fish families. Pleistocene changes in sea level, on the other hand, are believed to be responsible for isolation and differentiation of the Lake Eustis pupfish (*Cyprinodon variegatus hubbsi*), which is endemic to lakes of the upper Oklawaha River system. Other aspects of endemism and differentiation in Florida freshwater fishes are also discussed.

175

SCHMALZER, PAUL A. The Bionetics Corporation, NASA, Biomedical Operations and Research Office, John F. Kennedy Space Center--Using mechanical cutting and prescribed burning to restore long unburned oak-saw palmetto scrub.

Oak-saw palmetto scrub in Florida is habitat for the threatened Florida scrub jay (*Aphelocoma coerulescens coerulescens*) and other species of conservation concern. With landscape fragmentation and fire suppression, scrub shrubs can reach size and structure that make reintroduction of fire difficult. Unburned scrub becomes unsuitable as habitat for scrub jays and other scrub organisms. Methods are needed to return fire to unburned scrub. In this paper, I report early data from a project using mechanical cutting followed by prescribed burning to restore unburned scrub. Before treatment vegetation data were recorded from the >0.5 m and <0.5 m height layers on permanent 15 m transects. Stands had not burned for >25 years. Scrub oaks (*Quercus myrtifolia*, *Q. geminata*, *Q. chapmani*), saw palmetto (*Serenoa repens*) and ericaceous shrubs were dominant throughout. Vegetation was dense with cover > 0.5 m exceeding 100% and little or no open space. Shrub height exceeded 2 m. Scrub was cut between August 1992 and February 1993 and then burned. Transects were resampled in August 1993. Shrubs resprouted vigorously. Differences between recovery of cut/burned scrub and burned scrub were subtle. Some

177

ASHTON, RAY E., JR. Water and Air Research, Inc.--The distributional and taxonomic problems of mudpuppies (Proteidae) in the Southeastern United States.

Prior to 1937, all of the currently recognized *Necturus* in the southeastern U.S. were considered as one species. Through 1958, the number of described species grew to five. Electrophoretic and albumin studies have indicated that the most primitive form of the genus is *N. lewisi* from the Neuse and Tar Rivers of North Carolina. At least two new species of the genus are warranted including one from the Black Warrior River drainage of Alabama and

a species from the panhandle of Florida. Additional studies have indicated that striped or spotted post hatchling larvae may prove to be an important indication of taxonomic relationship.

178

COOK, DAVID Florida Game and Fresh Water Fish Commission--A blueprint for conserving Florida's biodiversity.

One of the primary goals of the Florida Game and Fresh Water Fish Commission's Nongame Wildlife Program is "to maintain or restore the richness and natural diversity of Florida's native nongame wildlife." From 1987-89, the program developed a system to rank 668 vertebrate species and subspecies according to biological vulnerability, extent of current knowledge of population status, and management needs. The resultant rankings indicate those taxa that should receive high priority for survey, monitoring, research and management efforts, and together comprise a blueprint to help guide future conservation initiatives. The geographic regions and ecological communities in the state that harbor concentrations of high-ranking taxa are being specifically targeted with long-range conservation plans that include a hierarchy of survey, monitoring, research, and management projects. The first conservation plan developed, which targets 92 taxa in Florida's imperiled coastal communities, is being actively implemented by biologists in the Division of Wildlife, as well as by nongame staff in the Commission's habitat protection and education sections. Statewide surveys for nesting and wintering shorebirds, and efforts to protect and manage important wading bird colonies, are two ongoing initiatives of this Coastal Conservation Plan. Upcoming projects will target coastal-strand and salt-marsh endemic mammals, and estuarine and marine turtles and snakes, among other. For interested biologists, resource managers, and educators outside the Commission, Nongame Wildlife Program funds are available for contracted projects that help implement our blueprint to conserve Florida's biodiversity.

179

DEYRUP, MARK Archbold Biological Station--Jumping geography grasshoppers reveal patterns in Florida uplands. The sandy uplands that are scattered through Florida and other parts of the Southeast usually have specialized biota adapted to fire, drought, and sterile soil. Some of these uplands have been isolated for so long that some of their inhabitants have undergone evolutionary divergence. Certain flightless grasshoppers of the genus *Melanoplus* can beautifully express the isolation of these uplands. Sexual selection appears to act relatively rapidly on these grasshoppers to produce separate species that can be instantly recognized by their remarkably distinctive genitalia. Rapid disappearance and degradation of sandy upland habitats throughout the Southeast requires that we identify areas of endemism as quickly as possible and the genitalia of grasshoppers provide a convenient way to do so.

180

THOMAS, MICHAEL C. Florida State Collection of Arthropods--Biogeography of Florida Cerambycidae (Coleoptera)

Florida has a distinctive but rather depauperate fauna of the family Cerambycidae (Coleoptera). Including old literature records and introduced species, 215 species and subspecies occur in the state. The fauna in the northern two-thirds of the state is predominantly Nearctic, with a few precinctive species characteristic of snadhill and scrub habitats. The fauna of the southern third of the state has a strong Neotropical flavor; its greatest affinities are with the Caribbean fauna. A surprising number of the species in the south appears to be precinctive.

181

MULLER, JAMES W. Florida Natural Areas Inventory--Florida Natural Areas Inventory's role in protecting biodiversity

The Florida Natural Areas Inventory (FNAI), a Natural Heritage Program and member of the Biodiversity Information Network, maintains a dynamic data base on rare/endangered species, natural communities, ecosystems, and managed areas in Florida. Using its data base of more than 20,000 species/natural communities occurrence and 500 managed areas records, FNAI advises the state on acquisition of conservation lands and numerous other activities. FNAI is formulating a statewide land acquisition plan for the Conservation and Recreation Land (CARL) Program by systematically interpreting aerial photographs statewide, conducting regional biological workshops, and using FNAI's and other organizations' data sets. Analyses used and progress on the plan will be discussed.

182

WALSH, STEPHEN J. and GEORGE H. BURGESS. National Biological Survey and Florida Museum of Natural History. -- Ichthyofaunal Zoogeography of the Suwannee River Drainage

The Suwannee River drainage is the second largest watershed emptying into coastal Florida, with most of the approximately 26,000 km² drainage area lying in the northcentral portion of the state. The river originates in the Okefenokee Swamp of Georgia and courses southwesterly to the Gulf of Mexico, draining a large karst area of the Floridan Aquifer. Historically, the river, many of its tributaries, and Okefenokee Swamp drained easterly into the Atlantic Ocean. Totals of 60 freshwater fish species, 5 diadromous species, and 3 non-indigenous species have been recorded from the drainage; at least 14 species of euryhaline marine invaders commonly penetrate into fresh waters. Numerous other marine and brackishwater species occur in the river estuary but rarely ascend upstream beyond the mouth or tidal influence. Two species have extralimital distributions intermittently restricted to drainages northwesterly to the Apalachicola River. Several other species have disjunct populations in southern Atlantic coastal drainages. The Suwannee corridor represents an apparent zone of intergradation of nominal subspecies of five taxa. Based on ichthyofaunal similarities, the Suwannee drainage clusters most closely with the Ochlockonee, Aucilla, and St. Marks rivers to the west and the St. Johns, St. Marys and Satilla rivers to the east. The Suwannee ichthyofauna has greater affinities with Atlantic coastal drainages (Altamaha, Ogeechee, and Savannah) than with Gulf of Mexico drainages (Apalachicola to Lake Pontchartrain).

183

FRANZ, RICHARD Florida Museum of Natural History--Distributinal patterns of Florida cave animals.

The specialized cave biota of Florida includes 27 mollusks and crustaceans and one salamander. They can be grouped into six distinct cave faunas: Econfinia Creek, Apalachicola, Woodville, Ocala, St. Johns River, and Miami. The Ocala Fauna has the largest number of taxa (12), while the Econfinia Creek has the smallest number (2). Each fauna occupies a specific geographic range in Florida, and the range of only one fauna (Apalachicola) extends beyond the state's borders. Faunal relationships and their possibly origins will be discussed in light of new information.

184

HARRIS, LARRY D. University of Florida--Florida's biodiversity crisis: an abusive disregard for ecology and natural selection.

Florida's biodiversity resource is being eroded at all levels of scale ranging from hemispheric phenomena to genetic integrity within species. Major phenomena such as monarch butterfly migration, regional faunal and floral distinctiveness, landscape panoramas, ecosystem processes, community integrity, whole species, and even the genetic constitution of species kept extant by high technology means are all being eroded. The biosphere is being homogenized and Florida is leading the way. A snapshot view of a typical current Florida wildlife community is not all that different from one taken in London or Seattle. Arguably, the single greatest challenge to conservation biologists is to identify, quantify, monitor, and argue for the issue of biodiversity integrity at all levels of scale. This does not mean reverting back to the statics of Clementsian ecology, but only the substitution of sound dynamic ecology for unsound ecoactivism. The Association of Southeastern Biologists has a unique and unchallenged role in this issue.

185

ARRINGTON, RYLAND W. and CLETUS M. SELLERS, JR. James Madison University--Temperature effects upon selected ventilatory parameters of rainbow trout, *Oncorhynchus mykiss*.

Effects of thermal pollution upon aquatic environments are poorly understood. General effects of this type pollution upon higher aquatic organisms include: (1) death resulting from direct effects of heat; (2) internal functional aberrations; (3) death resulting indirectly from effects of heat; (4) disruption of critical life cycle activities such as spawning; (5) inability to compete with more tolerant species. Each fish species has a natural thermal zone in which it can live and reproduce in a normal manner; when the temperature exceeds the upper limit of this zone, its resistance to adverse conditions is reduced. The primary effect of temperature increase on gas exchange in fish is to alter amount of oxygen required. It has been determined that resting oxygen consumption increases linearly with temperature, while oxygen consumption of an active fish reaches a peak and subsequently declines. It has been noted that with salmonids in the summer, hemoglobin level and erythrocyte surface area increase, in order to meet increased oxygen requirements. In this study, effects of temperature on three ventilatory parameters (ventilatory rate, ventilatory volume, percent oxygen utilization) of rainbow trout, *Oncorhynchus mykiss*, were monitored to determine how additional oxygen is obtained.

186

HOGAN, G. RICHARD. Saint Cloud State University--Comparative spatial and temporal tissue distribution patterns of four selenium compounds in mice.

Female mice received a single IP injection (5 mg/kg) of sodium selenate (SA), sodium

selenite (SI), selenomethionine (SM) and selenocystine (SC). At regular intervals through 24 hours post-injection, animals were sacrificed and seven tissues were excised and analyzed fluorometrically for their selenium concentration (ppm/g tissue). The organic forms are compared to the inorganic species relative to their concentration maxima determined at the different sampling intervals. Of the selenium compounds tested, SM showed the greatest tissue accumulation, followed by SA, SC, and SI, respectively. In some tissues, a second concentration peak was observed, e.g., brain, lung, and heart. Postulates are made to account for the differential selenium accumulation rate and extent.

187

Ingram, G. Walter and Frank A. Romano Jacksonville State University, Jacksonville, AL. The effects of salinity and temperature on oxygen consumption of *Nertina usnea* (Röding).

The olive nerite, a common estuarine gastropod, ubiquitous to estuaries, is located from the Carolinas through Central America. Also, it has been reported that the olive nerite can be found in a salinity range from 0‰ to 40‰. The literature on this animal, until recently, is depauperate. This project will provide information on some basic aspects of the animal's physiological ecology. Two fundamental questions were asked. At what salinity is *N. usnea* least osmotically stressed? What is the temperature tolerance range of *N. usnea* from Meaher State Park, AL were collected and acclimated, in the laboratory, to different salinities (0‰ through 39.6‰). Sea water was first made using aged tap water and instant ocean. *N. usnea* experience a very high mortality rate in this water (at 0‰). Spring water, from a local freshwater spring was then used in subsequent tests. The mortality rate was reduced in 0‰ but was still considerably higher than in all other salinities tested. Osmotic stress was estimated by measuring oxygen consumption using a Clark type polarographic oxygen probe and a YSI biological oxygen monitor. All tests had several replicates and mean oxygen consumption was calculated. Initial results suggests that *N. usnea* is least osmotically stressed at 19.8‰, i.e., the mean oxygen consumption was lowest at that salinity, and highest at 39.6‰.

188

ALBER, SEAN M and DAVID MORTON. Frostburg State University --Structural observations of the vascular bundles in the kidney of the common vampire bat, *Desmodus rotundus*, and their functional relevance.

The common vampire bat (*Desmodus rotundus*) is an obligate sanguivore, which normally forages once a day. Within minutes after feeding starts, *Desmodus* excretes a very dilute urine (250-

600 mOsm) Five to seven hours after the cessation of feeding, *Desmodus* produces minimal amounts of very concentrated urine (5000-6000 mOsm). Vascular bundles are one aspect of renal morphology involved in the "insulation" of the inner medulla with respect to the corticopapillary osmotic gradient. In a comparative view, species with a tight inner medullary insulation can concentrate their urine in a relatively short period of time but cannot dilute their urine easily. However, species with a poor inner medullary insulation require a long time to reach maximal urine concentration but can easily produce dilute urine. Vascular bundles in *Desmodus* kidneys were studied using both light and transmission electron microscopy. *Desmodus* has many narrow "simple" bundles composed of only descending and ascending vasa recta and no nephron segments. Vascular bundles originate near the base of the narrow outer stripe and descend through the inner stripe, decreasing in diameter, before breaking up at the outer-inner medullary border. Descending vasa recta contribute to about 60% of the bundle vessels and usually form concentric rings around individual ascending vessels. The intimate juxtaposition between descending and ascending vasa recta is likely to result in passive solute recycling, but comparatively, not enough for a good insulation of the inner medulla. A poor inner medullary insulation in *Desmodus* may be necessary for the rapid transition from the production of a highly concentrated urine to diuresis once feeding has begun.

189

DABYDEEN, SIMON. Frostburg State University. Photosynthetic activity of chloroembryos of two tropical taxa.

The role of chloroplastids in the mature embryos of two tropical plants (*Eugenia malaccensis* L. [Myrtaceae], *Triphasia trifolia* [Burm. f.] P. Wils. [Rutaceae]) was investigated. Extracted chloroembryos of both taxa exhibited CO₂ exchange rates that vary during exposure to light and dark regimes. The difference in CO₂ exchange rates was interpreted as a measure of the rate of photosynthesis. Whole mature fruits of both species exhibited some photosynthetic activity but isolated pericarps of none of the fruits photosynthesized when exposed to light. Thus, the photosynthetic activity of embedded chloroembryos may be ascribed to the uptake and utilization of respired CO₂ facilitated by optically transparent pericarps permitting sufficient insolation. Chlorophyll content and chlorophyll a/b ratios of both chloroembryos vary, and were lower than those found in typical leaf material. There was no correlation between chlorophyll content and rate of photosynthesis. Chloroplastid ultrastructure revealed features typical for photosynthetic organs. Photosynthesis in enclosed organs may be advantageous in that it contributes to the nutrient balance of organs involved, and in the case of chloroembryos might function as a boost for morphogenetic processes during seed germination.

190

BEARD, CHARLES E. and THOMAS M. McINNIS, JR. Clemson University--Nutrition of *Lagenidium callinectes* Couch in relation to a marine existence.

The nutrition of the marine Oomycete *Lagenidium callinectes* Couch (ATCC 48625) is

being investigated in relation to tolerance of marine conditions. Osmotic stress is being studied by substituting other osmotica for NaCl. In this investigation sucrose is tested as an alternative osmoticum. Sucrose has been shown to not be metabolized by this strain of *L. call.*, and was used to adjust water potential. With decreasing water potential, growth, represented by dry weight, also decreases at salinities of greater than 20 ppt NaCl. In growth using the sucrose instead of NaCl, this fungus exhibits the same growth trend, but lower growth than in NaCl at the lower water potentials. The requirements for the ions present in seawater was also tested. Growth with the cations of sodium, potassium, magnesium, and calcium were compared to Instant Ocean brand artificial seawater. None of the cations could substitute for sodium and give detectable growth. NaCl alone had significant growth, but was less than half the growth on Instant Ocean. Instant Ocean gives the maximal growth, matching or exceeding that in collected seawater. When NaCl solutions alone were supplemented with calcium, yield is near that of Instant Ocean. Chlorine has also been found to be a necessary anion and could not be replaced by sulfate, phosphate, or nitrate.

191

THOMAS, TRAVIS S., JIMMY G. WILSON, and SAFAA H. AL-HAMDANI. Jacksonville State University--Effects of root-zone temperature on invertase activity and carbohydrate accumulation of winter and spring wheat.

Winter wheat (*Triticum aestivum* L., Chisholm) and spring wheat (Mexico 82), grown at air and root temperature of 25°C, were exposed for 7 days to root chilling at 5°C. Root chilling influenced significant decrease in invertase activity of the roots and the shoots of both varieties. Both varieties showed significant increase in concentrations of soluble sugars and starch accumulation in the shoots.

192

BOONE, MICHELLE D. and JAMES M. VOSE. Furman University, Coweeta

Hydrologic Laboratory --The carbon balance of differing age classes of *Liriodendron tulipifera* and *Quercus rubra*.

Although reduced tree growth is correlated with increased tree age, mechanisms causing this decrement have not been adequately explained. Carbon balance, the key functional attribute of a tree's production, was studied for two differing age classes of *Liriodendron tulipifera* and *Quercus rubra* at Coweeta Hydrologic Laboratory in western North Carolina during July, 1993. Physiological parameters including leaf structure, percent nitrogen, stomatal conductance, plant

water potential, and transpiration were used to determine if differences existed between age classes and if these differences were correlated to variations in photosynthetic rates. A ratio of tree photosynthesis to tree respiration was established to glean whether carbon balance differed between older and younger trees. Five trees of each age class in each species were used to measure leaf parameters with an LCA-3 open-based infrared gas analyzer (IRGA), LCA-3 Parkinson's leaf chamber, and nitrogen pressure chamber; stem respiration rates were measured with an IRGA and plastic stem respirators. Because physiological data were highly variable, there were few significant differences between age classes. However, trends of reduced rates in older *L. tulipifera* and increased rates in older *Q. rubra* were observed. The ratio of photosynthesis to respiration on a whole tree basis revealed that older trees in both species had a more positive carbon balance.

193

LIANG, DALI and J. M. HERR, JR. University of South Carolina--Use of the four-and-a-half clearing technique in the study of Gymnosperm embryology: *Cunninghamia lanceolata*

Since its introduction in 1971, the four-and-a-half clearing technique has been widely applied to the study of ovule and female gametophyte development in flowering plants as an alternative to the more arduous paraffin section methods. The technique has undergone several modifications to broaden its application to studies of Angiosperm embryology, but to date it has not been successfully applied to embryological features of Gymnosperms. Dark coloration caused by naturally occurring substances and by-products of fixation render the clearing fluid ineffective, and special pretreatment methods used to remove dark substances in Angiosperm ovules have little or no effect on Gymnosperm material. In the technique reported here, paraffin sections of ovules and young seeds of *Cunninghamia lanceolata* 80 to 120 μm thick are cleared in BB-4½ clearing fluid composed of lactic acid, chloral hydrate, phenol, clove oil, xylene, and benzyl benzoate (2:2:2:2:1:1, by weight) and examined with phase contrast optics. Observations of the mature female gametophyte in these cleared preparations are compared with those obtained from sections 10 μm thick, stained with safranin and fast green, and examined with bright-field optics. Although contrast and definition are more pronounced in stained sections than in cleared ones, the difference would not alter one's interpretation of characteristic structural features. The thick, cleared section offers an advantage over the thin, stained one in that many structural entities are contained within a single section rather than being spread through several serial sections. The time required for clearing thick sections is much shorter than that required for making stained preparations.

194

THOMAS, MARY BETH, NANCY C. EDWARDS, THOMAS D. OWENS, AND LAWRENCE S. BARDEN. The University of North Carolina at Charlotte--The role of mesolamella in elongation of the planula larva of *Hydractinia* sp.

Hydrozoan polyps and planulae consist of two epithelia separated by an acellular mesolamella. Since mesolamella resembles vertebrate basal lamina, these organisms are useful systems for examining the role of basal lamina in morphogenesis. The role of mesolamella in morphogenesis of the planula larva of *Hydractinia* was assessed by perturbing synthesis of collagen with the proline analog L-azetidine-2-carboxylic acid (LACA) during embryonic development and examining effects morphometrically and morphologically. LACA was found to 1) perturb synthesis of normal mesolamella, 2) inhibit elongation of the larva, 3) inhibit differentiation of nematocysts, and 4) interfere with production of mucus. Elongation of the planula and cell division during elongation were correlated with formation of the mesolamella. A model for the role of mesolamella in elongation of the planula is presented.

195

ZETTLER, LAWRENCE W. and THOMAS M. McINNIS, JR. Clemson University--The effect of white light on the symbiotic seed germination of an endangered orchid, *Platanthera integrilabia*.

Orchid seed germination occurs in nature when a suitable fungus infects and forms a symbiosis with a receptive embryo. Symbiotic seed germination *in vitro* is known to be markedly affected by the choice of fungal strain, temperature and light. Few studies have addressed the role of light during early germination of orchid seed; however, most recommend continuous darkness for the establishment of a symbiosis. In this study, seeds ($n = 6,601$) of the endangered terrestrial orchid, *Platanthera integrilabia* were exposed to three white light (55.8 $\mu\text{mol m}^{-2}\text{s}^{-1}$) treatments (7 days darkness then 16 hr photoperiod, 7 days with 16 hr photoperiod then darkness, 16 hr photoperiod continuous) and continuous darkness. Each seed treatment was inoculated with one of four symbiotic fungal isolates (*Moniliopsis* sp.), and light exposures immediately followed. Seeds exposed to a 16 hr photoperiod followed by darkness had a significantly higher ($p = 0.05$) percent germination (43.5 %) than the other treatments (continuous darkness = 19.1 %; 7 days darkness then 16 hr photoperiod = 0.4 %; 16 hr continuous photoperiod = 0.2 %), 70 days after fungal inoculation. In addition, seedling development was also enhanced by early light exposure with 3.8 % of seeds developing leaves or leaf primordia compared with 0.9 % for those in continuous darkness, and 0.0 % for the other two treatments. We speculate that light exposure followed by darkness occurs naturally from the time seeds are shed from capsules to their fixation in a substrate, where germination then commences. The apparent beneficial effects of light in this study argues against earlier recommendations to germinate orchids symbiotically in darkness.

- 196 POLLARD, A. JOSEPH and MAHJABEEN S. SIDDIQUI. Furman University--Chemical constituents of the stinging trichomes of *Urtica dioica* and *Cnidoscopus texanus*

The stings of nettles, known to deter feeding by mammalian herbivores, result from chemical irritants injected by specialized trichomes. Literature on the chemical basis of stinging is fragmentary, contradictory, and often methodologically obsolete. We have examined two quite distantly related plants, *Urtica dioica* (Urticaceae) and *Cnidoscopus texanus* (Euphorbiaceae), using high performance liquid chromatography with an electrochemical detector, a UV diode array detector, and an enzyme loaded post-column reactor for acetylcholine. Our findings confirm older results showing that *Urtica* trichomes contain histamine, serotonin and acetylcholine, however, acetylcholine seems to rapidly degrade to choline in dried specimens. *Cnidoscopus* trichomes, on the other hand, contain serotonin and histamine, but not acetylcholine. Other substances may also contribute to the sting in both species.

197

- MCGUIRE, W. R., W. S. WOOLCOTT, and E. G. MAURAKIS. Saint Christopher's School, University of Richmond, and Saint Paul's College--Relations of Neural Structure to Reproductive Epidermal Morphology in Pebble Nest-Building Minnows (Pisces: Cyprinidae).

It has been proposed that the distribution of specialized keratin structures in the epidermis of males of cyprinid pebble nest-building species of *Nocomis* and *Semotilus* is related to reproductive activities of substrate modification, agonistic behavior, and spawning. With the aid of light and scanning electron microscopy nerve fibers have been identified at the base of epidermal keratin tubercles. Their presence at this location stresses the significance of tubercles functioning as tactile sensory structures during the reproductive period. Neural elements may be associated with the species-specific patterns of distribution and form of keratinized breeding structures in pebble nest-building cyprinids. This study was funded in part by University of Richmond and Saint Christopher's School.

198

- MYER, PATRICK A. University of Tennessee--The systematics of the sculpins (Cottidae, *Cottus*) of the Holston River system.

The systematic relationships among the morphologically similar forms within the

genus *Cottus* have been a subject of debate. Much of the current literature for the southeastern United States reflects the taxonomy proposed by Robins (1961), who recognized two species complexes within the area, *Cottus bairdi* and *C. carolinae*. Sculpins are characterized by having high degrees of intra- and interspecific morphological variation. Most systematic studies on southeastern sculpins have encompassed populations of one or several species from different river systems throughout their often disjunct ranges. These wide ranging studies can cloud morphological patterns that are apparent in individual drainages. This study concentrated on the sculpins of the Holston River system of the Tennessee River. A number of mensural and meristic characters were utilized for analysis of samples from regular spacial intervals throughout the Holston system. Analysis indicated the existence of populations of *Cottus bairdi*, *C. baileyi*, *C. carolinae*, and an undescribed broadband species within the Holston system.

199

- PETERSON¹, M.S. C.F. RAKOCINSKI² AND S.J. VANDERKOOY¹. ¹Mississippi State University and ²Gulf Coast Research Laboratory--Habitat suitability of the bluespotted sunfish in tidal rivers of the Mississippi Gulf coast.

Along the Mississippi Gulf coast, the bluespotted sunfish, *Enneacanthus gloriosus*, occurs at the western most extent of its geographic range. Here, this small sunfish appears to be relatively abundant in vegetated oxbow side-ponds associated with tidal rivers. To characterize habitat suitability for the bluespotted sunfish, we used a comparative sampling design to survey shoreline habitats of side ponds and adjacent main channels in the Old Fort Bayou and Bluff Creek systems. Several habitat variables were measured and fishes were collected from a total of 29 stations, including 17 side-pond stations (where 87.4% of the bluespotted sunfish were collected) and 12 main-channel stations (where 12.6% were collected). Abundance of bluespotted sunfish as well as several habitat characteristics differed noticeably between side-pond and main-channel stations. Compared to main-channel habitats, side-pond habitats tended to have greater bluespotted sunfish abundance, higher conductivity, pH, water temperature, litter, and aquatic vegetation, while having lower current velocity and turbidity. Of these habitat characteristics, only conductivity and litter amount were particularly useful in predicting catch-per-unit-effort of the bluespotted sunfish. The bluespotted sunfish is indicative of a unique and poorly studied aquatic community occurring within vegetated side ponds of tidal rivers along the northern Gulf coast.

200

PETERSON, TANYA L. and STEPHEN T. ROSS. University of Southern Mississippi-- Effects of Salinity on Survival and Growth in Juvenile Hogchokers, *Trinectes maculatus*.

Hogchokers exhibit a unique migration pattern in which estuarine spawned larvae migrate into freshwater, then progressively extend their annual range back towards the estuary until sexual maturity. The biological significance of this pattern is unclear, although juvenile salinity intolerance has been proposed as the driving mechanism. Lab experiments were used to address this hypothesis, in terms of survival, growth, oxygen consumption, and feeding, with fish from Biloxi Bay, MS. Mortality rates were low (<0.03/dy) during the tests and non-significant between salinity levels (0,7,15ppt). With *ad libitum* feeding, significant growth differences only occurred with larger juveniles, who showed higher growth in the 15ppt treatment. Juvenile oxygen consumption rates varied across salinity levels in the absence of significant growth differences. Feeding rates were monitored through behavioral observations and the data are currently being analyzed. Preliminary data suggest that, while juvenile salinity tolerance probably is not responsible for this migration pattern, salinity does affect their metabolism. Compared to low salinity habitats, higher salinity environments appear to be more energetically costly for juveniles so that continued positive growth would be increasingly dependent on high food availability.

multi-species reintroduction project. Multiple spawnings by a single female were observed and juvenile territoriality played a major role in survivorship of captive-reared young.

202

SCHWARTZ, FRANK J. Institute of Marine Sciences, University of North Carolina--Presence, dispersal, interrelationships, and fate of fishes inhabiting freshwater ponds of North Carolina's Outer Banks.

Fishes inhabiting freshwater ponds located on North Carolina's Outer Banks are compared in relation to interrelationships, presence, and dispersal to each island within the Outer Banks island system. Historical island origin, type, and movement of the system are compared. Ocean and lagoonal habitats are examined as possible sources for the fishes inhabiting the system. Long-term historical changes and fate of the fishes inhabiting Mullet Pond (Shackleford Banks) serve as clues to what other faunal areas can expect from natural and man-made changes being exerted on the system.

201

RAKES, P. L. and J. R. SHUTE. Conservation Fisheries, Inc.-- Captive propagation of the federally listed blackside dace, *Phoxinus cumberlandensis*, and duskytail darter, *Etheostoma (Catonotus) sp.* for reintroduction projects.

Blackside dace, which scatter eggs in nests constructed by other species, were successfully spawned in aquaria in spring 1993. The fish were collected in breeding condition and provided with laboratory conditions simulating their natural environment. Spawning occurred within days of collection. A second spawning was induced by adding milt from a tuberculate male stoneroller, *Campostoma anomalum* into the system. The resultant eggs from these spawns were collected and approximately 300 young were successfully reared and released at two localities in October. Duskytail darters, which spawn beneath slabrocks and guard eggs, were also induced to spawn by simulating natural conditions in laboratory aquaria. Nests were also collected from the wild. The eggs resulting from these spawns were reared and approximately 80 young were released at two sites in Abrams Creek (Great Smoky Mountains National Park) in September as part of a

203

SHUTE, J. R.¹, P. L. RAKES¹ and P. W. SHUTE². Conservation Fisheries Inc.¹ and Tennessee Valley Authority²--Population trends and reintroduction efforts for rare southeastern freshwater fishes.

Since the early 1980's, personnel now associated with Conservation Fisheries, Inc. (CFI) have been using non-invasive sampling techniques (mask and snorkel), to monitor populations of several rare southeastern freshwater fishes. CFI has been tracking population trends and relative abundances of the federally threatened yellowfin madtom, *Noturus flavipinnis*, and the federally endangered smoky madtom, *N. baileyi*, and duskytail darter, *Etheostoma (Catonotus) sp.*. These species are all components of a multi-agency captive propagation/reintroduction project. Our monitoring adds basic knowledge on regional trends in extinction-prone species. In addition, there is little baseline data on population trends in "nongame" stream fishes in general. Because of the manipulations of source populations that provide individuals for the reintroduction project, this monitoring is imperative to determine if the trends observed are natural. CFI has also initiated work with the federally endangered boulder darter, *E. wapiti*,

the federally threatened blackside dace, *Phoxinus cumberlandensis* and spotfin chub, *Cyprinella monacha* has been maintaining captive populations and monitoring status of the Barrens topminnow, *Fundulus julisia*, a candidate for federal protection.

pigmentation also were intermediate for the hybrids. There have been 12 hybrid combinations involving *Percina*, four with *Etheostoma*, and eight intrageneric crosses. Six hybrids had a species of logperch (subgenus *Percina*) as one parent. We report on this new hybrid between the smallest (*copelandi*) and one of the largest species (*caprodes*) in the genus *Percina*.

204

SHUTE, PEGGY W., CHARLES F. SAYLOR AND CHARLES P. NICHOLSON. Tennessee Valley Authority--The geographical affinities of fish communities in the Tennessee River Drainage, with emphasis on rare or sensitive species.

The fish communities at reference sites in streams of the Tennessee River Drainage were compared to determine whether characteristics of these assemblages are more closely aligned with physiographic provinces, watersheds, or "ecoregions". Relatively undisturbed sites in the Blue Ridge Mountains, Ridge and Valley, Cumberland Plateau and Interior Low Plateau physiographic provinces were chosen for the comparison. Modified Index of biological Integrity (IBI) indices were computed to assess current fish communities at these sites. Comparisons of current and historical communities were used to determine trends in the status of rare or sensitive species. As has been noted before, several rare species appear to be restricted to transitional areas between physiographic provinces. Degraded systems occur in all physiographic provinces, watersheds and ecoregions. Sites used for these comparisons may be especially useful as reference sites to determine success of restoration efforts in degraded riverine ecosystems.

206

VANDERKOOY, STEVE J. and MARK S. PETERSON. Mississippi State University--The influence of preservation shrinkage on the determination of gape-limitation in fishes.

The effects of preservation on morphometric measurements in fish have been documented by many authors. This suggests that a researcher looking at preserved specimens may get very different results than if live specimens were used. We examined shrinkage over one year of standard length (SL) and throat gape in 113 young-of-year walleye, *Stizostedion vitreum*, fixed in 10% formalin and stored in 50% Isopropyl alcohol. After two months in preservative, gape reduced to 83.5% of live gape ($p < .001$) and then stopped. SL continued to shrink to 96.7% of live SL after one year in preservative ($p < .001$). Potential errors arise when one uses preserved specimens to make predictions about live individuals. For example, underestimates of growth and skewed population demographics can result. In addition, misinterpretations of gape-limited foraging and underestimates of available prey sizes also are likely when examining preserved predators. Similarly, overestimates of available prey sizes can occur when analyzing preserved prey items. By recognizing such potential problems, researchers can calculate adjustments to account for these inherent biases and make more accurate predictions of gape limitation.

205

THOMPSON, BRUCE A.¹ and KARSTEN E. HARTEL.² Louisiana State University and Harvard University²--Hybridization between *Percina copelandi* and *P. caprodes semifasciata* with a review of hybridization in *Percina*.

Sampling in the Poultney River, a westward flowing tributary to Lake Champlain in Vermont, produced series of *Percina copelandi*, *P. caprodes semifasciata* and six hybrids. The hybrids (4 males, 2 females) ranged from 30.0 to 57.1 mm SL. Fin rays and scales of the hybrids were intermediate in number between the lower *P. copelandi* and higher *P. caprodes* counts. Vertebra number was also intermediate (X, 38.5 *P. copelandi*, 40.3 hybrids, 42.6 *P. caprodes*). Scapulation patterns, modified scutes, and

207

WALSER, CHRIS A. and HENRY L. BART Jr. Tulane University--An overview of historical trends in fish diversity and abundance with respect to land usage in watersheds of the Chattahoochee River, USA. Past research suggests that land-use is a primary factor causing the decline of fish resources in headwater and mainstem ecosystems. The purpose of this study is to measure the general effect of land usage patterns on fish species diversity and abundance in watersheds of the Chattahoochee River. Historical ichthyological data from the Chattahoochee system were obtained from collections housed at Tulane University, University of Georgia, University of Alabama, Cornell University, University of Florida, University of Michigan, and Columbus College. The collection data were incorporated into an AGIS (Advanced Geographic Information Systems) database. Land usage data for the appropriate watershed and time periods were overlaid on to the ichthyological collection

data. Trends in fish diversity/abundance were examined in relation to percent forest cover in each watershed over time. Changes in fish diversity and abundance were analyzed with respect to feeding (omnivores and carnivores) and spawning (broadcast and substrate) guilds. Prior studies of streams in deforested watersheds show a decline in top carnivore species and substrate spawners.

morphological data, investigators have recently recommended that R. bowersi be resurrected as a valid species. We are examining the chromosomes of these three species for markers that might further clarify the taxonomic status of R. bowersi. Chromosomes of R. cataractae and N. micropogon have been stained with Giemsa and AgNOR-banded. Numbers of nucleolus organizer regions (NORs) have been compared to numbers of nucleoli in gill epithelium. All specimens of N. micropogon and R. cataractae possess $2n = 50$ chromosomes. Two nucleolus organizer regions (NORs) have been found on intermediate length, sub-metacentric chromosomes of both species and are associated with the production of 1 to 2 nucleoli per epithelial cell.

208

TENNANT, ALAN and MICHAEL LITTLE.
Marshall University--Genetic interactions between subspecies of *Rhinichthys atratulus*.

In West Virginia, two subspecies of blacknose dace are distributed along the divide between Atlantic slope and Ohio River drainages. *Rhinichthys atratulus atratulus* is native to tributaries of the Potomac and James River to the east and *R. a. obtusus* to tributaries of the Ohio River to the west of this divide. Through either stream capture or human activity, *R. a. atratulus* has been introduced into headwater streams to the west of this divide and is now widely distributed in seven tributaries of the Cheat River, Ohio River drainage. After extensive collecting in these streams, we have found no evidence of intergradation between these two subspecies. All blacknose dace in these streams are morphologically *R. a. atratulus* and show no traits of native *R. a. obtusus*. We are presently, looking for genetic markers that are unique to each subspecies. Fish from five populations of *R. a. atratulus* have been karyotyped and positive of nucleolar organizer regions (NORs) and numbers of nucleoli determined. Karyotypes of both Cheat River and Potomac River populations show one to four NORs per chromosome set, with 2 or 3 NORs most prevalent. NORs are located on acrocentric (2) and sub-metacentric chromosomes (1-2). Consistent measures of three NORs per spread could serve as a genetic marker for a subspecies and thus lend insight towards the character of its genetic interaction. Further karyotypical analyses as well as molecular analyses are presently being performed to yield more accurate data as to the level of interaction between these populations.

210

DOBSON, TERRI L. Jacksonville State University--An ichthyofaunal survey of Little River Drainage in Alabama with notes on *Cyprinella caerulea* (Jordan) (Teleostei: Cyprinidae).
Little River is located in northeast Alabama, flows mostly within Little River Canyon, and is a tributary of the Coosa River. Six stations were sampled monthly for fifteen months. These stations were selected according to their habitat diversity, accessibility and location. A number of additional sites were arbitrarily sampled in order to make the study a more complete survey. Over 103 collections have been made since September 1992. The distribution, percent relative abundance and percent occurrence of each species within the river has been ascertained. Physical parameters such as dissolved oxygen (mg/l) and temperature of the water were calculated for each collection. This documented survey has produced a total of 42 species representing ten families. *Cyprinella caerulea* (Jordan), the blue shiner, is a threatened species (federal list) known to occur in Little River. The range of *Cyprinella caerulea* within Little River has been determined by this study and was found to be further upstream in the river than originally assumed. The number and standard length of this threatened species below the Canyon Mouth Park have been monitored and recorded. Within Little River this species prefers clear water with slow to moderate flow over a sand-rubble substrate. This research was supported in part by a grant from the Theodore Roosevelt Memorial Fund of The American Museum of Natural History.

211

¹BENJAMIN, SHARLA, ²DONALD W. IMM, and ³BARBARA P. MOYER. ¹Duke University and ²Savannah River Ecology Laboratory, Univ. of Georgia--Nutrient dynamics of hardwood slopes and the influence of composition, topography, and management.

Within ecosystems, nutrient (N and P) dynamics are related to standing stock levels of vegetation and soil. Litterfall and mineralization rates influence nutrient cycling rates. Standing stocks are dependent upon species-specific biomass amounts and

209

PUCKETT, CHARLES and MICHAEL LITTLE.
Marshall University--Chromosomal NOR phenotypes of two species of Cyprinidae.

Rhinichthys bowersi has been described variously as a valid species and as a river chub (*Nocomis micropogon*) X longnose dace (*Rhinichthys cataractae*) hybrid. With the exception of a few records in the Great Lakes drainage, the distribution of *R. bowersi* is restricted to the Cheat River, its tributaries, and adjacent streams of the Monongahela River system. Based upon electrophoretic, distributional, and

soil characteristics. A five compartment model (wood, foliage, litter, soil OM, and mineral soil) was used for analysis. Four study sites were used with two transects at each. Management adjacent to each study site differed: unburnt pine, burnt pine, open oak-pine canopy, closed oak canopy. Along each transect circular plots were evenly spaced from the ridge to the base of each slope. Woody and herb vegetation was surveyed in each plot. Woody and foliar biomass estimates were made using regression equations for each species. Soil samples were collected at each plot and used to estimate standing stock nutrient levels as well as mineralization rates. Litter samples were collected in June and December at fixed positions and used to estimate annual litterfall. Lower slope plots had the higher soil OM, soil and vegetational standing stocks of nutrients. Decomposition and mineralization rates were lowest at ridge positions.

212

BERTRAM, TRACY E., DANIEL E. FUNSCH, and JOHN E. PINDER III. Savannah River Ecology Laboratory--Deforestation and Forest Fragmentation in the Upper Coastal Plain of Georgia and South Carolina.

To quantify changes in quantity and distribution of forested habitats in a 100 x 100km area centered on the Savannah River Site (SRS), Landsat Multispectral Satellite (MSS) data were used to map changes in the distributions of pine and hardwood forests. Forest distributions were mapped for 1974, 1980, 1984, 1988, and 1991 using winter images to identify pine stands and summer images to identify hardwood stands. Changes in forested areas were measured by comparing forest distribution among years. Initial analyses show that 45% of the area was pine in 1974. By 1988, however, 47% of this area had been cut. Most of the remaining pines were subdivided into small, fragmented stands, with the median size being less than 20 ha. Analysis of pine forest dynamics will be conducted through the 1991 year. Similar analyses are being conducted for the hardwood forests, and preliminary results indicate that little cutting occurred on this type of habitat.

213

CAPPELLATO, ROSANNA. U.S. Geological Survey, Atlanta, Georgia --Above-ground cycling of base cations and sulfur in adjacent deciduous and coniferous forests in the Georgia Piedmont.

Base cation and sulfur deposition to the forest floor were compared between adjacent deciduous and coniferous forests at Panola State Conservation Park, Georgia. The most important input pathways of S, K⁺ and Na⁺ to the forest floor were throughfall and stemflow. Litterfall was the primary pathway for Ca²⁺

and Mg²⁺. Nutrient requirement for annual wood and foliage production were balanced by the nutrient uptake, i.e. annual litterfall, canopy leaching and wood increment, for Ca²⁺, K⁺ and S in the deciduous forest and for Ca²⁺ and S in the coniferous forest. Annual Mg²⁺ requirement was not balanced by nutrient uptake in either forest. Biomass and nutrient content in the coniferous litterfall were less than in deciduous litterfall, and nutrient retranslocation was higher in coniferous forest than in the deciduous forest. These results indicate that nutrient cycling was more conservative and nutrient use more efficient in the coniferous forest than in the deciduous forest. Site nutrient availability or differences in nutrient dynamics between an early successional coniferous stage and a late successional hardwood stage are probable causes of the differences in nutrient cycling.

214

Grahame, Anthony, and Philip Robertson. Southern Illinois University--The woody vegetation of six Research Natural Areas (RNA's) in southern Illinois.

Within 6 RNA's, 94 circular 0.1 ha plots were randomly located on homogeneous sites. Each plot was permanently marked and trees > 5.0 cm dbh were recorded. Shrubs/saplings > 2.5 cm dgI ≤ 5.0 cm dbh were tallied in a 0.04 ha nested subplot. Woody regeneration ≤ 2.5 cm dgI was sampled in a 0.001 ha microplot nested within the shrub/sapling plot. Data were also collected for slope aspect, angle, and position. Plot richness averaged 10.6 species. Basal area averaged 21.9 m²/ha for all plots. COMPAH classification of the plots revealed *Acer saccharum*, *Quercus rubra*, *Quercus alba*, *Q. velutina*, *Q. stellata* and *Juniperus virginiana* dominance types. These types occurred on mesic, dry-mesic, dry and glade habitats, respectively. From the mesic to the most xeric sites, basal area decreased from 24.9 to 4.8 m²/ha. This research was supported, in part, by the USDA Forest Service.

215

HICKOX, TRACEY E. and B. COLLINS. Memphis State University and Savannah River Ecology Lab--Regeneration in an oldgrowth bottomland hardwood forest.

Oldgrowth bottomland hardwood forests are a decreasing component of landscape diversity. Remnant forests are susceptible to disturbances such as windthrows that open the canopy and create sites for tree regeneration. Variation in microsite abundance and distribution may interact with gap formation to determine which species establish and persist in gaps and beneath the canopy. We monitored tree seedling establishment and survival with respect to irradiance, amount of plant and leaf litter cover, and microtopography in and out of gaps formed by a windstorm in an oldgrowth bottomland forest that floods seasonally. After one year,

seedlings of 15 tree species had greater survival on high relief microsites and greater mortality on low relief and with a high percentage of leaf litter cover. Microsite variation, and not opened canopy as such, enhances regeneration in this oldgrowth bottomland hardwood site.

forest; in the absence of a fragipan, *Q. alba*, *Q. velutina*, and *Carya* dominate. Moist low east and north slopes presently support a community of *Acer saccharum* and associated species indicating an immediate conversion to mesophytes in the absence of preharvest fire or other operations to eliminate *Acer*.

This research was supported by the Center for Field Biology, Austin Peay State University, Clarksville, TN, and the Department of Forestry, Southern Illinois University, Carbondale.

216

ROBERTSON, PHILIP A. and SHANDA WIERINGA. Southern Illinois University--Composition and structure of a disjunct *Quercus prinus* L. stand 18 years after clearcutting.

Fifty-two 0.04 ha permanent plots were sampled prior to and 18 years after clearcutting a disjunct *Quercus prinus* L. stand in southern Illinois. Tree density was 446.8 and 1338.6 stems/ha for the precut and 18-year postcut stands, respectively. The 15.5 m²/ha basal area of the 18-year postcut stand was 74.7% of that of the precut stand. The precut stand showed a poorer fit to the negative exponential size-class model. Tree species richness and richness of all woody species was 36 and 43, respectively. Five species that occurred in the precut sample did not appear in the postcut sample. Evenness and Shannon's diversity measures showed more dominance in the postcut stand. The precut stand was dominated by *Quercus alba* L. followed by *Sassafras albidum* (Nutt.) Nees and *Quercus prinus* L. The postcut stand was dominated by *Liriodendron tulipifera* L. followed by *Sassafras albidum* and *Quercus prinus*. Composition of forests following severe disturbance appears to be a function of species that reproduce vegetatively and the stochasticity of the environment that affects establishment success of species regenerating from seed.

218

Strazzante, Lisa and James Fralish. Southern Illinois University, Carbondale--Estimating the rate of development of *Acer saccharum* stands in the oak community of the Illinois Ozark Hills.

To study the rate of development of *Acer saccharum* stands in the mature undisturbed oak-hickory community of southern Illinois, tree, sapling and seedling data were collected from 46 permanent nested plots of 0.04, 0.006, and 0.003 ha, respectively. Data from an additional 48 temporary plots randomly located throughout the Ozark Hills region also were included. Data from plots were analyzed by site type (ridgetop, high south, low south, high north, low north, terrace). Compositional index [CI = sum of (Species Importance value x Adaptation Value)] was developed for each of the three strata, and differences between overstory and understory compared to examine successional trends by site type. These trends and results from TWIGS, a stand table projection program, indicate that *A. saccharum* will dominate stands on most sites in less than 100 years. Results from the FORET forest growth model are similar. Published studies from throughout the central states have reported the development of an *A. saccharum* understorey in natural oak forests suggesting a substantial loss in the oak-hickory resource over the next 100 years.

217

Snyder, Pam and James Fralish. Southern Illinois University, Carbondale--A study of oak re-establishment in clearcut forest at Land Between The Lakes, KY and TN.

Oak re-establishment after timber harvesting was studied at Land Between The Lakes. During the summers of 1992 and 1993, sapling data were collected from 149-0.006 ha plots and seedling data from 149-0.003 ha plots located in 20 areas of oak-dominated forest clearcut between 1978 and 1981. After initial harvesting all remaining stems between 2.5 and 12 cm DBH were cut. These data were compared with that of uncut forest on adjacent or analogous sites. On dry sites, regrowth appears to be similar in composition to the overstorey of uncut stands. On ridgetops and south slopes where a soil fragipan is present, *Quercus stellata* and *Q. prinus* are major species in the new

219

YORKS, THAD E. and SIMON DABYDEEN. Frostburg State University--Plant diversity in second-growth hardwood clearcuts of western Maryland.

Vascular plant diversity in variously-aged clearcuts is not well-documented in the western Maryland region. To investigate this, a 0.1-hectare quadrat and a series of nested subplots were established on twenty sites in the Savage River State Forest and

Frostburg's watershed property. Sites ranged in age from one to twenty-six years since clearcutting. Additionally, twelve of the sites (Savage River State Forest) were located on south-east and north-west slopes to examine plant diversity on opposite aspects. On each site, herbaceous plants and shrubs were sampled three times throughout the 1993 growing season. Their abundances were quantified by estimating percent-coverage on one-m² subplots. Tree species diversity was calculated using basal area. Preliminary treatment of data indicated that plant diversity may increase for several years (four to ten) after a clearcut. Diversity eventually decreases, possibly due to greater tree crown closure and/or increased abundance of a limited number of species. Sites with a south-east aspect exhibited higher plant diversity than those with a north-west aspect. Finally, many plant species were observed to be abundant in only certain stages of forest regeneration.

220

YOUNG, P. J., R. F. LIDE, and R. R. SHARITZ. University of Georgia, Savannah River Ecology Laboratory--Growth response of loblolly pine to the hydrology of a Carolina bay.

Carolina bays are isolated wetlands found only in the south-eastern Coastal Plain. Bay hydrology, primarily influenced by rainfall, is unique to each bay; some hold water year round while others fill temporarily following rains. Many bays are surrounded by stands of mature loblolly pine (*Pinus taeda*). To determine the effect the highly variable hydrology has upon pine growth both within the bay and in the adjacent environment, we collected increment cores from 37 loblolly pines along four 100m transects radiating from the north, south, east and west edges of a bay. Growth of annual rings was compared based on distance and direction from the bay using dendrochronological techniques. Analysis revealed a common climate response in all cores. However, differences based on distance and direction from the bay were found. These differences were most likely related to stresses associated with water availability.

221

TURRILL, NICOLE L.¹ and FRANK S. GILLIAM². University of Tennessee¹ and Marshall University²--Influence of soil nutrient availability on species niche partitioning of herbaceous and woody herb layer species of a central Appalachian montane hardwood forest.

Plant-soil nutrient relationships of herb layer communities are influenced by soil fertility and the physiological

requirements of the species present. The purpose of this study was to determine the role of soil nutrient availability in herb layer species niche differentiation and to see if these relationships vary with stand age. Herb layer sampling was conducted within 120 m² plots in four watersheds (WS) of the Fernow Experimental Forest, Parsons, WV [WS4>80yr, WS13>65yr, WS3-20yr, and WS7-20yr]. All vascular plants ≤ 1m in height were harvested, separated by species, oven dried, and analyzed for macro- and micronutrient concentrations. One 10 cm soil sample was taken from each plot and analyzed for texture, pH, macro- and micronutrient concentrations. All watersheds were similar in species composition and were dominated by *Laportea canadensis*, *Dryopteris marginalis*, *Smilax rotundifolia*, and *Viola* spp. Soils of all watersheds were acidic sandy loams. Watershed means of soil and tissue nutrient concentrations showed no significant differences suggesting that the watersheds were of similar fertility. Canonical discriminant analysis (CDA) of tissue nutrient concentrations revealed that woody herb layer species were lower in Mg and N concentrations compared to herbaceous species. In addition, CDA of soil nutrient concentrations showed that woody species were found in soils lower in Ca and Mg compared to herbaceous species. Correlations of mean canonical axis scores indicated that species position in the tissue and soil nutrient hyperspaces were significantly related ($P < 0.01$) suggesting that species niche, in part, is determined by availability of soil nutrients such that herbaceous species are superior competitors for NO₃-N, Ca, and Mg compared to woody herb layer species. This preference of herbaceous species to high fertility soils explains their dominance in early successional stages where the herb layer is influenced by allogenic factors. Later in succession, when herb layer development is influenced by autogenic factors, lower light, lower nutrient tolerant woody species increase in importance.

222

Thomson, M. Sue and Angela C. Morrow. Auburn University at Montgomery--Electron Microscopy Examinations of the Attachment of Hemophilus somnus to Preimplantation Bovine Embryos.

Hemophilus somnus is an economically important cause of disease in cattle in North America, and has been isolated as the etiological agent in encephalitis, pneumonia, and reproductive disease. Adherence to preimplantation bovine embryos *in vitro* by *H. somnus* isolate 649 has been demonstrated but the mechanism of adherence is unknown. The objective of this study was to investigate the attachment of *H. somnus* to preimplantation bovine embryos using scanning and transmission electron microscopy. The SEM studies revealed no evidence of pili or capsule. Bacteria were observed to be adhering to the zona pellucida of the embryos in both TEM and SEM. Some bacteria appeared to be invading the zona pellucida. Compacting of treated embryos was observed and could be due to damage to or leakage from the zona pellucida. The bacterial cells varied in shape and size.

223

REIMERS, DANIEL B., B.J. TALLER, and S.E. STEVENS, JR. Memphis State University--Cytokinin production in the thermophilic cyanobacterium *Mastigocladus laminosus* UTEX 1931.

Cytokinins are N⁶-substituted adenine derivatives produced by bacteria, fungi, algae, and higher plants. They function as plant growth hormones by affecting such processes as cell division and differentiation. Among prokaryotes, cytokinin production is associated with symbiotic bacteria, so it was of interest to identify the cytokinins produced by the free-living cyanobacterium *Mastigocladus laminosus* UTEX 1931. *M. laminosus* is a cosmopolitan, thermophilic, nitrogen-fixing cyanobacterium of complex morphology. Six liters of culture filtrate was passed over an XAD-2 column to concentrate the cytokinins. The eluate was then run on a Sephadex LH-20 column in 35 % ethanol, which separated the cytokinins based on their relative mobilities. Fractions were pooled based on the relative mobilities of cytokinin standards and were tested for cytokinin activity in the tobacco callus bioassay. Activity was found in two fractions, corresponding to isopentenyladenosine-methylthioribosylzeatin and to isopentenyladenine. Sephadex LH-20 chromatography in water, affinity chromatography, high performance liquid chromatography, immunoassay, and gas chromatography-mass spectrometry will be used to further identify the cytokinins produced. The cytokinin content of *M. laminosus* tRNA will also be analyzed.

224

WUBAH, D. A. and S. KIM Towson State University - Preliminary morphological studies on a new obligately anaerobic zoosporic fungus isolated from a pond.

The order Neocallimasticales was recently created to accommodate the obligately anaerobic zoosporic fungi. Most of these fungi described in the literature to date were isolated from the gastrointestinal tract of herbivores, especially the rumen of cows. A few isolates have been obtained from the dung of herbivores. However, none of these fungi have been isolated from nature. This study describes the first isolation and morphological characterization of an obligately anaerobic zoosporic fungus from the anoxic layers of a pond.

Two pure cultures of obligately anaerobic zoosporic fungi were isolated from sediments collected from a pond on a cow pasture in Frederick, MD. Isolates were maintained in basal anaerobic medium. Zoospores of the first isolate were polyflagellated with 9-15 flagella and a spore diameter of 4-6 μm . Each zoospore developed into a monocentric, eucarpic thallus with or without an apophysis. The zoosporangia had a diameter of 40-90 μm and this isolate had

characteristics of the genus *Neocallimastix*. The second isolate also produced polyflagellated zoospores with 8-20 flagella, but the zoospores developed into a polycentric thallus with extensively branched rhizoids. The zoospores and the zoosporangia were 10-15 and 60-140 μm , respectively, in diameter. No resting sporangia have been observed in both cultures.

225

COGGIN, STEVEN J. and JAMES L. PAZUN. Catawba College -- Dynamical complexity in *Physarum* cytoplasmic streaming.

The plasmodial stage of the slime mold *Physarum polycephalum* exhibits dramatic cytoplasm streaming with rates as high as 1 mm/s. Streaming in the plasmodium reverses directions at intervals of about 1 minute. Time series analysis indicates the timing of cytoplasmic streaming reversal is not periodic but chaotic. The chaotic behavior of this system is described by a low dimension attractor. Fourier spectra of time series data and analysis of time intervals between reversals both show cytoplasmic streaming is described by an inverse power law. Inverse power law behavior is characteristic of complex dynamical systems. It has been hypothesized that evolution drives biological systems to the complex state or "the edge of chaos". These results show the timing of *Physarum* cytoplasmic streaming reversals is a dynamical system in the complex state. Biological systems exhibiting complex behavior include extinction events, behavior of ecosystems (both real and computer modeled), and numerous physiological systems. This report is the first example of complex behavior in the cytoplasm of cells.

226

SAMPSON, CHRISTOPHER S., DAVID C. NIEMAN, AND DRU A. HENSON. Appalachian State University -- The Immune Response to Exhaustive Anaerobic Exercise.

The acute response of the immune system to an exhaustive bout of leg squat exercise was studied. Ten male, highly trained weightlifters performed a parallel leg squat exercise session consisting of sets of 10 reps at 65% 1-RM, to muscle failure. O_2 consumption was measured during each minute of the entire exercise session, with blood samples taken before, immediately after, and 2 hrs post-exercise. Mean O_2 consumption during exercise was 1.58 ± 0.06 L/min at $42.5 \pm 2.0\%$ $\text{VO}_{2\text{max}}$. A strong leukocytosis, lymphocytosis, and lymphocytopenia, similar to what has been reported following high-intensity cardiorespiratory exercise, were measured following leg squat exercise. Con A-stimulated lymphocyte proliferation rose 50% above pre-exercise levels ($P=0.07$), but when these data were adjusted on a per T-cell

basis, no major alteration was measured. Natural killer cell cytotoxic activity (NKCA) when adjusted on a per NK cell basis, was decreased about 40% below pre-exercise levels for at least 2 hrs. No significant increase in cortisol was measured after exercise, while catecholamines were elevated 250% immediately following exercise. The data demonstrates that leg squat exercise to muscle failure results in a similar immune response to that of endurance exercise despite a mean O_2 consumption that is approximately half that of high-intensity cardiorespiratory endurance exercise and a nonsignificant rise in cortisol.

227

GARNER, MARILYN S. and MARY U. CONNELL. Appalachian State University--
Restriction mapping of transposon insertion mutants of bacteriophage T4.

Five transposon insertion mutants of the bacteriophage T₄ have been mapped. Mutants were developed by Dr. Kenneth Kreuzer and Denise Woodworth at Duke University and provided to selected high school teachers after completion of an orientation workshop sponsored by the North Carolina Biotechnology Center. The mutants contain a transposon plasmid within the gene 24 selection marker. Transposon insertions for the five mutants were determined by restriction mapping and comparison with parental strain CD17. Mutants were found to have insertion sites in genes *rIIA* and *alt*, and ORFs *tk 3*, *dex A -2*, and *144.7*. Initial screening of morphotypes in both the virus and the host bacterium utilizing negative staining TEM techniques will be reported.

228

MADIGOSKY, STEPHEN R.,¹ XAVIER ALVAREZ,² and JONATHAN GLASS.² Widener University,¹ Louisiana State University Medical Center.²--The Effect of Zinc on Iron Handling by Human Derived Caco-2 Cells.

Human derived Caco-2 epithelial cells grown in bicameral chambers were used to study the cell biology of zinc (Zn) and iron (Fe) transport *in vitro*. The iron status of the cells was established by culturing Caco-2 monolayers, prior to exposure to Zn, in media with either low (0.1M), normal (1M), or high (50M) Fe concentrations. Zinc was offered on the apical surface of Caco-2 monolayers as Zn-lactate. Cells were incubated with or without Zn-lactate and 1 μ M ⁵⁹Fe-ascorbate was added as Fe(II)-ascorbate at an Fe:ascorbate ratio of 1:1000 (Fe:ascorbate molar ratio) for 1h at 37°C with molar ratios of Fe:Zn of 1, 10, and 100. Radioactivity in the cells was determined in a Compugamma LKB gamma counter. Results indicate that Zn-lactate inhibits the uptake of ⁵⁹Fe+2 by Caco-2 cells with the effects being most noticeable in the Fe deficient cells. Na-lactate had no effect on ⁵⁹Fe

uptake when ⁵⁹Fe ascorbate was offered to cells for an hour. This suggests that Zn acts as a competitive inhibitor in the uptake of iron across Caco-2 cell monolayers. These results indicate that the inhibitory effect of Zn is on Fe transport into the cell.

229

WINKFIELD, BLONKA and Elaine J. Davis. Howard Univ., Washington, DC.--The origin of transfer region for the conjugative plasmid R64drd11.

R64drd11 is a conjugative plasmid which confers tetracycline and streptomycin resistance to its host cell. The origin of transfer region has been identified as a specific site required for the transfer of genetic material from one bacterial cell to another involving specific wall-wall contact. The plasmid was digested with *Hind*III and cloned into the *Hind*III site of the vector pBR322. Two fragments, identified by triparental matings, demonstrated origin of transfer activity, the 4.445 and 1.74 Kb fragments. Based upon restriction endonuclease analysis, the two fragments do not represent DNA duplication of genetic information. Preliminary studies using DNA-DNA hybridization suggest that the two fragments are not duplicates and that the plasmid R64drd11 possesses two origin of transfer regions. Since an origin of transfer region was recently reported for R64, experimental procedures are currently underway to determine which of the two cloned fragments (4.445 or 1.74 Kb) isolated in our laboratory, represents the same genetic information.

230

BATH, DANIEL W. Austin Peay State University--Analysis of chromosome morphology using scanning electron microscopy.

A simple, direct procedure for preparation of chromosomes for analysis with the scanning electron microscope has been developed. The procedure allows for identification of chromosomes using trypsin-induced banding patterns. Bands observed in the scanning electron microscope appear as areas of alternating greater and lesser concentrations of chromatin fibrils. These differences in chromatin concentrations correspond to dark and light bands observed with the light microscope. With this procedure the complete chromosomal complement of a cell can be observed and each individual chromosome can be analyzed for possible ultrastructural abnormalities.

231

BYRD, PAMELA B.,¹ DWAYNE A. WISE,¹ and WILLIAM DENTLER.² Mississippi State University¹ and University of Kansas²--
Antibody Disruption of Spindle Function.

We have identified a rabbit autoimmune serum that causes shortening of the metaphase spindle when injected into mitotic *Potorus tridactylous* (PtK₂) cells. The serum contains antibodies that recognize proteins that may be essential for spindle function in dividing cells. Whole serum and affinity purified antibodies were injected into cells to determine their effect on mitosis. Phase contrast microscopy was used for time lapse video to monitor changes in spindle length of injected cells. Cells were prepared for immunofluorescence by injecting with serum, fixing and staining the microtubules with anti-tubulin antibody and by labeling with a fluorescein secondary antibody. An Image 1.33 image analysis computer program was used to measure the microtubules from pole to pole and chromosome to pole. Injections of the serum into metaphase cells caused gradual shortening of the spindle over a 20 minute period and the eventual arrest of chromosome movement. Injection of nonspecific antiserum had no effect on spindle size or chromosome movement. Interphase cells injected with the autoimmune serum remained viable and had normal appearing (non-mitotic) nuclei after a 24 hr period, which suggests that the autoimmune serum contains antibodies that inhibit the initiation of mitosis. Western blots of PtK₂ proteins showed antibody reactive bands of M, 35kD, 65kD and 140kD. Antibodies affinity purified against the 35kD and the 65kD bands mimicked the effects of the autoimmune serum when injected into mitotic cells.

232

GREEN, BECKY L.,¹ DWAYNE A. WISE,¹ and NILLO VIRKII.² Mississippi State University¹ and Agricultural Experimental Station²--Sex Chromosome Behavior in Spermatocytes of *Alagoasa bicolor* L. In *Alagoasa bicolor* L., a neotropical fleabeetle, the spermatocytes have two sex chromosomes that occupy a spindle or spindle domain separate from that of the ten pairs of autosomes. The sex chromosomes segregate during meiosis I even though they are not connected. The purpose of this study was to determine spindle number and sex chromosome orientation in *A. bicolor* L. spermatocytes during meiosis I. Immunofluorescence microscopy techniques were used to determine the sex chromosomes and spindle location in the spermatocytes. The kinetochore microtubule attachment was analyzed by 3-D computer reconstructions of serial thin sections of the spermatocytes photographed with the transmission electron microscope. It is possible that two spindles exist; however, at the electron microscopy level there is only one centriole pair at each pole. The autosomes and sex chromosomes are separated during prometaphase and come to lie in what can be considered separate spindles or spindle domains. The sex chromosomes appear to be syntelically oriented, at least after the start of anaphase I. Functional differences in the two spindles may have an effect on the nonrandom segregation of sex chromosomes.

233

DAVIS, JENNIFER AND DWAYNE WISE. Shorter College and Mississippi State University--Causes and consequences of elevated levels of meiotic abnormalities in laboratory colonies of the crane fly *Nephrotoma suturalis*.

Progeny of five wild-caught crane flies were compared to a laboratory colony of *Nephrotoma suturalis* for mean % chromosome abnormalities, mean % survival, and parameters indicative of developmental rate. There was a highly significant difference in mean % chromosome abnormalities between the wild-derived progeny (1.2%) and the laboratory colony (15.7%). Consequences of this elevated level of chromosome abnormalities in the laboratory stock of *N. suturalis* included a significant difference in survival and developmental rate when compared to the wild-derived colony. Elevated levels of chromosome abnormalities of the JD lab stock of *N. suturalis* have been maintained in four different environments for two generations. Further, elevated levels of abnormalities were maintained in two different temperature environments. These results strongly support a genetic cause, rather than an environmental cause, for the increased level of chromosome abnormalities in the JD stock of *N. suturalis*.

234

SHIMP, JODY and PHILIP A. ROBERTSON. Southern Illinois University, Carbondale.--Ground layer vegetation of three Research Natural Areas (RNA's) in southern Illinois. During the summer of 1993, 33 .01-hectare circular plots were established and permanently marked within 3 RNA's, Barker Bluff, Dennison Hollow, and Panther Hollow in the Shawnee National Forest, Illinois. Within each plot ground layer vegetation was sampled by estimating percent cover of each species in 24 randomly located 0.25 m² quadrats. An inventory of all vascular plants within each RNA was also made. To date, 1,142 plant collections have been made and 24 Illinois threatened and/or endangered species have been identified. Average plot richness was 30.1 species and species richness for all samples was 225. TWINSPAN identified *Danthonia spicata*, *Asplenium platyneuron*, *Festuca obtusa* and *Agrostis elliotiana* as indicators of 4 vegetation assemblages, dry, dry mesic, mesic and sandstone glades. A highly significant between the first DECORANA axes from the ground layer and overstory data indicated a that both strata were responding to the same environmental gradient. This research was supported, in part, by the USDA Forest Service.

235

SPIRA, TIMOTHY P., ALLISON A. SNOW and DENNIS F. WHIGHAM. Clemson University, Ohio State University, and the Smithsonian Environmental Research Center--Effects of pollen competition on offspring vigor in *Hibiscus moscheutos* A number of studies have shown that the amount of pollen placed on stigmas can

influence the 'quality' of the seeds produced. However, in most of these studies, information on stigmatic pollen loads in natural populations was not obtained. Consequently, it is somewhat difficult to evaluate the ecological and evolutionary significance of this work (e.g., were unrealistically large pollen loads placed on stigmas?). The purpose of our research is to test the effect of varying pollen loads on offspring vigor in *Hibiscus moscheutos*, a species in which the amount of pollen reaching stigmas frequently greatly exceeds the number of ovules. We used six plants as pollen recipients and five plants as pollen donors each day over a three week period. For our 'light' pollen treatment, we applied slightly more pollen than needed for full seed set. In contrast, 'heavy' pollen treatment flowers received about 1500 more pollen grains than needed for full seed set. Our results indicate that seed mass increased and seedling emergence times decreased for seeds derived from 'heavy' pollen loads. Moreover, there was a marginally significant ($P = 0.06$) effect of a 'heavy' pollen load on seedling biomass (but no effect on seedling height). The effect of pollen load on seed and seedling traits varied among maternal plant families. Overall, our results are consistent with other studies suggesting that there is a positive effect of large stigmatic pollen loads on offspring 'vigor'.

237

TOWNSEND, JOHN F.,¹ RICHARD D. PORCHER,² and JOHN E. FAIREY,¹ CLEMSON UNIVERSITY,¹ and THE CITADEL² -- *Oxypolis canbyi* (Coulter and Rose) Fern and *Schwalbea americana* L. in Clarendon and Williamsburg Counties, South Carolina: A preliminary report on the status of two endangered species.

In late April of 1993, a project was undertaken to determine the extent and characteristics of unique botanical natural areas in Clarendon and Williamsburg Counties, South Carolina. In the process, all known populations of the endangered *Oxypolis canbyi* and *Schwalbea americana* were visited to confirm their continued existence, extent, and plant associates. Additionally, new populations were located for both species. These are the only two endangered species encountered so far during the project. As a result, known populations of *Schwalbea americana* have increased more than sixfold. Two new populations of *Oxypolis canbyi* were discovered, but the status of the other populations is harder to determine since some did not produce above ground structures, possibly owing to the severe drought during the growing season. Fire disturbance and moisture availability are pivotal factors in determining the continued existence of these species in the two county area. Vascular plant associations within these populations will be noted as this will aid in the location of these plants in the South Carolina coastal plain in the future.

236

STALTER, RICHARD. St. John's University, Jamaica, NY--Twenty eight years of vegetation change at a Rhode Island utility right-of-way.

The vegetation found on permanent line transects on a utility right-of-way, Exeter, Rhode Island, was sampled in late May, 1993. Three sites, 2 dry and one wet, were selected for study. The species found at these transects were compared with the vascular flora found at these same transects in May 1965. Tree sprouts and tall shrub sprouts have been selectively treated with herbicides from 1963 to 1990. Eleven tree species were observed at the transects in 1993; only five species were observed in 1965. *Gaylussacia baccata*, *Rubus hispidus* and *Rubus flagellaris* were dominant at the two dry sites in 1993, and occurred at 2 or more transects in 1965. Frequency values for *Clethra alnifolia*, *Rubus canadensis* and *Salix bebbiana* at transects on the wet right-of-way site have declined; *Lindera benzoin* has been eliminated. *Carex pensylvanica* and *Potentilla canadensis* have maintained dominance on the dry right-of-way sites. *Solidago* spp., *Lysimachia quadrifolia* and *Schizachyrium scoparium* were dominant or codominant on the dry sites in 1993.

238

WAGNER, LISA K. AND DENNIS F. WHIGHAM. Georgia Southern University and Smithsonian Environmental Research Center. -- Resource limitation of fruit and seed set in *Hibiscus moscheutos*.

Previous field studies showed that probability of fruit set in a natural population of *Hibiscus moscheutos*, a herbaceous wetland perennial, was enhanced by removal of either flower buds or juvenile fruits on the same shoot, suggesting that resource availability may limit fruit set under field conditions. Overall fruit set was also correlated with summer rainfall under field conditions; low fruit set coincided with summer drought years. To further investigate how resource limitation affects regulation of fruit and seed set in *Hibiscus*, we conducted a garden experiment over a two-year period in which pot-grown plants were subjected to one of 4 resource treatments: control, nutrient-limited, water-limited, and both nutrient- and water-limited. On primary shoots, flowers from control plants, which were fertilized and kept continuously moist, exhibited the highest fruit set (92.1%), compared to nutrient-limited (87.5%), water-limited (77.6%), and both nutrient- and water-limited (69.7%) plants. Fruit set in flowers borne on secondary branches was less than on primary shoots for all treatments except for both nutrient- and water-limited plants, where fruit set was similar. Seed set in fruits produced on primary shoots was also affected by resource limitation. Compared to seed set in control plants, seed set was reduced in nutrient-limited, water-limited, and

both nutrient- and water-limited treatments. These results indicate that Hibiscus moscheutos adjusts both fruit and seed set in response to resource availability.

239

SMITH, GERALD L.¹, MARK A. GARLAND,² and WALTER S. FLORY.³ High Point University¹, Florida Department of Environmental Protection,² and Wake Forest University³--Rediscovery of *Hymenocallis puntafordensis* Traub. Many of the native species of *Hymenocallis* occurring in peninsular Florida are poorly understood. One of the most enigmatic has been *Hymenocallis puntafordensis*. It was described by Hamilton Traub from bulbs that flowered, received from C.L. Burlingham who had collected them near Punta Gorda, Florida. Before our study the species was documented only from the type specimen and in recent years its status had been questioned by the authors and Alan Meerow. Field studies of *H. palmeri* in central and south Florida during August 1993 resulted in our being near Punta Gorda late one rainy afternoon. Near the *H. palmeri* plants on a grassy roadside embankment bordering disturbed pine flatwoods, an unusual *Hymenocallis* was encountered. It possessed thickened lorate leaves, a multiflowered inflorescence and most strikingly, a small funnelform staminal cup with highly ornate margin. A reexamination of the data collected from Traub's type specimen of *H. puntafordensis* strongly supported the identity of our finding as this species. We recognize this species as a distinctive taxon and will be pursuing further studies of it. Its chromosome number has been determined from the type collection as 2n=46.

240

HARP, P. I. The Citadel--A laboratory investigation of an oviposition attractant in the golden salt marsh mosquito, *Aedes sollicitans* (Walker).

No abstract provided.

241

HENN, C. D. The Citadel--A laboratory investigation comparing the affects of selected factors on the behavior of colonized forms of the black marsh mosquito, *Aedes taeniorhynchus* (Wiedermann).

No abstract provided.

242

VAILE, W. J. The Citadel--A model to test the recommendation that draining an abandoned rice impoundment would effectively reduce a population of salt marsh mosquitoes.

No abstract provided.

243

HANNAH, RACHAEL. Florida Institute of Technology--Phylogenetic conservation of neuroanatomical pathways in catfish electrosensory nuclei.

No abstract provided.

244

KREBS, WILLIAM D. Florida Institute of Technology--Central projections of electrosensory afferent neurons in the Atlantic stingray, *Dasyatis sabina*.

No abstract provided.

245

KENYON, LESLEY. Florida Institute of Technology--Hormonal induction of sex reversal in African cichlid fishes.

No abstract provided.

246

LEE, DONG WON, ROBERTO RICO-MARTINEZ, AND TERRY W. SNELL. Georgia Institute of Technology--Copulatory behavior and mate-recognition pheromone binding to male receptors of the rotifer *Brachionus plicatilis* (O. F. Muller).

No abstract provided.

247

MALATESTA, ANNE. Florida Southern College--Techniques for saving the scrub morning glory, *Bonania grandiflora*.

No abstract provided.

248

TOWNSEND, HOWARD. Wake Forest University--Habitat selection in Galapagos sea birds.

No abstract provided.

249

KING, JENNIFER. Wake Forest University--
Taxonomic boundaries of the genus *Kalmia*.
No abstract provided.

250

POHLMANN, SUZANNE. Wake Forest
University--The role of hydrophobicity in the
HN protein of the paramyxovirus SV5.
No abstract provided.

251

BOYD, GIONETTA L., JENNIFER A. WONG,
AND GLEN PARSONS. University of
Mississippi--Critical swimming speed of
schooling fish.
No abstract provided.

252

ADKINS, REBECCA G. AND DIANE R.
NELSON. East Tennessee State University--
A survey of water bears (Phylum Tardigrada)
from Greene Mountain, Tennessee.
No abstract provided.

253

TIPTON-JONES, ELIZABETH AND REBECCA
PYLES. East Tennessee State University--A
test of convergence: analysis of dorsal pattern
variation in *Desmognathus ochrophaeus*.
No abstract provided.

254

DUNCAN, REBECCA AND DIANE R.
NELSON. East Tennessee State University--
Comparison of variety and density of
tardigrade populations on White Top
Mountain, Virginia, based on forest type and
altitude.
No abstract provided.

255

NEAL, CHRIS AND FROSTER LEVY. East
Tennessee State University--Genetic
variability in the *Salidago arguta* complex.
No abstract provided.

256

SPECK, RENAE R. Western Kentucky
University--Endothelial cell locomotion during
wound healing is regulated by inositol (1,4,5)
triphosphate and by cyclic (3,5) adenosine
monophosphate.
No abstract provided.

257

SZEREMETA, BRAIN W. Western Kentucky
University--Studies of the paraflagellar body
(PFB) in the euglenoid algal flagellum and its
presumed effects on photoreception.
No abstract provided.

258

SIZEMORE, JEFF. Western Kentucky
University--The induction of manganese super
oxide dismutase (Mn SO D) in bovine
pulmonary arterial and bovine lung
microvascular endothelial cells.
No abstract provided.

REVIEWS

Mayden, Richard L. (ed.). 1992. **Systematics, Historical Ecology, & North American Freshwater Fishes**. Stanford University Press, Stanford, CA. \$69.50. 969 pp.

The North American freshwater fish fauna is by far the best known and most intensively studied of any continent. Hundreds of publications have appeared, particularly during the past 40 years, focusing on such diverse subjects as systematics, ecology, morphology, behavior, and biogeography. Comprehensive regional ichthyologies exist for many states and for Canada. These efforts in turn have culminated in several recent outstanding publications. The first of these, the *Atlas of North American Freshwater Fishes* (Lee *et al.* [eds.] 1980) provided detailed spot-distribution maps and capsule accounts for all species living north of the Mexican border. It provided the impetus for two subsequent comprehensive works, *The Zoogeography of North American Freshwater Fishes* (Hocutt and Wiley [eds.]), published in 1986; and *Community and Evolutionary Ecology of North American Stream Fishes* (Matthews and Heins [eds.]), which appeared the following year. *Systematics, Historical Ecology, & North American Freshwater Fishes* comprises the next logical step in this distinguished series of books, since it draws on the above works for much of its information, and integrates this with modern evolutionary theories and analyses. The net result is that it provides the reader with an in-depth view of "cutting-edge" science as it relates to the field of natural history in general and North American ichthyology in particular.

Ichthyology has benefitted from the increasingly sophisticated methodologies (in both techniques and analyses) that have characterized the natural sciences in recent years. The present book provides the reader with examples showing how these methodologies have been integrated and applied to the wide range of subjects indicated above. It comprises 30 chapters, written by 42 of North America's leading ichthyologists, and is the outgrowth of a symposium (organized by Dr. Mayden) held at the 1989 national meetings of the American Society of Ichthyologists and Herpetologists, in San Francisco.

The book is divided into five sections, as follows: 1. The fishes, the theory, and the methods; 2. Phylogenetic relationships of North American freshwater fishes; 3. Morphology, ontogeny, and genetics; 4. Ecology and evolution; and 5. Speciation and biogeography. The first section comprises six chapters (an introduction, synopses of the 50 North American freshwater fish families, historical ecology as a research program, review of the methods and principles of phylogenetic systems, phylogenetic theory, and significance of the fossil record). The second includes eight chapters dealing with recent systematic studies, including individual species groups (subgenus *Boleosoma* of the percid genus *Etheostoma*, the cyprinid genus *Rhinichthys*, the fundulid genus *Fundulus*, and the gasterosteid genus *Pungitius*) and family relationships and interrelationships (Percidae, Cyprinidae, and Ictaluridae). Section 3 includes five chapters involving such diverse subjects as evolutionary implications of the pharyngeal jaw apparatus in primitive ray-finned fishes, evolution of feeding biology in sunfishes, developmental variability and heterochronic evolution in poeciliid fishes, chromosomal evolution in cyprinids, and evolution of genome size in North American fishes. The fourth section provides specific examples of how the field of ecology has recently been integrated with evolution (size and phylogeny on life history variation in North American percids, historical ecology of salmonid fishes, evolution of reproductive strategies in North American minnows [cyprinids], evolution of stream fish communities, and historical and recent influences on reproduction). The specific topics appearing in the last section (Speciation and Biogeography) include chapters on the evolution of the *Cyprinodon variegatus* species group, speciation in the southwestern minnow genus *Dionda*, speciation and relationships of the catfish genus *Noturus*, and phylogeny and biogeography of the suckers (Catostomidae). One of the final two chapters provides a capsule summary of what the reader has learned from reading the book, and asks the question of where we go from here. The other includes an updated annotated checklist (with both common and scientific names) of North American freshwater fishes. This checklist in many ways duplicates the freshwater section of the recently published (1991) AFS-ASIH checklist of common and scientific names of fishes. However, it also includes that portion of the Mexican fauna occurring north of the Isthmus of Tehuantepec—the first time such an integrated checklist has appeared in its entirety. The reader will also notice certain nomenclatural decisions that differ from the more conservative approach adopted in the 1991 AFS-ASIH list, as for example recognition of the gar genus

Attractosteus (combined with *Lepisosteus* in the AFS list); recognition of several different killifish families (Cyprinodontidae, Fundulidae [and Profundulidae]) included in the Cyprinodontidae in the earlier list); inclusion in the genus *Etheostoma* of those species formerly placed in the genus *Ammocrypta*; and recognition of the pygmy sunfishes as a separate family—Elassomatidae (included with the Centrarchidae in the 1991 list).

One important topic that could have been included in the book, but for some reason seems to have “slipped through the crack,” pertains to the evolutionary implications of hybridization in fishes.

Errors are remarkably few for a work of this magnitude, and there appear to be practically none involving the text itself. There have been occasional misspellings of scientific names (e.g. *Phenacobius* “*castostomus*” on page 536; *Noturus* “*leptocanthus*” in figure 3 on page 750); the photographs in figures 2a and b (page 381) of Chapter 11 are obviously reversed; and a portion of the distribution map appearing in figure 1b (page 577) of Chapter 21 has an incorrect overlay (i.e. the shaded area in western New York and northwestern Pennsylvania depicts part of the range of *Hybopsis dorsalis*, and not of *Ericymba buccata* as indicated). Considering the obvious care that went into the editing of this book, it is ironic that an embarrassing error appears in the commemoration section on page iii, in which David Starr Jordan’s name is misspelled “Jordon.” This is even more significant when one considers that Dr. Jordan was the first president of Stanford University—the publishers of the book!

I should point out that a much more detailed (and eloquent) review of the book may be found in Dr. Mayden’s preface, which appears on pages xvii–xxi, and in fact I was strongly tempted to plagiarize portions of the preface in preparing the present review. Purchaser’s of the book are urged to read the preface before getting into the main body of the text itself.

In summary, this book provides an in-depth look at modern evolutionary approaches in North American ichthyology in such diverse areas as systematics, paleontology, ecology, and functional morphology. Although a comparable effort probably is not yet possible for other parts of the world, where the necessary background information is not yet available, it serves as a model of what can be done. Dr. Mayden is to be strongly commended and congratulated for conceiving and organizing the 1989 symposium, and for carrying the excellent book that has resulted through to completion. Although fishes are the subjects on which the book is based, the paradigms provided extend far beyond the field of ichthyology. For this reason the book deserves to be on bookshelves of individuals working in other areas of evolutionary biology, both in this country and elsewhere. The relatively modest price tag for a work of its size (\$69.50) goes a long way toward making this possible.

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Bildstein, Keith L. 1993. *White Ibis Wetland Wanderer*. Smithsonian Institution Press, Washington, DC. \$22.50. 242 pp.

Read this book and get two for the price of one. It provides an in-depth look into the life of the white ibis and provides it in a manner that will, I believe, be attractive to the non-scientist as well as to students of ibises. Perhaps more important than the information provided about ibises, however, this book is an excellent introduction to field biology. Further, it provides considerable insight into the kind of thinking that goes into developing ecological research programs and demonstrates very well the way that the first answer leads to a second question and so on until years of work begin to provide a real understanding of a species or an ecological problem. It will be an excellent primer for students planning careers in field biology, ornithology or ecology.

The plan of the book is unusual. Most such volumes about a single species or group of species come across as impersonal accounts of the various aspects of the life of the selected species. Bildstein conforms in chapter one, beginning with a look at the place of ibises in early human civilizations, including Egypt, Europe, and the Americas. He then departs from most single species books focusing closely on the white ibis in coastal South Carolina; interweaving a discussion of the ecology of white ibises nesting in a large rookery on a marsh island owned by the Belle W. Baruch Institute for Marine Biology and Coastal Research near Georgetown, South Carolina, with an account of how he became so deeply involved with research on the species. While the approach appears difficult, it was handled with aplomb. The reader learns about white ibis reproductive cycles, relationships with the environment, and of things still to be learned.

Bildstein’s work began with field studies employing detailed observations of ibises in their natural environment as he documented the reproductive cycle, but his studies soon evolved to incorporate work with captive ibises as he sought information on the growth of chicks and of the importance of freshwater crayfish in their diets. This leads to discussions on the importance of regional climate on

ibis reproductive success and helps to provide insight into the reasons for the “wandering” of the species.

If there is a criticism, it has to do with the chapter on the plight of Trinidad’s scarlet ibises. While interesting, it seemed not to fit the flow of the story as well as other chapters.

The book is technically very well done. Bildstein and Smithsonian Press have produced a book with strong, clean, uncluttered pages. Black-and-white figures are frequent, helpful, and well done. Unfortunately the black-and-white photographs are somewhat dark and not as useful as are the line drawings.

When I had completed reading the book, I had two thoughts. The book was a good compilation and summary of what is known about the white ibis. As such, it will be required reading for students of wading birds. My second thought was that this should be required reading for anyone considering a career as a field biologist. I think that all of my future graduate students will find it on their required reading list.

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Katona, Steven K., Valerie Rough, and David T. Richardson. 1993. A Field Guide to Whales, Porpoises, and Seals from Cape Cod to Newfoundland. 4th ed. Smithsonian Inst. Press, Washington, DC. \$15.95. 185 p.

Not “your usual field guide”.

Following the pattern of the original edition, the authors have expanded the format of a field guide far beyond the concept of Peterson and Audubon Field Guides. This guide is not just, a what is it, and where does it occur rendition. The authors have expanded the traditional “field guide” to include and expand their perception of behavior, comment on apparent abundance and editorialize on current problems and potential threats to individual species. A welcome addition to the edition is the inclusion of a section “bonuses for whale watchers,” the listing of other animals frequently seen, and the acknowledgement by cetacean people that there are “Important Prey Species of (maybe they should have said ‘for’) Whales, Porpoises and Seals” and a short summary of the prey species.

Perhaps, a better title might have been “A Naturalists Account of the Whales, Porpoises and Seals” Contrary to the author’s expressed intent to describe the species by their initial and most identifying characteristics the reader has to wade through the individual species accounts to find out: how to identify the beast, where is it found and what are the identifying characteristics. Regrettably, the “Key for Identifying” occurs at the end of each section. While the authors profess that each species description begins with the most obvious key to species identification the pattern is soon obscured in the species, behavioral and human interaction accounts.

This is not “your usual field guide”. The authors have recounted their experiences, expanded on the observations of other’s and extrapolated the hypotheses of some environmentalists and animal rightists by using such anthropomorphic terms as sadness and pathetic to describe situations, and refer to ozone deletion and aquarium capture as being the problems for the survival of marine mammals. Unfortunately there is a lot of inference and little bibliographic documentation in the field guide. While there is an extensive “bibliography”, and the authors acknowledge the difficulty in citing each reference, it would have been appropriate to cite the key references in their editorial comments.

Technically the “Guide” needs some editing. On page seven there is a reference to a table “below” that occurs on the previous page. In addition, the authors constantly refer to their study area without defining their study area, we must assume that it is from Cape Cod to Newfoundland. They also wander from “their study area” to editorialize on the hunt of whales by or for endemic peoples. Within the individual species accounts the authors have accumulated and interpreted their and other marine mammal researchers’ observations. They have defined the organization of the species accounts into four ecological groups. Unfortunately, the fourth grouping is not an ecological distinction. While they acknowledge it is similar to their third group it can lead the lay reader, the intended user of the guide, to illogical conclusions. Within the species accounts there are some minor errors, assumptions, and misstatements.

Harbor porpoise: Harbor porpoise probably eat more than 35–40 times their body weight per year. *Pilot Whales:* I do not believe water depths “descend”, they may increase and the whales may descend. *White-sided dolphin:* While I agree that it is a “lovely and energetic” animal, I am not sure that it is a sad occasion for the dolphin when it strands. Tragic, yes, but do we know that the dolphins are “sad”? *Common dolphin:* An accurate description, but the diversion from the Atlantic situation to

the problems of the Pacific Ocean issue of the tuna-dolphin problem is an editorial diversion. In addition the facts seem out of date. *Striped dolphin*: The authors seemed to imply a cause and effect between harbor seal die-offs and the striped dolphin mortality and human caused contamination. This is an instance where their reference to specific literature would be helpful. In particular since the "Guide" is targeted to the lay reader. At best this section is unclear and speculative.

Bottlenose dolphin: The authors report that this dolphin eats 10% of its body weight per day. This is significantly more than reported for the harbor porpoise, a much smaller animal, with a high metabolic demand. The authors need to carefully review the facts and figures. In addition the authors have promulgated that the capture of bottlenose dolphins has reduced populations (significantly) in some locations, that swim programs are detrimental to the animals, and that the Navy has trained dolphins to "plant explosive charges". These assumptions ignored current literature and/or do not provide specific bibliographic references. Unfortunately, the lay audience may not realize the difference between scientific fact and editorial license. *Killer whale*: The authors have succumbed to the anthropomorphic trap, that whales have cultures. While we all acknowledge that different populations of whales have different vocal signals, somewhat like our pet dogs have different barks, and dogs recognize the difference between "get the paper", "go outside", and "sit up", whether in Chinese, Russian or English, we do not ascribe or define the difference to "culture". The accounts of killer whales in captivity appear to be based on hearsay. The account of Orky, and the speculating of his socialization is inaccurate. I was personally involved in his capture, and he was almost 17 feet long when captured. *Sperm whale*: The authors accurately described the known behavior and habits of this whale until they relate that the "preferred" feeding depths of males and females are different, and that difference in their size makes the difference. This is speculation, in science a hypothesis, and today still a hypothesis.

The species accounts for basking sharks, ocean sunfish, and leatherback turtles is a welcome addition. These animals are frequently seen by whale watchers off New England. I was surprised to see in print one more time the myth that basking sharks are inactive, rest on the bottom during the winter and that they shed their gill rakers and then grow new ones for resumption of feeding in the spring.

The section on seals is well done. The photos, drawings and descriptions enable the user to easily identify the animals and the interesting comments on behavior, research and human interactions provide the reader a wealth of information.

Unfortunately this volume is not a scientific paper, open to challenge and peer review. It is intended to be a field guide. The authors have not always distinguished between fact, theory, and opinion and the lay reader may continue to promulgate some of the opinions.

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Clark, Robin J. H. and Ronald E. Hester (eds). 1993. Biomolecular Spectroscopy, Part A. John Wiley & Sons Ltd., Chichester, England. \$250.00. 383 p.

As the editors state in the preface, this book is "concerned with spectroscopic studies of a wide range of molecular species and their reactions in solution. The common theme throughout is molecular biology". The topics covered in this volume are: Infrared Spectroscopy of Retinal Proteins; Ultraviolet Resonance Raman Studies of Proteins and Related Model Compounds; Raman, Resonance Raman and FTIR Studies of Enzyme-Substrate Complexes; Cytochrome c Peroxidase: Resonance Raman Spectroscopy and Site-Directed Mutagenesis for Studying Structure-Function Relationships in Peroxidases; Genetically Inserted Tryptophans in Protein Spectroscopy; Raman Microspectroscopy of Single Whole Cells; Surface-Enhanced Raman Spectroscopy and its Biomedical Applications; Quantitative Determination of Conformational Disorder in Biological Membranes by FTIR Spectroscopy.

This book is certainly not a textbook but is a series of eight reviews by acknowledged leaders in the field. The editors claim that the subject matter is presented "in a manner comprehensible to the non-expert" and that this will be of value "to teachers and to both graduate and undergraduate students". To assist in this, a table of the International System of Units (SI), some explanation of relationships of SI and non-SI units and definitions of some of the terms used throughout the book is in the front of the book. Each chapter (review) has an introduction and a summary that is simple and easily understood to virtually anyone with a rudimentary knowledge of spectroscopy. However, after that, it becomes difficult wading to anyone who is not an expert in that specific area. The large number of abbreviations and symbols used require close attention but, at least, they are reasonably uniform between chapters. Most of the difficulty is due to the technical nature of the material. The index is limited, three pages of 233 indexed terms, which does not help much when trying to thumb back

through the volume to look for other explanations of specific phenomena. The references listed at the end of each chapter is comprehensive (avg. = 95 references per chapter; range = 31–152 references per chapter) and most useful.

The chapter that was of most interest to me was the one on Raman spectroscopy of single whole cells. This gave a description and a line drawing of the instruments that can be used with single (or small numbers of) cells. It described some of the problems with the procedures and instruments, and some ways to overcome those problems. It gives examples of spectroscopy research done with prokaryotic cells, algae and plant cells, erythrocytes, thrombocytes, leukocytes, lymphocytes (T-lymphocytes, B-lymphocytes, T-helper/inducer cells and T-cytotoxic/suppressor cells), and photoreceptor cells (rods).

This book is more valuable to the researcher than it is to the teacher or student. Even so, I cannot imagine many researchers having interests that are broad enough to include more than 2–3 chapters of this book. Because much of this information is available in the primary literature and since many journals provide yearly reviews (e.g. *Photochem. Photobiol.*) that often include spectroscopic techniques, it is hardly worth paying this kind of money for this book. It is a good treatment of biomolecular spectroscopy but priced far beyond the value of the book.

JIM ROSS, *Department of Biology, Cumberland College, Williamsburg, KY 40769.*

McMeekin, T. A., J. N. Olley, T. Ross, and D. A. Ratkowsky. 1993. **Predictive Microbiology: Theory and Application.** John Wiley and Sons, Inc., NY. \$84.95 (hard cover). 340 p.

During the last 100 years, there have been many approaches to measuring the effects of temperature on the rate of chemical reactions. The leading proponents of these predictive kinetics have been Svante Arrhenius and Jan Bělehrádek. The Arrhenius equation was derived to describe the effects of temperature on the reaction velocity of gases while Bělehrádek described the regulatory influence of temperature upon physiological processes. Parts of these mathematical models were adapted to predict microbial behavior in a given environment. This has evolved into the field of predictive microbiology, a concept which is defined by the authors of this book as "a detailed knowledge of the growth responses of microorganisms to environmental conditions".

The text is designed to present a contemporary view of the status of kinetic predictive microbiology both from a theoretical and applied perspective. The authors have chosen to apply predictive microbiology to food processing; and develop techniques for evaluating the effects of processing, distribution and storage operations on the microbiological safety and quality of foods. However, the book is much more useful than this. Growth responses to temperature and other factors show apparent universality so that the predictive models (and mathematical approaches) are applicable to other microbial environments and food microbiology serves as a useful illustrative theme.

Many of the models and equations presented in this book are based upon the effect of temperature on the growth of microbes. This is a valid approach since the discipline of predictive microbiology has evolved largely from experiments to measure the change of growth rate of organisms in response to temperature. The authors contend that other microbial responses to environmental changes follow patterns similar to the temperature responses indicating an apparent universality of rate responses to temperature so that this topic serves as a useful illustrative theme.

Both researchers and technologists concurrent with growth kinetics will find this monograph a useful reference. Thoroughly covered are the basic strategies and methods for sampling and development of kinetic model designs. Different predictive models are presented and their performance compared. Particularly useful are the sections on modelling combined effects of factors on microbial growth rate and evaluation of hygiene and microbial safety of products and processes. For a biologist, the section on thermodynamic approaches to bacterial growth is especially useful and, in fact, deserves expansion. Predictive microbiology is a developing field. Referenced in this book are more than 350 research articles, an apparently thorough compilation. This book is a basic reference work for bio-engineers, food processors, pilot plant operators, and basic or applied researchers involved with growth of bacteria and observation of their products. My major criticism is directed toward the production aspects of the book. The print contrast is variable and bleeds through the paper making the book less than pleasing to read. The unattractiveness of the book, however, should not deter one from utilizing the well organized monographic information contained therein.

GERALD H. ELKAN, *Department of Microbiology, North Carolina State University, Raleigh, NC 27695.*

James R. Troyer. 1993. **Nature's Companion: B. W. Wells, Tar Heel Ecologist.** The University of North Carolina Press, Chapel Hill. \$24.95. 248 p.

James Troyer has written a comprehensive and detailed account of the life and works of Bertram Whittier Wells. This authoritative biography fully completes the briefer sketch of Wells' life which he published in the *American Journal of Botany* in 1986. The text is rich in the history of North Carolina and of the nation during the first half of this century. With this as backdrop, Troyer recounts the social and political mores experienced by Wells and the educational and scientific values by which he guided his professional life. The main theme that runs throughout this story is that Wells was a man driven by an irrepressible pioneering spirit.

Wells, a true "Tar Heel Ecologist," was born in 1884 and lived until 1978. The near-century of his life spanned the time, almost exactly, from when the field of plant ecology had its origins in Europe to when the science of ecosystems ecology had come of age and, for the first time, began to shape thinking in such areas as business, politics, and law as well as reshape thinking in many disciplines of the life sciences. Though not trained as an ecologist, Wells was an excellent field botanist and became one of the most ardent enthusiasts of the wonders of North Carolina's rich vegetation, restricting his studies of plants almost exclusively of the eastern regions of the state. His observations of plant communities and his qualitative descriptions of factors that molded them are among the earliest made in the state and, for that matter, in the field of plant ecology. His major publications date from 1924 to 1953. In describing these activities and contributions, the author rightly dubs Wells as one of the nation's "first-generation" plant ecologists.

A scientific career, more than most, rests on the evaluation of professional acuity as measured by one's peers. One of the most interesting features of the book is the way in which the author objectively weighs this measure of Well's career. Though Wells is appropriately given due recognition for his numerous scientific, academic, and administrative achievements, the author goes to some length in relating actual or perceived errors in Wells' judgment and the ways in which many of such "faults" were interpreted by his peers. To summarize a good deal of interesting evidence and opinion, it may be said the author concludes Wells was poorly understood and little recognized in the field of plant ecology. The result was his isolation and the near-dismissal by his peers and the generations following them. A casual examination by this reviewer may add some credence to these conclusions. In the first edition of the classic textbook *Plant Ecology* by J. E. Weaver and F. E. Clements, published in 1929, there are three citations listed of works by Wells while in the second edition, published in 1938, there are two.

The biography has been organized in a way that facilitates an understanding of the many sides of Wells in his various pursuits of life. There are four principal parts each with three chapters (one has five), which recall Wells the Scientist, the Champion of Nature, the Academician, and the Private Person. Though most of the content of the chapters unfolds parallel with time, there is little overlap of information in them. Thus, by use of this method, Troyer provides an effective interweaving of information that continually adds to knowledge of the character and disposition of Wells. The reader quickly learns of his integrity, determination and energy; all of which served him as an administrator in initiating a department of botany in a fast growing state college (which became North Carolina State University), as an educator teaching his students as well as the general public, and as a research/scholar asserting himself within the boundaries of an emerging and complex science. The book is well written, attractively laid out, adequately indexed, and thoroughly annotated. James Troyer has made a valuable addition to the history of science with this biography. Further, he has provided a significant contribution to those of us who knew B. W. Wells and those of us who did not.

TOM K. SCOTT, *Department of Biology, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

ALABAMA

University of North Alabama, Department of Biology. Dr. Paul G. Davison (Ph.D. Botany, University of Tennessee) has been appointed Assistant Professor of Biology. His research interests include bryophyte taxonomy and floristics.

GEORGIA

Georgia Southern University, Department of Biology. The following individuals were guest speakers at the CLEC Seminar Series. Dr. Henry R. Mushinsky, University of South Florida; Dr. Stewart Nicol, University of Tasmania, Australia; Dr. Catherine Pringle, Institute of Ecology, University of Georgia; Dr. E. Paul Wileyto, U.S. Agriculture; Dr. Thomas Schmidhouser, Southern Illinois University.

KENTUCKY

Western Kentucky University, Department of Biology. Dr. Douglas M. McElroy (Ph.D., University of Maine) has joined the department as an Assistant Professor filling the position in Evolutionary Ecology and Genetics. Dr. McElroy was on a Postdoctoral fellowship at Arizona State University before coming to Western Kentucky. A scholarship fund has been established in honor of the late Dr. Larry Neil Gleason and contributions may be sent to the College Heights Foundation of Western Kentucky Univ.

MISSISSIPPI

Gulf Coast Research Laboratory, Ocean Springs. Project Marine Discovery (PMD), the Laboratory's multi-faceted educational program at the J. L. Scott Marine Education Center and Aquarium, has been recognized as one of 20 award-winning environmental programs by Renew America, a non-profit organization based in Washington, DC, which identifies, verifies, and promotes environmental initiatives. A \$347,096 contract has been received by the GCRL for the development of water quality, eutrophication and coliform models for the Back Bay of Biloxi. Dr. William W. Walker, assistant director for research and senior toxicologist, will direct the program. Dr. Sharon H. Walker participated in the Marine Technology Society's 1993 meeting in Long Beach, California. GCRL histotechnologist Retha Edwards was presented the Convention Scholarship Award by the National Society for Histotechnology at its annual meeting. Wade E. Howat, geology research associate, attended the 43rd annual convention of the Gulf Coast Assn. of Geological Societies. He accepted the Best Published Paper Award for 1992 from the Society of Economic Paleontologists and Mineralogists for a paper he co-authored with senior geologist Dr. Ervin G. Otvos.

NORTH CAROLINA

The University of North Carolina at Greensboro. Dr. Paul Lutz is currently serving a year-long term as President of the N.C. Academy of Sciences. Dr. Karen S. Katula joined the Biology faculty this year in cellular and molecular biology. Her Ph.D. is from Northwestern University, and postdoctoral work at Oregon State University and at Caltech. Her last assignment was at West Virginia University. Her general interest is in the genetic regulation of animal development, with a special emphasis on

genes that are involved in the control of cell division. *Robert Caple*, another relatively new member of the department, works as the lab manager and safety officer. His B.S. degree is from Shaw University. *Dr. Randa Meehan* (Ph.D., School of Marine Science, Virginia Institute of Marine Science, College of William and Mary) joins the faculty in the area of behavioral ecology, fisheries biology, and biostatistics. *Paula Burch* is a new addition to the department with duties of teaching anatomy labs and lecturing in physiology. Her Master's degree is from Eastern Kentucky University in Biology. *Jim Chandler*, whose B.A. is from UNCG, is the general biology and physiology lab preparator.

MUSEUMS AND BOTANICAL GARDENS

MISSISSIPPI

Mississippi Museum of Natural Science, Jackson. *Mark Woodrey* has been hired as the staff Ornithologist to replace *Dr. Cheri Jones*, who left Mississippi last year to take the position of Curator of Mammals at the Denver Museum of Natural History in Colorado. He earned his M.S. in Zoology from Ohio State University, and is currently a Ph.D. candidate in biology at the University of Southern Mississippi. Federal funds amounting to \$126,000 have been received from the Museum for eight projects dealing with endangered species research. *Ms. Sherry Stultz* is new to the education staff. Sherry earned her B.S. degree from Mississippi State University in Forestry with an Environmental Conservation Option. Sherry's diversified environmental interests deal with the Red-cockaded Woodpecker habitat surveys in the DeSoto National Forest.

OBITUARY—Dr. Woolford B. Baker

Dr. Baker died 27 December 1993, a few days short of being 101 yr old, at Emory University Hospital. He is survived by eight grandchildren and 13 great grandchildren, as well as two daughters, two sisters, and one brother.

Dr. Baker was a noted biologist, educator, and civic leader. He held degrees from Henderson-Brown College (AB), Emory Univ. (MA), and Columbia Univ. (Ph.D.). He was professor emeritus of biology at Emory Univ. for 43 yr before retirement in 1961. He served an additional 22 yr as director of the Emory Museum.

Dr. Baker served as acting professor of biology at Agnes Scott College (1922–24), summer teaching staff Univ. Virginia (1952, 1955), summer instructor Woods Hole Oceanographic Institute (1926), Asst. prof. biology Columbia Univ. (1924–25), and director Ga. Sci. Curriculum Conf. (1957–58). He was Rosenwald Fellow Wilhelm Inst. Berlin, in 1932–33.

Dr. Baker was the ASB 1955 outstanding biology teacher in 1962 and the first recipient of the Thomas Jefferson Award given by Emory Univ. for outstanding service to the Univ. and the community. He was designated “Founder of FernBank” by the Fernbank board of trustees, and served on the board for many years.

Dr. Baker was president of the Ga. Acad. Sci., Atlanta chapter Amer. Assoc. Univ. Professors, and the local chapter of Phi Beta Kappa. He was fellow of the Amer. Assoc. Adv. Sciences, a member of Phi Sigma Biol. Soc., Botanical Soc. Amer., Ga. Soc. Naturalists, Torrey Botanical Club, Sigma Xi, ODK, Kappa Phi Kappa, and Sigma Chi social fraternity.

Dr. Baker co-authored the three-vol. “Southern Nature Stories” in 1938–40. He spoke on horticulture, conservation, and biology to civic groups and garden clubs throughout the southeast. He authored numerous scientific papers.

Dr. Baker was a member of Glen Memorial United Methodist Church where he served as chair of the board of education and superintendent of the church school. For the past several years he was a resident of Wesley Woods, Decatur, Ga.

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CONTENTS

THE ASB BULLETIN

VOLUME 41, NUMBER 2, APRIL 1994

Program of the 55th Annual Meeting of ASB	39
Invited Plenary Speaker	48
ASB Candidates for Office—1994	50
ASB Paper and Poster Sessions	54
Author Index	80
Abstracts	82
Reviews	143
News of Biology in the Southeast	149
Obituary—Dr. Woolford B. Baker	151

The *ASB BULLETIN*

Volume 41, Number 3

July 1994

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Society, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, SE Div. Amer. Microscopical Society, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1995	April 19-21	University of Tennessee, Knoxville, TN
1996	April 10-13	Ga. Southern College, Statesboro, GA
1997	April	Furman University, Greenville, SC
1998	April	Northeast Louisiana Univ., Monroe, LA

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DISTRIBUTION AND ABUNDANCE OF THE
SHARPHEAD DARTER, *ETHEOSTOMA ACUTICEPS*
(PERCIDAE), IN NORTH CAROLINA

Fred C. Rohde

North Carolina Division of Marine Fisheries
127 Cardinal Drive Extension
Wilmington, NC 28405-3845

and

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ABSTRACT

The distribution and abundance of the North Carolina state-endangered sharphead darter, *Etheostoma acuticeps*, was surveyed in the upper Nolichucky River system in North Carolina during the period 1991–93. This was augmented by literature and unpublished records. *Etheostoma acuticeps* was found at 11 of 57 sites sampled in the Nolichucky River and upstream in the lowest 8 km of the Cane River, the lowest 18.6 km of the North Toe River, and in one tributary of the last. It was common to abundant (>10 specimens per collection) at most localities. The darter was collected in riffles over a substrate of large gravel, medium-sized rubble, and boulders, and the latter two were usually encrusted with riverweed, *Podostemum ceratophyllum*. It was most common in riffles near river islands. Although the range of the species in North Carolina is small, its presence is secure there.

INTRODUCTION

Etheostoma acuticeps, the sharphead darter, was described by Bailey (1959) based on two specimens collected in 1947 and four collected in 1949, all from the South Fork Holston River in Tennessee. At the time of its description, the only known sharphead darter locality had been inundated by the newly constructed South Holston Reservoir. L. W. Knapp with B. B. Collette, and T. Zorach, independently located in the 1960's in the Academy of Natural Sciences at Philadelphia three collections (21 specimens) of *E. acuticeps* made by J. G. Carlson and T. Kerr in June 1930 in the lower South Fork Holston River in Tennessee and one collection (7 specimens) from an unspecified site in the upper North Toe River (upper Nolichucky River system) 6–10 km upstream of Spruce Pine in North Carolina (Zorach and Raney 1967; Zorach 1972). The species was not found in subsequent searches in the North Toe River and it was believed to be extinct (Jenkins and Burkhead 1975), presumably due to siltation from mining activities and erosion that had reduced its spawning habitat (Bryant *et al.* 1979).

Three individuals were captured in 1972 in the South Fork Holston River in Virginia just above the South Holston Reservoir by Jenkins and Burkhead (1975) who recommended that the species be listed as federally endangered. Additional specimens were then collected by Tennessee Valley Authority biologists in 1975

in the Nolichucky River in Tennessee (Saylor and Etnier 1976; Bryant *et al.* 1979). This led to searches for it in tributaries of the upper Nolichucky River. Bryant *et al.* (1979) reported the darter from the lower Cane River in North Carolina. These records prompted a status survey in 1984 by W. H. Haxo and R. J. Neves (1984, U.S. Fish and Wildlife Service unpublished rep., 47 p.), which was based on their collections and some by E. F. Menhinick of the University of North Carolina at Charlotte. Haxo and Neves (*loc. cit.*) better defined its range and they concluded that the darter did not warrant federal protection, although they did identify threats to its continued survival in the upper Tennessee River drainage. A. L. Braswell (1991, North Carolina Wildlife Resources Commission unpublished rep., 127 p.), however, concluded that it be listed as threatened in North Carolina.

The objective of this paper is to summarize and to add to the existing data on the distribution and habitat of the sharphead darter in North Carolina.

STUDY AREA

Collections were made in the upper Nolichucky River system (Nolichucky River, Cane River, North Toe River, and South Toe River) in North Carolina. This system is located in the Blue Ridge physiographic province, and drains all of Mitchell and Yancey counties and part of Avery County, an area of approximately 1,686 km² (Crowell 1965).

MATERIALS AND METHODS

Six field trips were made to Avery, Mitchell, and Yancey counties, North Carolina during low water conditions in July, August, and September 1991, October 1992, and July and September 1993. We sampled at four previously known sharphead darter sites, but our emphasis was on sampling outside of the known distribution of the species in North Carolina as it was defined by Haxo and Neves (*loc. cit.*).

We collected primarily with a backpack shocker and a seine, as described by Jenkins and Burkhead (1975). Each site was electrofished for 45–110 min. However, we sampled 12 sites in 1991 with only a seine (3.05 m × 1.2 m, 0.64 cm mesh) and one site in July 1993 only by snorkeling. Fishes were preserved in formalin for later identification except when large numbers of *E. acuticeps* were captured; fishes were then immediately identified and released. We deposited preserved specimens in the North Carolina State Museum of Natural Sciences in Raleigh. Fish associates and habitat (stream depth, width, current, and substrate type; air and water temperatures; and pH and aquatic vegetation) were recorded at each site. Our data on “current” are qualitative, and are estimates based on our previous field experience. Substrate type was characterized by the approximation procedures of Jenkins and Burkhead (1975): gravel (0.3–8.0 cm diameter), rubble (8.0–30.0 cm), and boulder (>30 cm). We added the category bedrock (unbroken solid rock).

We made 43 collections for the darter, Menhinick made 32 collections during 1967–85 (Menhinick, *pers. commun.*, 1993), and Haxo and Neves made 18 collections in 1984. These collections were made at a total of 57 localities as follows: Nolichucky River (2 localities), Cane River (18), North Toe River and its tributaries (23), and South Toe River (14); 14 localities were sampled more than once.

RESULTS

Etheostoma acuticeps has been collected at 11 of 57 sites sampled in North Carolina; it was not taken at another 46 sites (Fig. 1).

Sites (by number) where it was taken, the location, the number of individuals collected, and the months of collection are: **North Toe River:** Site 1) below NC 197, 12.5 km NE of Burnsville, 13 specimens (Oct 1992); 2) along State Route 1336, 0.6 km downstream of bridge at Green Mountain, 29 (Oct 1992); 3) Pigeonroost Creek, above NC 197 bridge, 2 (July 1993); 4) below junction NC 197 and State Route 1349, 20+ (June 1984); 5) along State Route 1304, 0.6 km ENE of Hunt Dale, 20+ (June 1984), 55 (July 1993). **Cane River:** 6) below State Route 1444 bridge at Ramseytown, 6 (June 1984), 1 (July 1984), 7 (July 1993); 7) along US 19W, 1.3 km NE of Ramseytown, 1 (June 1984); 8) below US 19W bridge, 1.3 km SE of Sioux, 19 (July 1977), 0 (Sept 1980), 1 (June 1984), 1 (Sept 1993); 9) along State Route 1417, 2.1 km ESE of Sioux, common (June 1984); 10) above State Route 1343 bridge, 3.4 km E of Sioux, 10 (Sept 1977), 11 (Sept 1980), 8 (Sept 1985), 133 (Oct 1992), 195 (Sept 1993). **Nolichucky River:** 11) along State Route 1320, 2.1 km NW of Hunt Dale, 15+ (June 1984).

We collected *Etheostoma acuticeps* in the lowest 18.6 km of the North Toe River (Fig. 1, Sites 1, 2, and 5). It had also been captured by others at Site 5 in 1984. We did not sample at Site 4 where the darter was collected in 1984. The number of sharpnose darters per collection per site ranged from 13 to 55; the largest numbers were taken downstream. Our collections represent an upstream extension of 15.4 km beyond that reported by Haxo and Neves (loc. cit.). We also captured two specimens in lower Pigeonroost Creek, just above its confluence with the North Toe River (Fig. 1, Site 3).

Seven specimens of *E. acuticeps* were collected in two attempts at Site 6 in the Cane River (Fig. 1). It had been taken there in low numbers in 1984. One specimen was captured downstream at Site 7 in 1984. We did not sample there. We found one specimen at Site 8, where 19 specimens had been collected in 1977 by Bryant *et al.* (1979). Bryant *et al.* (1979) noted that the area had been heavily impacted by a flood and a subsequent bridge replacement in late 1977, the latter had eliminated most sharphead darter habitat. This might explain our small catch. We did not sample at Site 9. Our largest collections (133 to 195 specimens of *E. acuticeps*) were made downstream at Site 10 (Fig. 1). It had also been common here in 1977 and 1980. We did not locate a new site in the Cane River.

Haxo and Neves (loc. cit.) collected 15 specimens at Site 11 (Fig. 1) in the Nolichucky River, and they had reported that Menhinick did not collect it at a site 4.1 km further downstream. We did not sample in the Nolichucky River.

No sharphead darter is known from the South Toe River.

Our collections are dominated by adults of the darter, but all size groups are represented.

We collected 31 fish species with the darter (total $n = 32$ species) at Sites 6, 8, and 10 in the Cane River, at Sites 1, 2, and 5 in the North Toe River, and at Site 3 in Pigeonroost Creek (Table 1). All sites were sampled by the electroshocker and seine method. Sixteen of the 32 species were taken together in all three streams, while nine species were taken at only one site (Table 1). Seven species associates were darters, of which four, the greenside darter, *E. blennioides*; greenfin darter, *E. chlorobranchium*; banded darter, *E. zonale*; and gilt darter, *Percina evides*, occurred with *E. acuticeps* in all three streams (Table 1). Twenty-six species (14 were cyprinids) were collected in the North Toe River, the largest (mean width 31 m) of these three streams. The gilt darter was taken in the largest numbers

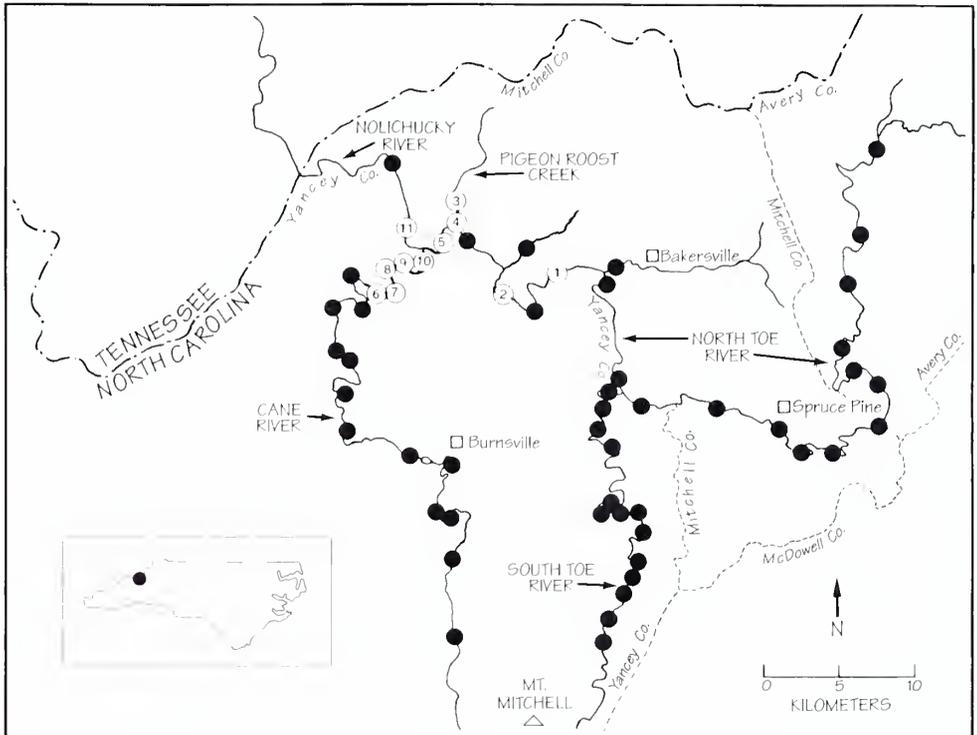


Fig. 1. Upper Nolichucky River system, North Carolina, sites ($n = 57$) sampled for *Etheostoma acuticeps* during the period 1967–93. The species was found only at the numbered sites.

(mean of 185.0 specimens per collection) in the North Toe River. Twenty-four species were collected in the mid-size (mean width 18 m) Cane River. Dominant species here were river chub, *Noconius micropogon* ($\bar{x} = 129.7$); banded darter (84.7); gilt darter (75.3); central stoneroller, *Campostoma anomalum* (74.3); and sharphead darter (67.7). We collected a total of 21 species in Pigeonroost Creek (width 6 m), of which the central stoneroller ($\bar{x} = 172$), greenfin darter (97), and mottled sculpin (71) predominated.

Environmental Observations—Substrate in the lowest 8 km of the Cane River consisted primarily of large gravel, medium-sized rubble, and small boulders. Riverweed, *Podostemum ceratophyllum*, encrusted the rubble and boulders. Water-willow, *Justicia americana*, bordered the shoreline. *Etheostoma acuticeps* was most abundant in riffles of large gravel and medium rubble at a depth of 15 to 46 cm, often near rocks which were covered with *P. ceratophyllum*. Substrate and depth at productive localities in the North Toe River were similar to those observed in the Cane River, but *P. ceratophyllum* was more common in the latter. Haxo and Neves (loc. cit.) collected the darter at the head of an island over a riffle of medium-sized rubble in the larger (>61 m wide) Nolichucky River.

We estimated that the current at the Cane River and North Toe River capture sites was moderate (<1 m/sec). *Etheostoma acuticeps* was not taken in the swiftest waters. Current in the Nolichucky River at Site 11 was slower than that noted by us at productive sites (e.g. Sites 1, 2, 10) upstream in the other rivers. Bryant

Table 1. Mean number of specimens per collection of fish-associates taken with *Etheostoma acuticeps* in 1992–1993 in the upper Nolichucky River system, North Carolina. Numbers in parentheses refer to number of sites in which a species was taken. An asterisk denotes the number of sites sampled for which data are included in this table.

	Cane R (3*)	N. Toe R (3*)	Pigeonroost Cr (1*)
<i>Camptostoma anomalum</i>	74.3 (3)	15.0 (3)	172
<i>Cyprinella galactura</i>	18.0 (3)	11.7 (3)	4
<i>Erinystax insignis</i>	5.3 (2)	14.0 (3)	10
<i>Luxilus coccogenis</i>	7.3 (2)	11.3 (3)	20
<i>Nocomis micropogon</i>	129.7 (3)	16.3 (3)	3
<i>Notropis amblops</i>	1.0 (1)	0.7 (1)	
<i>N. leuciodus</i>	10.0 (3)	22.7 (3)	
<i>N. photogenis</i>		0.7 (2)	3
<i>N. rubellus</i>	1.0 (1)	13.7 (3)	5
<i>N. spectrunculus</i>		1.3 (1)	8
<i>N. telescopus</i>	4.0 (3)	48.0 (3)	26
<i>N. volucellus</i>		4.3 (2)	
<i>Phenacobius crassilabrum</i>	5.3 (3)	1.3 (3)	3
<i>Rhinichthys atratulus</i>			1
<i>R. cataractae</i>		0.7 (1)	
<i>Hypentelium nigricans</i>	7.0 (3)	9.3 (3)	8
<i>Moxostoma dugquesnei</i>	0.3 (1)		
<i>Ictalurus punctatus</i>		0.3 (1)	
<i>Noturus flavus</i>	0.7 (1)		
<i>Pyloodictis olivaris</i>	1.3 (2)		
<i>Oncorhynchus mykiss</i>			23
<i>Cottus bairdi</i>	1.0 (3)	0.3 (1)	71
<i>Ambloplites rupestris</i>	2.7 (3)	0.7 (1)	
<i>Micropterus dolomieu</i>	4.7 (3)	2.7 (2)	1
<i>Etheostoma acuticeps</i>	67.7 (3)	32.3 (3)	2
<i>E. blennioides</i>	33.7 (3)	8.3 (3)	2
<i>E. chlorbranchium</i>	40.3 (3)	5.3 (2)	97
<i>E. swannanoa</i>		0.3 (1)	2
<i>E. zonale</i>	84.7 (3)	25.3 (3)	16
<i>Percina aurantiaca</i>	3.0 (2)	5.3 (2)	
<i>P. evides</i>	75.3 (3)	185.0 (3)	42
<i>P. squamata</i>	0.3 (1)		
Total species	24	26	21

(1979) collected it in the lower Nolichucky River in Tennessee at a surface current speed of about 2 m/sec, and Jenkins and Burkhead (1975) captured it in the South Fork Holston River in Virginia where the surface current ranged from 0.8 to 1.5 m/sec.

Annual mean dissolved oxygen concentration in the North Toe River below Spruce Pine ranged from 8.7 to 10.4 ppm for the years 1983–91; the pH ranged from 6.8 to 7.3 (North Carolina Division of Environmental Management, NCDEM, unpublished data). Oxygen and pH values from the lower Cane River and the upper Nolichucky River were similar (NCDEM loc. cit.). Biotic Index Ratings based on benthic invertebrate sampling were Good for the Cane and Nolichucky rivers, and Fair for the North Toe River during the years 1983–89 (NCDEM, 1985, Unpublished rep. No. 85).

DISCUSSION

The sharphead darter was common (13 to 195 specimens per collection) at six of the 11 productive areas (Sites 1, 2, 4, 5, 10, 11). These six sites were located near river islands, although islands are infrequent in the upper Nolichucky River system. Islands produce a river flow of several components, especially of shallow riffles with a substrate of smaller rubble and gravel. It is this area which is preferred by the darter. The less productive sites were characterized by less optimal habitat, *i.e.* less riffle area, more large rubble, and boulders. Most of the sampled sites are characterized by deeper (>1 m) water, long runs and chutes, and by occasional fast water where the rivers are constricted; substrate is primarily bedrock, boulders, and larger rubble.

The sharphead darter apparently tolerates turbidity. Much of the flood plain as well as some of the hillsides along the Cane River have long ago been cleared for agriculture, and the soil is heavily eroded during the brief and localized but heavy rains characteristic of the North Carolina mountains. A long-time resident along the lower Cane River noted (1992, pers. commun.) that mudslides often created a "river of mud" in the 1930's. Reforestation and better erosion control practices have reduced siltation. However, high turbidity is still common and can occur rapidly. We noted little turbidity in the North Toe River, probably because the area is more pristine and wooded.

Upstream distribution of the sharphead darter is apparently limited by the absence of suitable substrate, by unsuitable water temperature, and/or by the presence of pollutants. The substrate in the Cane and North Toe rivers above known darter sites consists primarily of exposed bedrock and boulders. Where suitable substrate does occur, the water is cooler, as evidenced by the presence of trouts (Haxo and Neves loc. cit.; pers. obs.). We hypothesize that such conditions exclude the sharphead darter, as perhaps do pollutants produced by industry in the North Toe River near Spruce Pine. Water quality has improved near Spruce Pine in recent years (F. Westall, NCDEM, pers. commun., 1992), and this may have an effect on distribution of the darter in the future.

The absence of the sharphead darter from the South Toe River is an enigma. The water quality is excellent (NCDEM, 1985, Unpublished rep. No. 85) and suitable substrate is widespread. Cooler water upstream could exclude it. Although the darter had been collected in 1930 in the North Toe River (Bryant *et al.* 1979), at an unspecified locality 6–10 km upstream of Spruce Pine above the confluence of the North Toe River with the South Toe River, it possibly never became established in the latter.

The sharphead darter occurs in only a small portion of North Carolina, and our data indicate that its distribution is larger than previously known. Comparison of abundance with the sketchy data of earlier years is difficult, but the species is common to abundant at a number of localities at present, and other ichthyologists (pers. commun., 1993) have even suggested that the range of this darter is increasing. Perhaps data herein will serve as a baseline to assess this in the future.

ACKNOWLEDGMENTS

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Environmental Management for the loan of backpack shockers. E. Menhinick, University of North Carolina—Charlotte, provided collection data from the upper Nolichucky River system, and R. Jenkins, Roanoke College, provided copies of W. Haxo field notes. J. Bowen kindly prepared the figure. The helpful comments of F. Schwartz and two anonymous reviewers are greatly appreciated. The research was supported in part by a grant from the North Carolina Wildlife Resources Commission, Nongame and Endangered Wildlife Program.

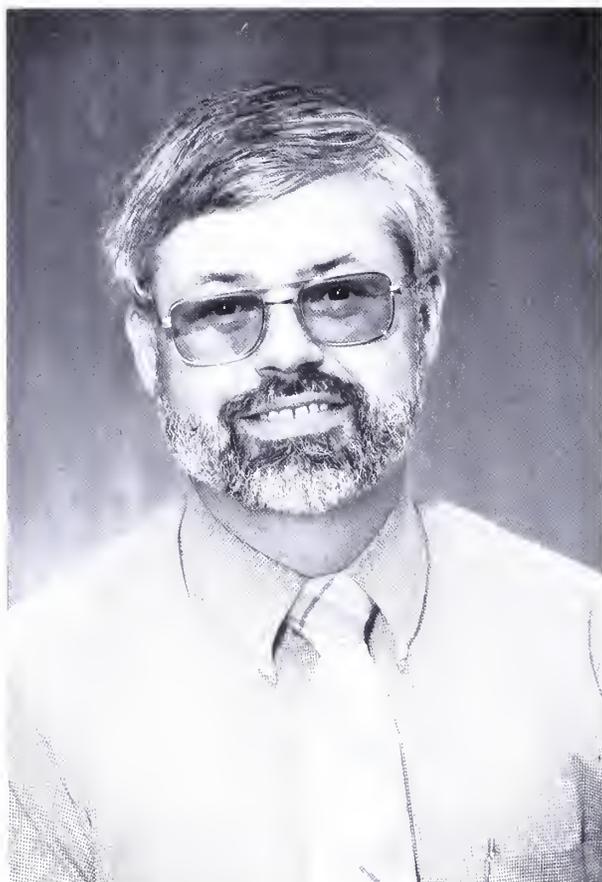
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ASSOCIATION AFFAIRS

The 55th annual meeting of ASB was held at Orlando, Florida with 600 members in attendance. Notables in attendance were Dr. W. Duncan, founding member, and many past presidents. Dr. Clarice Gaylord, Director of the Office of Environmental Justice-EPA was the Plenary speaker replacing Carol Browner of EPA who could not attend because of other demands. The special workshop, sponsored by ASB's enrichment fund: Professional Biologists/Ecologists and K-12 teachers: a winning participation, was well attended even though it was not fully stated in the April issue because of publication deadlines.

1994 MERITORIUS TEACHING AWARD



Dr. T. Larry Mellichamp

The 1994 Meritorious Teaching Award was presented to Dr. Thomas Lawrence (Larry) Mellichamp at the ASB banquet in Orlando, Florida, April 15. This award includes a bronze plaque, the nomination and supporting letters, and a check for \$1,000 from the *Carolina Biological Supply Company*.

Dr. Mellichamp is a native of Pennsylvania and received his Ph.D. from the University of Michigan in 1976. He went that year to the University of North Carolina at Charlotte and has been there now

for 18 years. He is an Associate Professor of Biology. He has not only achieved wide recognition as an outstanding teacher, in and out of the classroom, for which this award is given, but he is known throughout the region as the very fine Director of the McMillan Academic Greenhouse of UNC-C and also Co-ordinator of the UNC-C Botanical Gardens. He is a popular speaker for garden clubs, professional societies, and non-professional organizations.

The following excerpts are taken from the supporting letters.

- “Larry has directly and profoundly influenced two Ph.D. candidates and 10 master’s candidates in botany and well over 30 selected general botany students at the undergraduate level.” as well as “. . . literally hundreds of nonprofessionals . . .”
- “. . . his natural ability to explain and describe has led me to pursue botany . . .”
- His “. . . ability to deliver botanical concepts to student audiences with zest and enthusiasm is outstanding.”
- “. . . he is a most dedicated, tireless, and extremely talented Professor of Biology.”
- “I seriously doubt that I would have had the courage to go for a masters degree, had it not been for Dr. Mellichamp’s enthusiastic, sustaining support.”

It is clear from these few comments that Larry Mellichamp is most deserving of this recognition by the ASB as a meritorious teacher and a credit to Biology at UNC-C and to the biological profession.

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1994 Meritorious Award winner, Dr. L. Mellichamp (left), presenter Dr. J. Hardin (right).



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1994 RESEARCH AWARDS

STUDENT RESEARCH AWARD \$500 supported by the Martin Microscope Co. of Easley, SC was presented by Dr. M. Perry to Anne Maglia for her coauthored paper on Feeding and ecology of *Plethodon cinereus* with R. A. Pyles (see ASB Bull. abstr. 136, 41(2) 1994).

EUGENE P. ODUM AWARD \$250/plaque, was presented by Dr. A. Ash to Christine E. Conn for the paper (Abstr. 57 ASB Bull. 41(2): 91) on Nitrogen dynamics of root decomposition in response to nitrogen availability gradients. Honorable mention was given to Anne Maglia (see Abstr. 136 above).

SOUTHERN APPALACHIAN BOTANICAL SOCIETY AWARD was presented by Dr. G. Dillard:

RICHARD AND MINNIE WINDLER AWARD—SABS Selection Committee: Drs. Nancy Coile, Jim Matthews and David Whetstone.

The Richard and Minnie Windler Award recognizes the best systematic botany paper published in *Castanea*, The Journal of the Southern Appalachian Botanical Society, in the past year. The awardees for 1994 are Gwynn W. Ramsey, Charles H. Leys, Robert A. S. Wright, Douglas A. Coleman, Aubrey O. Neas and Charles E. Stevens, for their paper, "Vascular Flora of the James River Gorge Watersheds in the Central Blue Ridge Mountains of Virginia," *Castanea*, 58(4): 260–300.

ELIZABETH ANN BARTHOLOMEW AWARD—SABS Selection Committee: Drs. Cliff Hupp, George Ramseur and Dan Evans.

The Elizabeth Ann Bartholomew Award is presented to individuals who have distinguished themselves in professional and public service that advances our knowledge and appreciation of the world of plants and their scientific, cultural and aesthetic values. The recipient for 1994 is Dr. James W. Hardin, Professor of Botany, North Carolina State University, Raleigh.

N.C. BOTANICAL GARDEN AWARD was presented by Dr. B. Collins to John G. Rae (see Abstr. 172, ASB Bull. 41(2): 124).

SE DIVISION AMERICAN SOCIETY ICHTHYOLOGISTS AND HERPETOLOGISTS awards were presented by Dr. R. W. Van Devender in: *Ichthyology* to Tanya Peterson, coauthored with S. T. Ross (see Abstr. 200 ASB Bull. 41(2): 131); *Herpetology* to Anne Maglia (see Abstr. 136 above).

STUDENT AWARD IN AQUATIC BIOLOGY \$100 sponsored by the Wildlife (Wildco) Co. was presented by Dr. M. Perry to Vinnie Burke for his joint paper with W. Gibbons on Evaluating wetland conservation policies with GIS models of habitat use by aquatic turtles (see Abstr. 67, ASB Bull. 41(2): 98).

ASB AWARD FOR RESEARCH IN CELL AND MOLECULAR BIOLOGY \$500 certificate for equipment by Fisher Scientific Co. was presented by Dr. K. Shull to Blonka Winkfield coauthored with E.J. Davis on the Origin of transfer region for the conjugative plasmid R64 drd 11 (Abstr. 229 ASB Bull. 41(2): 138).

ASB PRIORITIES IN PUBLIC AFFAIRS COMMITTEE RESOLUTION

WHEREAS the Association of Southeastern Biologists is comprised of more than 1,200 professional biologists who engage in research and teaching of life sciences from molecules and cells to ecosystems; and

WHEREAS the members of the Association recognize the value of and the necessity for maintaining a clean and healthy environment, including the conservation of all forms of life and their environments; and

WHEREAS the Clean Water Act is up for reauthorization and the provisions of this Act are of great concern to the members of the Association; and

WHEREAS implementation of the original 1972 Act and amendments, although successful in cleaning up some waters, has not met the original goals of

- 1) eliminating the discharge of pollutants into the Nation's waters by 1985;
- 2) achieving Nationwide "fishable and swimmable waters" by 1983; and
- 3) maintaining and restoring the chemical, physical and biological integrity of the Nation's waters.

BE IT THEREFORE RESOLVED THAT the Association supports the reauthorization of a strengthened and fully-funded Clean Water Act, with provisions that improve efforts to prevent pollution, protect critical ecosystems, and provide stricter enforcement.

BE IT FURTHER RESOLVED that the Association believes that the slow but steady progress that has been made to date to "restore and maintain the chemical, physical and biological integrity of the Nation's waters" is indicative of the need for increased vigilance in the future. The Association is adamantly opposed to any amendments that weaken the Act.

RESOLUTION OF APPRECIATION TO BREEDLOVE, DENNIS AND ASSOCIATES, INC. FROM THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

WHEREAS Dr. Michael Dennis of Dennis Breedlove, Dennis and Associates Inc., graciously supported the Association of Southeastern Biologists at its annual meeting in Orlando, FL 13-16 April 1994

WHEREAS they have extended to the membership of the Association cooperation and assistance in addition to hospitality

THEREFORE BE IT RESOLVED that the members of the Association of the Southeastern Biologists express their gratitude and respect to Breedlove, Dennis and Associates Inc. for contributing to the continued success of our organization.

RESOLUTION OF APPRECIATION TO THE UNIVERSITY OF CENTRAL FLORIDA, FACULTY, STAFF, STUDENTS, AND LOCAL ARRANGEMENTS COMMITTEE FROM THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

WHEREAS the University of Central Florida and its president Dr. T. Hitt graciously invited the Association of Southeastern Biologists to hold its 55th annual meeting in Orlando, FL on 13-16 April 1994

WHEREAS the University and immediate community have extended the membership of the Association cooperation and assistance in addition to hospitality and friendship and

WHEREAS the Arrangements Committee chair *Dr. Jack Stout*, Program chair *Dr. F. Snelson* and the department of biology chair *Dr. D. Vickers* and the students and staff have given generously of their time, expertise, and enthusiasm in organization and conduct for the enjoyment of the meeting

THEREFORE BE IT RESOLVED that the members of the Association of Southeastern Biologists extend their gratitude to the University of Central Florida and the Department of Biology for contributing to the success of our organization.

Graduate Student Travel Award Recipients

Twenty-eight students received funds to assist them in attending the Orlando, FL ASB meetings. The number following each name refers to the abstract as found in the ASB Bulletin 41(2) 1994.

Michele Audo 151
 Charles Beard 190
 Carol Britson 76
 Joseph Buckley 137
 Pamela Byrd 231
 Christine Conn 57
 John Dilustro 60
 Terri Dobson 210
 Melissa Dunaway 78
 Mark Fisher 38
 Scott Franklin 61
 Marilyn Garner 227
 Anthony Grahame 214
 Becky Green 232

Michael Greene 62
 Jennifer Hart 99
 Tracey Hickok 215
 Ginger Kees 80
 Anne Maglia 136
 Chris Parkison 129
 Tanya Peterson 200
 Jody Shimp 234
 Candice Steed 21
 Lisa Strantc 218
 Nicole Turrill 221
 Steve Vanderkooy 206
 Christoph Walser 207
 Lawrence Zettler 195

Necrology

Woolford B. Baker, Emory University
 Frank Seabury, Jr., Charleston, SC
 Horton Hobbs, Jr., Falls Church, VA

Horton H. Hobbs, Jr.

Horton Holcombe Hobbs, Jr., 79, a zoologist emeritus and Senior Scientist at the National Museum of Natural History, Smithsonian Institution and expert on crayfish and other crustaceans, died on 22 March at his home in Falls Church, Virginia.

Dr. Hobbs taught biology at the University of Florida, Gainesville, from 1937 until 1946, after which he taught at the University of Virginia, Charlottesville, for 16 years. In 1962 he came to the Smithsonian Institution as Head Curator of the Department of Zoology, and from 1964 until his retirement in 1984, was a Senior Scientist. As Emeritus Zoologist at the Smithsonian, he continued his research on crayfishes and other crustaceans until the time of his death. He was the author of *The Crayfishes of Florida* as well as 207 additional scientific papers.

He served as Director of the Mountain Lake Biological Station of the University of Virginia from 1956 to 1960, President of the American Microscopical Society in 1963–64, President of the Association of Southeastern Biologists in 1959–60, and President of the Virginia Academy of Sciences in 1961–62. He was a member of Phi Beta Kappa, Phi Kappa Phi, Phi Sigma, Sigma Xi, Alpha Epsilon Delta, The Raven Society, and the Cosmos Club.

Survivors include his wife, Georgia Cates (Blount) Hobbs; a son, Horton H. Hobbs III; a daughter, Nina Hobbs Singleton; five grandchildren, and one great-grandchild.

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
ENRICHMENT FUND
1 JANUARY - 31 DECEMBER 1993

I.	BEGINNING BALANCE			\$12,285.19
II.	RECEIPTS			
	GIFTS	\$15.00		
	INTEREST	360.61		
	TOTAL		\$375.61	
III.	TOTAL RECEIPTS AND BEGINNING BALANCE			\$12,660.80
IV.	TOTAL DISBURSEMENTS			0.00
V.	ENDING BALANCE			\$12,660.80
VI.	NET CHANGE FOR 1993			\$375.61

CASH ON HAND

	ASB Fund	Enrichment	Total
Merrill Lynch	\$15,619.72	\$12,651.00	\$28,270.72
First National Bank	300.58	9.80	310.38
Total	\$15,920.30	\$12,660.80	\$28,581.10

REPORT ON MEMBERSHIP

December 31, 1993

Membership Category	Total
Student	191
Active	720
Emeritus	70
Library	59
Contributing	9
Family	36
Sustaining	3
Patron	4
Complementary	15
	Total 1107
Membership Expiration	
1993	410
1994	582
1995	41
1996	59
1997	0
> 1997	15
	Total 1107

THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
TREASURER'S REPORT
1 JANUARY - 31 DECEMBER 1993

I.	BEGINNING BALANCE		\$17,656.39
II.	RECEIPTS		
	Regular Dues	\$18,846.00	
	Patron Memberships	1,000.00	
	Interest	293.91	
	N.C. Botanical Garden	200.00	
	BSA Reimbursement	250.00	
	Exhibitor's Fees	8,178.00	
	Sales	239.00	
	Page Charges	0.00	
	TOTAL RECEIPTS		\$29,006.91
III.	TOTAL RECEIPTS AND BEGINNING BALANCE		\$46,663.30
IV.	DISBURSEMENTS		
1.	MEMBERSHIP		\$525.54
2.	PUBLICATION		
	ASB Bulletin 40(1)	2,901.16	
	ASB Bulletin 40(2)	9,675.17	
	ASB Bulletin 40(3)	4,534.22	
	ASB Bulletin 40(4)	2,772.42	
	ASB Directory	3,385.46	
	TOTAL PUBLICATION		23,268.43
3.	OFFICER EXPENSES		13.10
4.	OFFICIAL TRAVEL		904.95
5.	AWARDS AND HONORARIA		
	Student Travel	3,499.68	
	Speaker Honorarium	675.00	
	N.C. Bot Garden	100.00	
	Research	1,000.00	
	TOTAL AWARDS		5,274.68
6.	MISCELLANEOUS		
	AIBS Affiliation	287.40	
	All. Environ. Ed.	125.00	
	Assoc. Syst. Coll.	100.00	
	Miscellaneous	243.90	
	TOTAL MISCELLANEOUS		756.30
	TOTAL DISBURSEMENTS		\$30,743.00
V.	ENDING BALANCE		\$15,920.30
VI.	NET CHANGE FOR 1993		-\$1,736.09

Editor's Report for 1993

A total of 224 pages, versus 196 in 1992, was published in ASB Bulletin Volume 40. Three full papers of 19 pages and one three page note appeared in the volume. Society items, book reviews, News of the Southeast, and abstracts (61 pages) accounted for 141 pages of the volume. Photos for the covers of forthcoming issues are in dire need.

EXHIBITORS AT THE 1994 ASB MEETING

Acoti Inc., Buffalo, NY	Harbor Branch Oceanogr. Inst., Ft. Pierce, FL
Associate Microscope Inc., Elon College, NC	Martin Microscope Co., Easley, SC
Baxter Diagnostic & Sci. Prod., Winter Haven, FL	Mosby Publ. Co., Tampa, FL
Benjamin Cummings Publ. Co., Redwood City, CA	Saunders Publ. Co., Philadelphia, PA
Breedlove, Dennis & Assoc., Winter Park, FL	Southern Micro Instr. Assoc., Atlanta, GA
W.C. Brown Co., Dubuque, IA	Wadsworth Inc., Belmont, CA
Carolina Biol. Supply Co., Burlington, NC	Wildlife Supply Co., New York, NY
Convion Controlled Environ. Inc., Ashville, NC	Worth Publ. Co., New York, NY
Forest Suppliers Inc., Jackson, MS	

CALL FOR PAPERS, IMPORTANT DEADLINES, AND ANNOUNCEMENTS

THE 56TH ANNUAL MEETING

Host: University of Tennessee
Knoxville, Tennessee

Date: 19-21 April 1995

Please note the following deadlines which are to be met before our 55th Annual Meeting hosted by the University of Central Florida, Orlando, FL.

- 15 November 1994 — New deadline date for titles and abstracts of papers and posters. Blue abstract forms will appear in the October 1993 issue of the Bulletin.
- 30 October 1994 — Nominations for ASB officers and executive committee.
- 1 February 1995 — Applications for travel awards for graduate students.
- 15 November 1994/— Application for research awards: Student Res. Award, Nov. 1 February 1995 15; Student Res. Award Aquatic Biology, 1 Feb.

ANNOUNCEMENTS

ASB Student Research Awards 1995

Encourage your undergraduate and graduate students to begin manuscript preparation now for the 1995 ASB Student Research Award (\$500), sponsored by Martin Microscope Co., Easley, SC, and the ASB Student Research Award in Aquatic Biology (\$100) sponsored by Wildlife Supply Company (Wildco) of Saginaw, Michigan. Both awards will be described in detail in the October 1995 ASB Bulletin. In general, these awards require:

- Students must be first author on a journal-ready manuscript worthy of publication, not published (may be in press) prior to the 1995 annual meeting.
- The student and faculty/professional co-author must be members of ASB.
- The author(s) must submit an abstract by the **15 November 1994** deadline.
- The paper must be presented orally by the author(s) at the annual April 1995 meeting.
- By **1 February 1995**, the student must submit:
 - 1) three typed or printed copies of the manuscript
 - 2) a brief biographical sketch, and
 - 3) a letter from the faculty/professional sponsor confirming their student status and sponsorship for the award

Manuscripts are evaluated on the basis of 1) significance of ideas, 2) validity of hypotheses, 3) quality and creativity of methodology, 4) validity of results, 5) soundness of conclusions, 6) clarity, completeness, organization, and 7) contribution to the field.

Recent awards have been of extremely high caliber. Please help us maintain active participation. Send inquiries to: Dr. Claudia L. Jolls, Department of Biology, Howell Science Complex, East Carolina University, Greenville, NC 27858, (919) 757-6718, bijolls@ecuvms.cis.ecu.edu.

“TRAVEL” SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB

DEADLINE: 1 FEBRUARY 1995

Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. *Recipients must be members of ASB.* The guidelines for application are as follows:

- *(a) *The recipient is a current member of ASB.*
- *(b) The recipient must be presenting a paper or poster at the Annual Meeting and must *include a copy* of the abstract of the paper or poster to be presented.
- *(c) The recipient must be currently enrolled as a graduate student in the department where he/she conducted this research.
- (d) Give a conservative, itemized estimate of meeting expenses including transportation. Student travel awards are granted on a competitive basis. Applicants *must* document expected expenses and list other sources of financial support for this meeting, including institutional aid, shared lodging and shared transportation.
- (e) In a paragraph, give a brief history of your education to date; indicate how many years you have been in graduate school and the expected date of completion of work for the degree, your major field of study and research, publications including those in press and in preparation, degree sought, name of major professor and any other pertinent details.
- (f) Give your source(s) of support while in graduate school; *e.g.* NSF, NIH, USDA, Teaching Asst., Research Asst., etc.
- (g) Include a letter of recommendation for an ASB support award from your faculty research advisor. This letter should comment on the work being

presented and indicate the financial need of the student presenter. It should also indicate whether any departmental or other funding is available to the student.

- (h) Send application, with supporting letter, *all in triplicate*, to:
- (i) Applicants will be notified of the decision of the Committee as soon as is practicable. Recipients of the award will receive their checks at the meeting.

American Institute of Biological Sciences
45th Annual Meeting of Scientific Societies
"Science and Public Policy"

The American Institute of Biological Sciences (AIBS) will hold its 45th Annual Meeting of Scientific Societies 7–11 August 1994 in Knoxville, Tennessee at the Holiday Inn World's Fair and the Knoxville Convention/Exhibition Center. This international meeting will bring together the Botanical and Ecological Societies of America, the American Bryological and Lichenological Society, the American Fern Society, the American Society of Plant Taxonomists, International Society for Ecological Modelling, the Association of Ecosystem Research Centers, and the National Marine Educators Association. Four days of symposia, paper and poster sessions, workshops, special lectures, field trips, and banquets are planned. For more information, or to receive a registration brochure, contact: Meetings Department, AIBS, 730 11th St, NW, Washington, DC 20001-4521, (202) 628-1500; ext. 506.

PUBLICATION ANNOUNCEMENT

The Association of Systematics Collections has published the report, "Guidelines for Institutional Database Policies," the result of its two-year study and workshop on data sharing and database ethics. The report contains guidelines for natural history institutions housing specimen-based databases which address legal ownership, responsibilities of owners and users, and financial support. In addition the report contains examples of data sharing agreements, presentations from the data sharing workshop, the ASC position on collections use agreements, and references on data sharing and transfer policies. 76 pp., 1993. Copies are available for \$12.00 (includes postage) from ASC, 730 11th Street, NW, Washington, DC 20001-4521, (202) 347-2850.

Copies of *Forests and the Environment: a U.S. response to the Rio Earth Summit* are available by contacting H. H. Gastfriend, Fernbank Museum Natural History, 767 Clifton RD NE, Atlanta, GA 30307.

BETA BETA BETA ABSTRACTS

DISTRICT I

William D. Krebs, Florida Institute of Technology—Central projections of electrosensory afferent neurons in the Atlantic stingray, *Dasyatis sabina*.

The neuroanatomy of the Atlantic stingray, *Dasyatis sabina*, was examined with emphasis on the structures related to the electrosensory system. Four major electrosensory cranial nerves, the dorsal and ventral superficial ophthalmic, the hyoid, and the mandibular were identified and traced from their respective ampullary clusters to the brainstem. The superficial ophthalmic nerves enter the brainstem rostral to the composite hyomandibular. Histological analysis shows the presence of a dorsal octavolateralis nucleus (DON) located ventrocaudal to the cerebellum and adjacent to the fourth ventricle. The DON of *D. sabina*, like other members of Rajiformes, contains a 1) dorsal granular ridge, 2) cerebellar crest, 3) peripheral zone and 4) central zone. The electrosensory primary afferent fibers enter into the DON on the dorsolateral surface and project ventrally to the central zone of the DON. Secondary fibers exit the DON ventromedially through a narrow isthmus that connects the DON to the underlying medulla. These secondary fibers originate along the central zone and project contralaterally presumably to form the ascending lemniscal tract. Bulk labeling of horseradish peroxidase (HRP) tracers shows the superficial ophthalmic projects only to the ventral portion of the central zone and indicates the existence of a somatotopic representation of the electrosensory system in the stingray brain.

Rachael M. Hannah, Department of Biological Sciences, Florida Institute of Technology—Neuroanatomy of the electrosensory nuclei in the fresh water bullhead catfish, *Ameiurus nebulosus* and the marine hardhead catfish, *Arius felis*.

Siluriform catfishes are one of the few teleost groups that can detect bioelectric fields produced by other aquatic organisms. Previous research shows the fresh water catfish, *Ameiurus (=Ictalurus) nebulosus*, has specialized gross and cellular neuroanatomy features for electroreception in the facial lobe of the brain. This study compared the gross and cellular neuroanatomy of the facial lobe in *Arius felis*, one of the few ocean catfishes, to assess differences in the neural substructure for electroreception.

The prominent posterior lateral line lobe of *Ameiurus* is absent in *Arius* and the fourth ventricle is dorsally enclosed. Like *Ameiurus*, segregation of mechanosensory and electrosensory primary afferent fibers occurs upon entry to the brainstem. For both anterior and posterior lateral line nerves, the mechanosensory fibers project directly to the nucleus medialis while electrosensory fibers project to the electrosensory lateral line lobe (ELL). The ELL fills approximately the rostral three-quarters of the facial lobe. The caudal margin is distinguished by the organization of the dorsally located molecular layer, and the entrance of the posterior lateral line nerve. The ELL region sits on the anterolateral edge of the facial lobe. Like *Ameiurus* the ELL contains a molecular layer of presumed granule cell origin, a layer of large crest cells, an intermediate cell layer and fiber bundles, and an innermost layer of round cells. Thus, the gross anatomy differs in this marine catfish, *Arius felis*, but the basic cellular organization of the ELL is conserved.

Dong Won Lee, School of Biology, Georgia Institute of Technology—Copulatory behavior and the mate recognition pheromone of the rotifer *Brachionus plicatilis* O.F. Müller.

Copulatory behavior of the rotifer *Brachionus plicatilis* O.F. Müller is based upon male contact of glycoprotein pheromone on the body surface of females. The result of copulatory behavior among six different strains of S and L types, from different geographic areas, suggests that in some cases total reproductive isolation exists. A 29 KD surface glycoprotein of *Brachionus plicatilis* is responsible for mate recognition after male contact. Purified mate recognition pheromone (MRP) was isolated from the Russian-L strain. The MRP binding to male receptors was observed by administering the biotinyl-

ated-MRP, which was prepared with succinilnidyl 6-(biotinamide) hexanoate (biotinamidocaproate, N-hydroxysuccinimide ester), and fluorescence labeled avidin, then quantitatively measured by using image analysis. Differences in fluorescence intensity among S and L strains were observed. These data support the idea that reproductive isolation exists among these two types of strains and S and L strains should be considered as different species.

Howard Townsend, Wake Forest University—Habitat selection in Galapagos seabirds.

Seabirds are dependent upon the world's oceans for their food resources and can spend much of their life at sea; however, most species are required to return to land in order to incubate eggs and raise offspring. Breeding grounds near the ocean are necessary to expedite access to resources. Since there are few land areas near seas, seabirds tend to aggregate in breeding colonies.

Masked boobies (*Sula dactylatra*) and blue-footed boobies (*Sula nebouxi*) occupy similar niches and habitats (ground-nesters and offshore feeding seabirds) probably resulting in competition for nest sites. On islands of the Galápagos Archipelago where both masked and blue-footed boobies have nests, the larger masked boobies are observed to take nest sites adjacent to coasts and coastal ledges, whereas blue-foots take sites farther inland. On islands where only blue-foots nest, they have nest sites near coasts.

From this study the following has been found: 1) Coastal nests are preferable because wind speed and temperature levels there are conducive to thermoregulation and flight initiation and 2) Pre-breeding adult masked boobies attempt to copulate with blue-foot chicks nesting too closely to masked boobies resulting in injury to the chick and in so doing exclude blue-foots from coastal sites.

Shelley L. Johnson, St. Andrews Presbyterian College—Tissue culture of *Ginkgo biloba*.

Sex chromosomes have been reported from *Ginkgo biloba* and several other species of dioecious gymnosperms. Successful *in vitro* propagation of *Ginkgo* and cycads has not yet been reported. If successful, such techniques may provide multiple shoot apices from individual plants for karyotypic analysis. Dormant lateral buds, mature megagametophyte tissue, isolated stem pith, split stem pieces and mature embryos were used as explants. Surface sterilized explants were cultured on Murashige and Skoog basal salts with minimal organics medium supplemented with 30 g/l sucrose, various concentrations of 2,4-D and kinetin, and grown under a 16 hr photoperiod. For various reasons, dormant lateral buds, mature megagametophyte and isolated pith cultures were not pursued. A high percentage of split stem segments produced callus. Most embryos failed to develop normal shoot and root systems but exhibited rapid and extensive callusing of the cotyledons. Both successful explant sources are being used for further studies of callus initiation, and for subculturing and organogenesis experiments using various growth media and plant growth regulators. Successful regeneration will facilitate critical examination of somatic chromosomes of *Ginkgo* and possibly assist in the development of horticulturally and medicinally important selections. It may also assist in the development of successful *in vitro* propagation methods for cycads.

William J. Vaile, The Citadel, Charleston, South Carolina—A model to test the recommendation that draining a rice impoundment will effectively reduce the population of salt marsh mosquitos.

This is a laboratory study using a model to test a recommendation in the literature. This recommendation states that draining a small abandoned rice impoundment will reduce a mosquito population by removal of larvae from the impoundment. The results indicate that this is not an effective means of population control. It was determined that a higher percent of first instar larvae were recovered than fourth instar larvae, but the overall percentage was minimal.

Ivan Harp, The Citadel—A laboratory study of selected factors in the oviposition behavior of the Golden Salt Marsh mosquito, *Aedes sollicitans*, and the Black Marsh mosquito, *Aedes taeniorhynchus*.

A laboratory study on oviposition behavior was conducted on the mosquito species' *Aedes sollicitans* and *Aedes taeniorhynchus*. Five different media were used for selection including: sterilized soil (autoclaved marsh soil), unsterilized marsh soil, control (moss + H₂O-1% NaCl), wild (moss + marsh H₂O), and culture (moss + yeast + liver extract + H₂O-1% NaCl). Experiment 1 used "normal" soil, control, wild, and culture. Experiment 2 used sterilized soil, control, wild, and culture. Two of each medium was placed in a cage for one day. Each experiment was repeated for ten days. This study suggests that the factors tested may influence mosquito ovipositioning, but it is not certain whether this information is valid under normal field conditions.

Istvan Urcuyo, The Citadel—Effect of irradiance on ciliate grazing rates in the Subsurface Chlorophyll Maximum.

Grazing rates of natural populations of ciliates in the Subsurface Chlorophyll Maximum (Anderson 1969) in the North Pacific Ocean were determined by using Hydroethidine (HYD) stained algal cells (*Isochrysis galbana* and *Gymnodinium simplex*). The effect of irradiance on the grazing rates of ciliates in the Subsurface Chlorophyll Maximum (SCM) was determined by analyzing the grazing rates at three irradiance levels (0%, 1%, and 25% surface irradiance). Significant differences among ciliate grazing rates were not found between light intensities but were found between darkness and both light levels (0% 1). Grazing rates in the absence of light were twice as high as those in 1% and 25% surface irradiance treatments. The higher ciliate grazing rate in the absence of light might be accounted for by the changing of feeding behavior from mixotrophic to phagocytic.

Jennifer King, Wake Forest University—Taxonomic limits of the genus *Kalmia*.*

The genus *Kalmia* contains seven species of shrubs restricted to North America and Cuba. It is characterized by the anthers held in distinctive pouches in the corolla at anthesis. *Leiophyllum* (1 sp. *L. buxifolium*) and *Loiseleuria* (1 sp. *L. procumbens*) lack the distinctive corolla pouches of *Kalmia* but have been considered closely related based on similar growth patterns and anatomical characters. Nucleotide sequences of nuclear ribosomal internal transcribed spacer (ITS) and 5.8s regions were obtained for representatives of *Kalmia*, *Loiseleuria*, and *Leiophyllum*. Sequences were aligned visually and cladistic analyses were performed using PAUP 3.1.1. The results indicate that *Loiseleuria* and *Leiophyllum* are derived from within *Kalmia*. This suggests that the lack of corolla pouches in *Loiseleuria* and *Leiophyllum* is likely due to the loss of this character and that the taxonomic limits of *Kalmia*, as presently recognized, need to be reassessed.

* Brooks Award winner.

Suzanne Pohlmann, Wake Forest University—The effect of mutations in the membrane-spanning domain of HN protein on rates of transport.

The hemagglutinin-neuraminidase (HN) protein of the paramyxovirus SV5, is an integral membrane glycoprotein that mediates the attachment of the virus to the host cell it is infecting. In its monomeric form, HN is composed of a 17-residue cytoplasmic N-terminal tail, a 19-residue membrane-spanning domain that serves as both an uncleaved signal sequence and a membrane-anchor domain, and a 329-residue C-terminal ectodomain that contains glycosylation sites. The mature protein is believed to be a homotetramer composed of a pair of disulfide-linked dimers.

Viral membrane glycoprotein provides a useful model for studying the intracellular transport and the assembly of integral membrane proteins. While a considerable amount of research has been done on integral membrane proteins, the precise signals involved in the orientations, translocation, assembly, and transport of these proteins across the ER membrane remain ambiguous. Studies using HN protein have demonstrated that the membrane-spanning domain plays an important role in orienting this protein in the membrane as well as in facilitating the oligomerization of this protein into its final tetrameric form. Therefore, we are using the HN protein as a model and specifically focusing on the

* Brooks Award winner.

membrane spanning domain to better understand the signals governing these processes in integral membrane proteins.

To conduct these studies, we have created mutants of the HN protein in which the hydrophobic membrane-spanning domain has been altered. Using site-specific mutagenesis, we have changed the specific amino acid residues of this domain to encode for various combinations of poly-leucine residues. These mutants were used to investigate different aspects of the cell biology of integral membrane proteins, namely protein transport. Pulse-chase experiments followed by immunoprecipitation of the mutant proteins were performed to study transport rates. This data gave useful information about whether a specific sequence of amino acids in the membrane-spanning domain of integral membrane proteins is necessary for facilitating the process of protein transport or whether a generic sequence of hydrophobic amino acids is sufficient in order for such events to properly occur.

DISTRICT II

Jeffery A. Sizemore, Department of Pathology and the Department of Pulmonary Medicine, Vanderbilt University—The induction of manganese superoxide dismutase (MnSOD) in bovine pulmonary artery and lung microvascular endothelial cells.

Manganese Superoxide Dismutase (MnSOD) is a metalloenzyme found in the mitochondrial matrix that protects the cell from DNA oxidation damage, which is due to the superoxide anion, by the dismutation of said anion to hydrogen peroxide and oxygen. The inducibility of the MnSOD gene was studied using Bovine Pulmonary Artery (BPA) and Lung Microvascular Endothelial cells (BLMEC). Stimulation of these cells with Lipopolysaccharide (LPS) has been shown to induce significant levels of MnSOD message and therefore was used as a positive control. The BPA and BLMEC cells were exposed to a number of chemical agents with or without LPS present to catalog the response profiles of the two cell types. The technique of autoradiography was used to determine relative levels of mRNA. In conformation with past studies, the BPA and BLMEC cells showed a markedly different response to the reagents as well as to the LPS. There was also strong evidence to suggest the induction of message in BPA cells by PMA and dbcAMP and the induction of message in BLMEC by Dexamethasone and Retanoic acid.

Brian W. Szeremeta, Western Kentucky University—Structural and biochemical investigations of the emergent flagellum and paraflagellar body of the photosynthetic alga *Euglena gracilis*.

The alga *Euglena gracilis* has a presume photoreceptor, the paraflagellar body (PFB), on the emergent flagellum. The PFB is involved in the phototactic response, which is a process that involves flagellar motility that propels a cell toward light. In this study, the flagellar complex—including the axoneme, paraxial rod, paraflagellar body, and flagellar hairs—is isolated and analyzed by phase contrast and Nomarski differential interference contrast microscopy. Initial biochemical analyses of flagella, with and without PFB's are performed to determine the chemical composition and crystalline substructural arrangement of the PFB to elucidate its role in the phototropic response.

Ginny Boyd, Jennifer Wong, and Glenn Parsons, University of Mississippi—A study of the critical swimming speed of schooling fish.

Using a Blazka swim tunnel the critical swimming speed of golden shiner, *Notemigonus crysoleucas*, was examined. The first objective was to compare the thirty minute critical swimming speed of individual fish with that of fish in schools. Fish swimming alone demonstrated significantly decreased critical swimming speeds (25.57) when compared with the critical swimming speed of the first individual of a group to fatigue (31.7). The second objective was to determine if the observed difference was due to a hydrodynamic advantage gained by being in a school. When fish were tested in such a way that they were swimming alone but in visual contact with another fish, they swam significantly faster than individuals swimming in the absence of visual contact. This suggests that intraspecific interactions may be important in the swimming performance of schooling fish.

Doug Smith, Northern Kentucky University—The effects of extremely low frequencies of electromagnetic radiation on plants (*Brassica rapa* and *Raphanus sativus*).

Extremely low frequency (ELF) radiation is produced from electrical appliances, tools, transmission lines, and devices operating on the standard U.S. 120 V 60 Hz power sources. Recent concern for the large exposure of ELF's to humans has prompted research to discover their potentially harmful effects. A loop apparatus was constructed to generate ELF fields to study their effects on *Brassica rapa* and *Raphanus sativus*. With the use of a 80–400 mGauss ELF field, preliminary results suggest a direct correlation between the strength of the field and plant growth.

Carrie Gillen, Northern Kentucky University—Bacterial communities of pitcher plants.

This study compares the microbial communities of three species of pitcher plants. The main focus of the research is the potential of using these communities for the taxonomic differentiation of species of *Sarracenia*, a taxonomically problematic genus. A total of eleven different bacterial isolates have been obtained from these plants. Most of the isolates are yet to be identified but three belong to the genera *Aeromonas*, *Azotobacter* and *Deinococcus*. Since most of the isolates are capable of nitrogen fixation and of protein hydrolysis, these microbes may play an important role in helping the plants digest their insect prey and supplement nutritional requirements.

Rebecca Duncan, East Tennessee State University—Comparisons of tardigrade populations on Whitetop Mountain, VA.

Tardigrades, more popularly known as water bears, are hydrophilous microinvertebrates which can be found in a variety of habitats. Tardigrades are commonly found in mosses and lichens in terrestrial habitats, and are bottom dwellers in fresh water and marine habitats. For this study, 16 samples were taken from two forest types at different altitudes (4,000 ft. & 5,000 ft.). The purpose of this study is to determine whether there are specific elevational differences that can be directly correlated to the species of tardigrade(s) present. Also, it will help to provide preliminary estimates of tardigrade populations in an unstudied area. On 17 June 1993, eight samples of mosses and lichens were collected from trees, rocks and ground litter (5,000 ft.) in a red spruce forest and eight more samples from a mixed hardwood forest (4,000 ft.). All 16 samples were taken to the laboratory, filtered and then preserved with boiling ethanol. Slides have been made of some specimens and some preliminary identifications have been made.

Chris Neal, East Tennessee State University—Genetic variability in the *Solidago arguta* complex.

Systematic relationships in the genus *Solidago* are often confusing because many species are morphologically similar with poorly defined species boundaries. Several morphologically unusual forms of goldenrods were collected from different geographical locations within the range of a known species. These unusual forms appear related to *S. arguta*. Biochemical methods were used to genetically characterize relatedness of the unusual forms to each other and to *S. arguta*. In the first study, plant enzymes were isolated by starch gel electrophoresis to estimate allele frequencies at enzyme encoding loci. Leaves were ground in extraction buffer, electrophoresed and gels were sliced and stained. Four to six plants were sampled from each of the six populations of unknown affinity and from one population of *S. arguta*. Five enzymes resolved seven putative loci. Three of these loci (GOT-F; ME; PRO) were monomorphic throughout the entire sample. All except one population showed genetic variability. The monomorphic population was at the northern limit of the range of the unusual forms. Two populations that occupy limestone ridges were also the most closely related to each other genetically. The researchers hypothesize that the river gorge and limestone ridge populations will each cluster into natural assemblages distinct from *S. arguta*.

Rebecca G. Adkins, East Tennessee State University—A survey of the Water Bears (Phylum Tardigrada) of Greene Mountain, Tennessee.

Water Bears (Phylum Tardigrada) are microscopic metazoans that inhabit freshwater, marine, and terrestrial habitats, such as mosses and lichens. Few studies have been done on tardigrades in Tennessee. Eleven genera of tardigrades were collected and identified from Roan Mountain by Nelson in 1975. Later, Maucci reported tardigrades from Roan Mountain and the bank of the Watauga River. This study is a survey of the Tardigrada of Greene Mountain, Greene County, Tennessee. Tardigrades were collected in May 1993 from mosses and lichens from three sites on Greene Mountain: a mixed hardwood-pine forest (8 samples), a hardwood forest (8 samples), and a rock cliff (2 samples). The samples were processed by soaking each one in water for 24 hours; the water bears were then preserved with boiling ethyl alcohol. Up to 100 tardigrades were removed from each sample. A representative number of specimens was mounted individually on slides in Hoyer's mounting medium. Specimens were identified to genus and species and were photographed under an Olympus BH-2 phase microscope at magnification of 40 \times . Comparisons were made of tardigrade species diversity from the three habitats and with previous data from Roan Mountain.

Elizabeth Tipton-Jones, East Tennessee State University--A test of convergence: analysis of dorsal pattern variation in *Desmognathus ochrophaeus*.*

The salamander *Desmognathus ochrophaeus* (family Plethodontidae) occupies a broad range of habitat types, and therefore co-occurs with many other salamanders, both terrestrial and semi-aquatic. Individuals of *D. ochrophaeus* also exhibit significant variation in dorsal pattern. Previous studies have documented convergence in dorsal patterns of *D. ochrophaeus* and a sympatric species, *Plethodon jordani*, and suggested similar convergences with other species at other localities. The purpose of this study was to determine if similarities in dorsal patterns exist between *D. ochrophaeus* and sympatric species. Two transects were laid along Hartsell Creek (Buffalo Mountain, Johnson City, TN) that traversed stream, seepage, and woodland areas to provide sampling of a variety of habitats. Each transect was sampled five times from April until October, and all salamanders found along the transect were released after data on size, location, and color pattern were recorded. Analyses of dorsal patterns revealed that *D. ochrophaeus* varies greatly with respect to dorsum color and dorsolateral line configuration. The color and line variation exhibited by *D. ochrophaeus* is sometimes similar to that of *D. monticola* and *Eurycea wilderae*. However, multiple character analyses coupled with distribution patterns showed that variation in *D. ochrophaeus* is not associated with the co-occurrence of other species.

LaSandra D. Robinson, Southern University and A&M College at Baton Rouge--Microbial metabolism of decayed cell matter.

Recently, researchers of U.S. DOE Battelle Pacific Northwest Laboratory constructed a mathematical model describing the kinetics of carbon tetrachloride degradation by denitrifying microbes native to the Hanford site and compared its predictions to experimental data. It was observed that the microbes survived between a nitrate-rich and nitrate-limited environment. It was suspected that the microbes metabolized its decayed cell matter and nitrate. To construct a more accurate model, a ten-week study was conducted to qualitatively determine if the Hanford microbes utilized the decayed cell matter as an electron donor and/or electron acceptor concurrently with nitrate or acetate. The decayed cell matter was prepared by sonication. The decayed cell matter was pumped into a 1 l stainless steel anaerobic bioreactor and immediately injected with live Hanford microbes and nitrate or acetate. Next, the bioreactor was placed in a 17 C water bath for a week and a half. Various analyses were performed. As a result, it was determined that the decayed cell matter (electron donor) and the nitrate supported live Hanford microbes, while the decayed cell matter (electron acceptor) and acetate could not. Thus, the decayed cell matter made a poor electron acceptor.

REVIEWS

Wolfe, Stephen L. 1993. **Molecular and Cellular Biology.** Wadsworth Publishing Co., Belmont, CA. \$66.00. 1,145 p.

It is almost unbelievable that any one author would attempt to write a text of this scope. Stephen Wolfe states that the aim of his book is to "integrate molecular biology, biochemistry, and cell biology," and, in my opinion, he succeeds admirably. Wolfe's strengths have always been in the structural aspects of cell biology. His *Biology of the Cell* was the book I used when I first taught cell biology. Much has changed since then, but I believe he had drawn on his strengths and used them as a foundation upon which he has constructed a thorough and accurate description of the cell and its processes.

There are 27 chapters, and each is beautifully illustrated. In fact, the artwork is spectacular, and you may find yourself almost distracted by it. Wolfe effectively combines the graphics with numerous electron micrographs, and it often is possible to gain a reasonable understanding of concepts without reading the text. The text, however, is well worth reading. The author writes clearly and the chapters are logically arranged.

There are too many strengths for a thorough elaboration here. As one might expect from Dr. Wolfe, some of the best chapters are those which detail structural features of the cell. The chapters on microtubules, microfilaments and intermediate filaments are detailed and exhaustive. They represent the best treatment of the structure, physiology, interrelationships, and regulation of these cellular elements I have seen in any text. The chapter on the nucleus and its constituents is well conceived. Building from the Watson-Crick model of DNA and subsequent refinements, he leads the reader through eucaryotic chromosome structure and chromatin organization to the structure and function of the nuclear envelope. All the chapters related to the production of proteins and their distribution are clearly written and stimulating. His description of RNA processing is more comprehensive than in many genetics texts. I particularly liked the author's introduction to biochemistry in the second chapter. For students with limited chemistry background, this early introduction should prove most useful. I found his application of basic chemical bond types to some fundamental biological examples helpful. Additionally, his emphasis on functional chemical groups is unusual and prepares students to understand their roles in cellular functions considered later.

Two general approaches to Wolfe's writing deserve special attention. Throughout the text he successfully incorporates experiments into the coverage. It is most important for the students to understand what science is and how its method has been used to answer important questions about the cell. Furthermore, such descriptions increase the students' appreciation of how we have come to accept what we accept in the field. The second innovation that characterizes this book is its emphasis on human applications. The study of cellular and molecular biology can be reasonably abstract to someone attracted to biology because they find cutting up a cat interesting. Relating collagen defects to human disease, for example, makes the study of the extracellular matrix a bit less abstruse.

This text includes a bevy of pedagogical aids that enhance its effectiveness. There are a series of Information Boxes, Supplements and Experimental Processes throughout the book. The Information Boxes, which predominate in the earlier chapters, are intended to provide background material that is necessary, but would likely destroy the continuity of the chapters. Students have varying training and experience, so these boxes will be more useful for some than others. Some of the choices, *e.g.* oxidation/reduction and DNA fingerprinting, seem reasonable, but others, *e.g.* storage and supply of ATP in striated muscle cells, seem more supplementary. The Supplements include more specialized information (*e.g.* bacterial flagella) and so they do. Many of these cover topics related to procaryotes. The most useful and stimulating of the pedagogical aids are the Experimental Processes. These sections are actually essays, written by key researchers. Some of the contributors are well-known, *e.g.* Singer, Hatch, Cande, and others are relative newcomers. The mixture is excellent. Students can identify more closely with the younger workers and more easily imagine themselves in the role of a researcher. At the same time they can gain appreciation of the accomplishments of established scientists. I feel these sections not only enliven the subject, but also will stimulate student imagination.

Within many of the chapters, there are very helpful summary and comparative tables (*e.g.* intermediate filament classes). Often these tables include material that you would not expect students to learn, but that are quite helpful for illustrations. At the end of each chapter is a set of useful and meaningful review questions and suggested readings. The questions are so well-done, I would actually

assign them. The suggested readings are appropriate and reasonably current. It is very convenient to have them arranged by category. The reading and analysis of scientific papers can be a very important teaching instrument. It not only familiarizes students with current research, but more importantly helps to develop their abilities to read critically. In the future, I would like to see texts include bundles of selected papers that parallel and supplement text material.

Considering the length of this work, I found amazingly few errors. There are some things I would like to see changed, however. For instance, in the chapter on enzymes, I would like to see kinetics treated more quantitatively within the body of the text. There is a "Supplement" on Michaelis-Menten kinetics, but there are no problems or practical applications made.

The text begins with a thorough survey chapter that summarizes the coverage of cell biology in a typical introductory course. To this the author adds a little history. I found that there was almost too much information in this chapter, but students may read it for review.

The development and application of techniques in cellular and molecular biology has been and is phenomenal. Wolfe dedicates one entire chapter to some of the more important ones. Unfortunately, I found this approach disruptive to the general continuity of the text. Naturally, the instructor could omit this section, but I would prefer that the techniques be integrated into the other chapters and discussed as they apply. Sometimes it is difficult for students to understand a procedure when they don't have the appropriate background and context.

Stephen Wolfe has crafted a work that clearly distinguishes itself from other available texts. He convincingly uses cell structure as the cornerstone for understanding cell function. Many comparable texts either diminish the importance of structure or overwhelm it with the molecular. Wolfe successfully integrates the molecular with the cellular, and he does so better than the rest.

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Ahmadjian, V. 1993. **The Lichen Symbiosis.** John Wiley & Sons, NY. \$69.95. 250 p.

It has been 26 years since the appearance of Vernon Ahmadjian's first volume on lichen biology, with the same title as the book under review. That book, although modest in size, was a groundbreaking treatise on all aspects of the workings of the fascinating mutualistic consortium of "alga" (in the broad sense) and fungus that we call lichen. Lichens have been subjected to a great deal of study over the past two decades, and, although there have been some notable reviews of lichen biology in the interim, we all could look forward to a synthesis by the man who, with his many students, has done so much in the field himself.

Comparisons are inevitable between this volume and the first. The text of the new edition is 60 pages longer, and it contains more than three times as many references (over 1,000), almost all of them having appeared after 1967. The book, therefore, thoroughly reviews the modern literature and will provide quick and ready access to that literature. The down side of the confinement to modern papers is that, in many cases, modern compilations and reviews are cited rather than the original, classic papers.

In a book like this, one expects to find answers (if they exist) for questions such as, "What is a lichen," "what are the physical and nutritional interactions between the components or bionts," "can the components be separated, and if so, how," "what makes lichens unique among symbiotic organisms," and "how does one study lichens experimentally?" Most of these questions are indeed answered in this volume, and where there are no answers to basic questions such as, "how does a lichen photobiont trigger the morphogenetic transformations in the mycobiont?," Ahmadjian points this out as well.

Also included in the book are sections on whole lichen physiology, air pollution effects, and genetics (rare in lichen texts, even if it is only one page here, showing how little we know on this vital subject).

The author is at his best when talking about his own studies of lichen resynthesis and the culture of isolated symbionts. The subject is brought right up-to-date, with a straightforward, often personal view of the significance of recent developments in the field. Ahmadjian is particularly enthusiastic about the potential of new molecular studies such as those based on DNA sequencing, and he presents some interesting speculations about the possibilities of gene exchange between symbionts as explaining some basic aspects of lichen biology.

And yet, there are disappointments in the book. One has the feeling that the author felt constrained by limitations on text length, and that as a consequence, he felt obliged to settle for a citation of

relevant papers, thorough as it is, rather than actually summarizing what is said in those papers. Some examples include the section on the establishment of lichens from isidia and spores. Later (on p. 117), we learn that "several mathematical models have been proposed to explain the growth . . . of lichens . . .," but not what those models are or what they tell us. Similarly, the whole subject of multiple-component symbioses in lichens outlined by Poelt, and later Hawksworth, was surprisingly ignored. The occasional puzzling phrase, such as (p. 151) "Fruticose lichens were found to be more sensitive . . . than saxicolous forms . . .," and the scattered typographic errors are unfortunate. And, despite what the cited author(s) said, *Hypogymnia physodes* should not be given as an example of an "unwettable sorediate lichen" (p. 151), nor should *Lecanora dispersa* be described as a lichen with a pigmented cortex (p. 40).

The illustrations are mostly good, especially the many SEM photos, but some of the schematic drawings are a bit "rough" (e.g. figures 37, 47: Why weren't the originals used, with permission?). Of special interest to professors and students will be the many comments on where more research is needed, and even how the experiments might be designed. If used as a text in a course in lichenology, it would have to be supplemented with material on systematics, morphology, community ecology, phytogeography, etc. since it was obviously not the intention of the author to cover such subjects. By and large, then, Ahmadjian has given us a concise, useful summary of what lichens are and how they live, with abundant leads into the literature for those who need to know more.

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Stern, Kingsley R. 1994. **Introduction to Plant Biology.** Sixth Edition. Wm. C. Brown, Dubuque, IA. Paperbound. \$40.00. 520 p.

There are probably as many approaches to teaching introductory botany as there are botany instructors, and it is no doubt difficult to target textbooks to such a varied market. To this market comes a brief, basic introductory botany textbook for majors and non-majors, the sixth edition of Kingsley Stern's *Introduction to Plant Biology*. Its content seems suitable for one-term introductory courses, including those that serve as basic prerequisites to more advanced courses in plant morphology, taxonomy, physiology, or ecology. The book is available in both casebound and paperbound versions; the paperbound review copy was printed on recycled paper. The accompaniments include an instructor's manual, a laboratory manual, a study guide, transparencies, and a computerized testpak. Also, for instructors who wish to use it, there is an inexpensive book of readings for critical thinking activities. The style of writing is clear, direct, and student friendly, and the botanical coverage is traditional and solid.

The subject matter of *Introduction to Plant Biology* is divided into 25 chapters, and there are five useful appendices that treat such topics as the scientific names of organisms in the text, biological controls, useful plants and poisonous plants, and houseplants and home gardening. There is a glossary of terms with phonetic spelling to assist with pronunciation. The book begins with a brief history of botany and some basic biology. It continues with a logical progression of botanical topics: vegetative and reproductive anatomy and morphology of vascular plants, soils and water relations, metabolism, growth, meiosis and alternation of generations, genetics and biotechnology, evolution, diversity, flowering plants and civilization, and ecology. Depending on what one wishes to emphasize, the organization of the text is such that an instructor can omit parts without unacceptable sacrifices to the general flow of information and ideas. As instructors, we continue to struggle with the pedagogic conundrum of how to deal with content coverage while striking a better balance between lectures, discussion, critical thinking activities, and other ways of knowing. This book accommodates rather well one's need to be selective while still offering a scientifically sound and suitably rich array of botanical topics for undergraduates who, in the experience of this reviewer, are increasingly interested in applications for theoretical knowledge, interdisciplinary connections, and the people who do science. There is some ethnobotany, pharmacology, biotechnology, and horticulture, and there are names of some of those who do science.

The chapters begin with learning goals, an outline, an overview, and very attractive colored photographs of plants or other organisms; they conclude with a helpful summary, review and discussion questions, and references for additional readings. The array of botanical topics is treated well for broad-based introductory courses. Basic biology is appropriately integrated and reinforced throughout the book. There is liberal use of illustrations, including drawings, colored photographs, graphs, tables,

and models. The classical illustrations on which instructors have come to rely are included, though some of the images on recycled paper are less sharp than is ideal. There is brief mention of methods of investigation and of evidence in support of textbook information to show students how plant scientists work.

There are a couple of additions to the book that would be useful to this reviewer. It would be highly beneficial to include additional references to the accomplishments and contributions of more botanists by name, including minorities and women. This could be done in very brief biographical sketches that highlight the work of selected individuals, illustrate the diversity of today's scientific community, and reveal the varied and interesting career paths of plant scientists. For example, a recent special issue of *The International Journal of Plant Sciences* contained a wonderful retrospective series from a symposium in 1992 on the life and work of Dr. Katherine Esau. This example and others should be shared with beginning students. Also, the reviewer felt a need for inclusion of some of the fascinating work on *Arabidopsis thaliana*, a model organism in plant genetics, development, and molecular biology. Students should be aware of the use of a major plant model organism in a genome project and in other exciting research that parallels studies with animal and microbial models.

This is a good textbook to add to those available to today's instructors. It is interesting to imagine right now what a "textbook" of the next generation will be. It is both exciting and challenging to think about the implications of information highways and other high technologies for the dissemination and acquisition of information for teaching in the next few years.

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Lawlor, David W. 1993. **Photosynthesis: Molecular, Physiological and Environmental Processes.** 2nd ed. Longman, Essex, England; John Wiley & Sons, NY. \$49.95, paper. 318 p.

In the preface to *Photosynthesis*, David Lawlor describes his text as intended for undergraduate and graduate study in plant biology courses and for non-specialists in other disciplines who wish to broaden their background in photosynthesis. As a mycologist who occasionally teaches introductory botany and plant physiology courses, I would include myself in the latter group. This compact volume makes an admirable attempt to cover a complex topic in a broad qualitative manner suited to undergraduates and non-specialists. However, quantitative aspects are introduced where understanding of the derivation of concepts requires such an approach. Occasionally, the density of the writing requires slow reading and analysis, and the depth is probably beyond the average undergraduate. At other times, the occasional quantitative sections will leave the more knowledgeable reader unsatisfied, as the author fails to provide sufficient depth of presentation for the sake of brevity. This, of course, is to be expected in a text intended for such a broad audience, but overall, the author has made excellent decisions in his compromises.

The 13 chapters can be divided into several broad sections. Following an introductory chapter, a series of eight chapters deals with the molecular aspects of photosynthesis (the nature of light, light harvesting, electron transport, and chemical bond energy generation, and the biochemistry of carbon assimilation and photosynthetic products, including C₄ and CAM metabolism). Some ideas on the evolution of photosynthesis can be gleaned from the inclusion of bacterial systems in this section. Also included in this section is a description of nitrogen and sulfur assimilation, photosynthetic processes often ignored in discussions of photosynthesis. The following chapter, new to this update of the 1987 edition, provides an excellent overview of the molecular biology of the photosynthetic system. Physiological aspects are next discussed in two chapters on carbon dioxide supply and whole leaf photosynthesis, including photosynthetic responses to environmental stress. The concluding chapter places photosynthesis in an ecological and economic context, with a discussion of plant production, yield, and photosynthetic efficiency.

The book benefits immensely in being written by a single author, an increasingly scarce approach in a time of "quick and dirty" compendiums of symposia and multi-authored collections of rewarmed publications. The abundant, well-designed diagrams and tables do an excellent job of clarifying complex processes. Most of the sources cited are from the secondary literature (e.g. reviews) which is probably appropriate for the intended audience. Of course, the primary literature can be accessed from these secondary sources. The book is up-to-date, and accentuates most of the current lines of research which will lead to greater understanding of one of life's fundamental processes. I would highly recommend

this text for graduate courses in plant physiology and photosynthesis, and as an addition to any professional's bookshelf where there is a need for current review of the topic.

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Hannesson, R. 1993. **Bioeconomic Analysis of Fisheries.** John Wiley & Sons, Inc., NY. \$49.95. 138 p.

As Professor Hannesson states in his preface: "Addressing two different readerships at the same time is a risky undertaking"; this also holds true for the reviewer. I will state up front that my background is that of a quantitative fishery biologist, and not an economist.

The first chapter (p. 1-4) presents a brief introduction as to how a market economy works with respect to the fishing industry and reasons for market failure. The next chapter (p. 5-46) goes into greater detail on the economic theory of fisheries. Mathematical support depends predominantly on the surplus production approach to fish population modeling. An interesting discussion on optimum exploitation of fish stocks under a variety of conditions is presented in the final subsections of this chapter.

The third chapter (p. 47-75) describes several applied fishery models, including the Schaefer surplus production model, the Ricker spawner-recruit model, and the Beverton-Holt yield model. These are standard fishery models used in fish stock assessments to judge the potential for stock overfishing. The issue of economic discounting is described as it relates to these models. Problems arising from natural fluctuations in fish stocks are discussed in the following chapter (p. 76-111). The economic advantage of stabilizing catch from a variable stock is described, as is the effect of natural fluctuations on optimum harvesting capacity with random catch quotas.

The final chapter (p. 112-131) on methods of fisheries management presents some interesting discussion under the following subchapter headings: 1) property rights to fish stocks, 2) why government regulation often fails, 3) characteristics of efficient management, 4) indirect control through tax on landings or effort, 5) control of fishing capacity and effort, 6) control of the catch, and 7) transferable quotas.

With the current interest in the application of risk assessment to fisheries management, the example with Barents Sea capelin and description of a stochastic recruitment model in chapter 4 are particularly relevant. Some expansion of the material in the final chapter on methods of fisheries management would improve this book. I would recommend someone with an interest in economic aspects of fisheries to scan this book, preferably a library copy given the price of hardbound text books.

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Cox, G. 1993. **Conservation Ecology, Biosphere and Biosurvival.** Wm. C. Brown Publishers, Dubuque, IA. \$42.50. 352 p.

This book is designed to be used as a text for an upper level undergraduate course and has an accompanying instructor's manual (not reviewed here). According to the author, the goal of the text is "to introduce the reader to the nature of the biosphere, to the threats to its integrity that are arising, and to the ecologically sound responses to these threats."

Conservation ecology is defined in the beginning of the first chapter in a way similar to how *conservation biology* is usually defined as the science of the origin and preservation of biotic diversity. The text is more oriented toward ecosystem-level aspects of conservation biology than toward species conservation, and this may be the reason why the title of "conservation ecology" rather than the more traditional "conservation biology" was selected.

Seven sections with a total of 28 chapters cover the range of issues involving conservation ecology. A glossary provides definitions of terms, as well as descriptions of conservation organizations and important conservation-related acts of law. The text is amply illustrated with maps, tables, graphs, and photographs.

The seven sections include an introductory section describing the basic concepts of conservation ecology, two sections each that cover terrestrial and aquatic ecosystems, a section concerning the theory and practice of conservation, and a final section that describes the history of conservation and the current status of global conservation programs. Throughout the text, one or two page "case studies" explore actual examples of conservation issues in greater detail.

Each chapter begins with a one page introduction and ends with a concise summarization of important points. I found this useful for understanding the flow of the text and the content of the chapters, and was able to get a quick overview of the entire book just by reading the first and last pages of each chapter.

Part Two contains chapters that cover major ecological and geographic groupings of terrestrial ecosystems, including chapters on temperate forests, woodlands, and shrublands; grasslands and tundra; deserts; moist tropical forests; tropical savannas and woodlands; coastal ecosystems; and islands. A worthwhile addition would have been a chapter on mountain ecosystems, detailing their unique ecological characteristics and conservation issues.

Following this section, Part Three covers special problems of terrestrial ecosystems, and includes large animal problems, migratory birds, predators and predator management, and pesticides and wildlife. The two sections on aquatic ecosystems follow this same pattern. Chapters in Part Four include lakes, ponds, and marshes; rivers and streams; oceanic ecosystems, and coastal marine ecosystems. Special problems addressed in Part Five include marine mammals and birds, and chemical pollutants in aquatic ecosystems.

I especially enjoyed some of the later chapters in Parts Six and Seven, where conservation theory and practice and the history of western conservation were covered. In Chapter 23, on management of exotic species, we are introduced to the concept of *keystone exotics*, defined as "exotics with distinctive features . . . that can cause almost complete biotic reorganization of the ecosystem." The Japanese honeysuckle that is smothering the forest around my home, with vines that reshape the crowns of the young saplings, bark that is collected by birds for nest construction, and with nectar that is an important early season food source for hummingbirds, may be a good example of a keystone exotic species.

There is a global focus to this text, as is appropriate in these days of growing awareness of international conservation issues. Case studies draw from experience gained throughout the world. Examples of case studies include The Hawaiian Islands, The Peruvian anchoveta fishery, and the Mara-Serengeti Ecosystem. Chapter 27 on the history of conservation is an exception to the global focus, since it deals exclusively with the history of western conservation. Nonetheless, it will allow the student to understand the development of western views of the relationship of humans and nature, how this may not be the same as in other parts of the world, and what the consequences of these differences may be for global conservation efforts.

The final chapter on global conservation programs gives the reader an overview of major international organizations that are working to achieve biodiversity conservation. It will be useful for students seeking careers in this area.

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Beacham, Walton (ed.). 1993. Beacham's Guide to Environmental Issues & Sources. Beacham Publishing Inc., Washington, DC. 5 Vols. \$240.00. 3,335 p.

It is hard to imagine tackling the vast literature that has accumulated on a subject like the environment. No one source could ever provide a complete list, let alone cross-indexed, to the thousands upon thousands of references. The best one could hope for is a window into the literature on each topic provided by readily available references. That is the focus of this five volume series. The books contain information and bibliographical entries grouped into the following 39 chapters: CEQ's State of the Environment, Global Environmental Crisis, Global Environmental Policy, U.S. Environmental Policy and Politics, Environmental Movement, Environmental Philosophy, Ethics and Economics, Animal Rights, Climate, Agriculture, Third World Food Supply and Agriculture, Water Supply, Food Safety, Health and the Environment, Population, Energy, Nuclear Energy, Nuclear Weapons, Transportation, Air Pollution, Acid Rain, Water Pollution, Groundwater Pollution, Ocean Pollution, Recycling, Solid Waste Management, Hazardous Waters Management, Radioactive Waste Disposal, Ecology and Nature Conservation, Biodiversity, Wildlife Conservation and Management, Endangered Species, Coastal Zone Management, Wetlands, Fishery Management, Rainforests, Temperate Forests, Public Lands, Mining and Minerals, and Arctic and Antarctica. The chapter on the state of the environment (Chapter 1) describes in narrative form the issues and U.S. programs and policies that form the framework for the bibliographical entries found in subsequent chapters. The information contained therein is from the U.S. Council on Environmental Quality's 1992 annual report and hence

reflect the policies of the Bush administration. Much of the information is still pertinent and for this book at least provided a means of identifying relevant topics.

Chapters 2–39 are all arranged in similar fashion, so I have selected only one, Biodiversity, to describe in detail. This chapter contains seven sections: Short List of Sources, Introductory Sources, Extinction, Climate Change, Tropical Deforestation, Coastal and Marine, and Politics and Policy. The table of contents for the chapter contains several “see also” entries that direct the searcher to chapters containing related material. Each section contains bibliographical entries for books (annotated), books (unannotated), general interest periodicals (annotated and unannotated), environmental and professional journals (annotated and unannotated), law journals, reports, federal governmental reports, conference proceedings, and bibliographies. The lists are comprised of selected literature citations on each topic and are far from complete. The brief annotations are generally informative and those on sources I know are accurate. Sources under “Environmental and professional journals” include entries from *Bioscience*, *Science*, and several natural history magazines, but few from the primary literature. Entries from what many consider to be the premier journal on biodiversity issues, *Conservation Biology*, are conspicuously absent. Searching a particular topic requires scanning the bibliographic entries and reading the annotations. Searching is also enhanced through the use of the 54 page Cumulative Index. Once a reference of interest is located, one must either find the magazine, journal, or book in their library. Entries for books contain Library of Congress catalogue numbers; those for many reports contain source addresses. Addresses and phone numbers are provided in appended lists of publishers and selected environmental organizations. Several other chapters, but not Biodiversity, also contain lists of videos and books for young adults.

No one source can be all things to all people. These books are no exception. I envision the audiences best served by this reference series are the lay public, secondary school teachers, college professors who teach at the freshman level, middle school and high school students, and college students who are majoring in subjects other than science. Although this is a source of information that everyone would want to consult for initial references, upper level science majors and graduate students will want to dig deeper into the primary literature for additional material. In addition, the literature contained in these books include those published through 1992 and thus this resource was already out of date when published. But then, what book isn't?

This five-volume series should be placed on the shelves of every library in the United States. Nearly anyone searching for information and references on most aspects of the environment will want to consult this useful bibliographic resource. These books will continue to be valuable resources if the publisher provides future volumes that update the literature on the topics covered in this original set.

JOSEPH C. MITCHELL, *Department of Biology, University of Richmond, Richmond, VA 23173.*

Malakhov, V. V. 1994. **Nematodes: Structure, Development, Classification, and Phylogeny.** Moscow State University, Smithsonian Inst. Press, Washington, DC. \$25.00. 286 p. Transl. by G. V. Bentz, edited by W. D. Hope.

This work on nematodes reflects the ideas and experience of the author who has been conducting research on the structure, sensory organs, and embryonic development of nematodes, mostly free-living marine forms, for many years. The first 129 pages deal with the structure of nematodes. In this section, the author has included many of his personal observations and some excellent transmission electron micrographs of nematode cuticle and muscle. Malakhov is one of the few nematologists to be aware of and to discuss phagocytic cells found in the body cavity of nematodes. The next 40 pages deal with nematode embryonic and postembryonic development. These sections are very thorough and detailed. The author then calls upon his past experience and the observations presented in the book to devise a new natural superclassification of nematodes. This classification is based on traditional morphological features (similarities between the cuticles of Dorylamoidea and Mermithidae), as well as embryonic development. In this new classification, the nematodes are placed as a class in the phylum Nemathelminthes together with the Gastrotrichia. The class Nematoda is separated into three subclasses: the Enoplida, Chromodoria, and Rhabditia. A description of the various orders within these subclasses is provided, but then the classification usually ends at the level of suborder but sometimes superfamilies and families are also listed. The final two chapters of the book are devoted to the origin of nematodes from other invertebrates, the evolution of nematodes, and how nematodes are related to the other pseudocoelomates such as the rotifers, acanthocephalans, gastrotrichs, priapulids, kinorhynchids, nematomorphs, and loriciferids. During this comparison, the author reviews the structural

make-up of these little known groups in admirable detail. The author's views on the origin of parasitism and a comparison of the spiroascarids with the rhabditostrongylids are interesting and unique.

The author omitted to discuss the few fossil records of marine nematodes, and just touched on how the free-living marine forms are related to fresh-water groups and how the former became parasitic in the marine environment. More on these topics would have been desirable. Malakhov's views are somewhat colored by the forms he has studied. The statement "nematodes are dioecious" is not universally true. In fact, nematodes are unique in having more variations in reproduction than any other group of invertebrates, save perhaps the insects. Strangely, the topics of hermaphroditism and parthenogenicity were never discussed.

This work was originally published in Russian in 1986. In this English language edition, Malakhov added some more recent information. Yet of the 450 references provided, only 16 (3.5%) are later than 1980. Since 1980, a number of papers dealing with nematode ultrastructure have appeared, including some on the structure of nematode sperm, which incidentally, also could be used to help formulate a natural classification of nematodes.

GEORGE POINER, *Dept. Entomology, Plant, and Microbiology, Univ. Calif. Berkeley, CA 9470.*

Bowler, P. J. 1993. **Darwinism.** Twayne Publishers, NY. \$24.95. 113 p.

Most biologists concern themselves with the proximate functions ("how" questions) of molecules, cells, organisms, or even of interactions between organisms and studiously ignore the ultimate functions (the "why" questions). Such investigators can be, and usually are, happily ignorant of most of evolutionary theory and its implications even though they will acknowledge the existence of evolution. This slender and expensive volume provides a good, brief summary of the impact of Darwin on scientific, social, and religious thought. Peter Bowler is Professor of the History and Philosophy of Science at the Queen's University of Belfast, Northern Ireland. The first of five chapters is an overview of the next three entitled: "From Darwinism to modern Darwinism." The next three chapters deal with Darwinism in Science, in religion and morality, and social Darwinism. The last chapter is a 21 page summary of Darwin's books on the Origin of Species and the Descent of Man and constitutes a good crib for a lazy, but concerned instructor in general biology. There is also a two page chronology listing of important events from the publication of the theory of transformism by Lamarck (and the birth of Charles Darwin) in 1809 through the publication of E. O. Wilson's Sociobiology in 1975 plus a bibliographic essay pointing the way to further reading.

The only major deficiency in this brief work is the lack of any discussion of the continuing controversy between the "adaptationists" of sociobiology and behavioral ecology and the "environmentalists" of other subdisciplines in evolutionary biology and in psychology. These arguments are at the forefront of modern "Darwinism" and biologists should be aware that evolutionary biology is a modern and exciting science and not merely an idle pastime from the past.

HELMUT C. MUELLER, *Department of Biology and Curriculum in Ecology, University of North Carolina, Chapel Hill, NC 27599.*

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

FLORIDA

Jacksonville State University, Department of Biology. New faculty are *Dr. Donald McGarey* (Ph.D., University of South Florida; post-doctoral, University of Florida), a microbiologist; *Dr. Roger Sauterer* (Ph.D., State University of New York at Stony Brook; post-doctoral, Albert Einstein College of Medicine); and *Dr. Randy Webb* (Ph.D., Washington State University). *Drs. LaJoyce Debroy* and *Jeri Higginbotham* were awarded an NSF-ILI grant to purchase equipment for molecular biology. *Dr. David Whetstone* published three chapters in the first two volumes of the *Flora of North America*; *Dr. Frank Romano* attended an NSF-sponsored workshop on "Stressed Stream Analysis" at SUNY State College at Brockport.

GEORGIA

Georgia Southern University, Department of Biology. The Seminar Series for the Winter Quarter included *Dr. Ellen M. Dotson*, "Presence and Metabolism of Ecdysteroids in Tick Embryos," *Dr. Russell C. Johnson*, University of Minnesota Medical School, "Lyme Disease: Host Response to *Borrelia burgdorferi*," *Dr. Hans Klompen*, "Ticks, Hosts and Rocks: Speciation Patterns in Ixodida," *Dr. Robert Carroll*, School of Medicine, East Carolina Univ., "Mg++ Movement in Circulatory Shock," *Dr. Roger E. Mitchell*, "Gene Expression in Corn and bean Seeds," *Dr. Ann E. Pratt*, "Voyage to Antarctica: Icebergs, Pinnipeds and Penguins," *Dr. Danny E. Akin*, USDA-ARS, "Rumenations on Digestive System Microorganisms," *Dr. Richard Byles*, U.S. Fish and Wildlife Service, "Migrations of Sea Turtles: Applying Modern Technology to Ancient Mariners."

KENTUCKY

Cumberland College, Department of Biology. *Dr. W. Blaine Early, III*, Professor and Chair, and a member of the department since 1979, has resigned his position to pursue a degree in environmental law at the University of Kentucky School of Law. Replacing him as chair is *Dr. Jim Ross*. Joining the faculty is *Dr. Robert G. Hancock* (Ph.D., The Ohio State University), an entomologist.

MISSISSIPPI

Delta State University, Department of Biological Sciences. *Dr. Samuel P. Faulkner* (Ph.D., University of Southern Mississippi) was appointed Assistant Professor of Biology, Fall 1993. In addition to teaching duties, *Dr. Faulkner* is curating the Museum of Natural History at Delta State. His research interests include wetland plant ecology and plant nutrition, and biology education, particularly in areas of critical thinking and concept formation. Before coming to Delta State, *Dr. Faulkner* taught botany and ecology at Dickinson State University in North Dakota.

Gulf Coast Research Laboratory, Ocean Springs. *Gerald C. Corcoran*, former curator of GCRL's J. L. Scott Marine Education Center and Aquarium, died 2 February in Biloxi. He was 64. GCRL has been awarded \$109,170 to participate in the Southeast Area Monitoring and Assessment Program. *Dr. William W. Walker*, assistant director for research, was recognized as Outstanding Citizen of Ocean Springs. He was honored for his community involvement over the past two decades. He is president of the Mississippi Gulf Coast YMCA Board of directors and is serving a five-year term on the School Board. He is past president of the Ocean Springs Jaycees and was a member of the Ocean Springs Park commission for six years.

TENNESSEE

The *University of Tennessee at Martin, Department of Biology*. *Dr. Rebecca R. Irwin* has joined the staff. Her Ph.D. is from the University of Michigan in Biological Sciences. Due to a retirement in the department, there are several years of back issues of several journals. The journals are *Natural History*, *Wildlife Reviews*, *National Wildlife*, *International Wildlife*, and *Nature*. They are available for the cost of shipping. Contact: *Dr. W. A. Sliger*, Chairman, Dept. of Biology, UT–Martin, TN 38238.

MUSEUMS AND BOTANICAL GARDENS

ALABAMA

Anniston Museum of Natural History, Anniston. The Museum scheduled a number of biological events for this past Spring. The included: an exhibition of paintings of 45 official state flowers; *Luann Craighton* of Callaway Gardens presented “Bluebirds, Bluebirds, Bluebirds”; *Charlotte Hamner* presented “Gardening in February,” and *Anita Jenkins* presented “Arranging Winter Flora”; Landscape Architect *Hayes Jackson* talked about “Designing Your Garden”; *Dr. David Williams* of Auburn Extension Service discussed “Southern Trees.”

ASB MEMBERSHIP DUES STRUCTURE

Please complete the information below, enclose check or money order payable to **Association of Southeastern Biologists**, and mail to **James C. Hull, Department of Biological Sciences, Towson State University, Towson, MD 21204**. The mailing label shows the year you are paid through--for example, if the date is 1992, you need to pay for 1993 and 1994. Please contact Jim Hull if there is an error (410-830-4117; Email E7B2HUL@TOE.TOWSON.EDU). Thank you for your support.

Name _____

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City _____ State ____ Country _____

Zipcode _____ - _____ Telephone (____) _____

FAX (____) _____ EMAIL _____

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_____ Emeritus--\$10

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_____ Patron--\$500

_____ Library--\$30; or Library for 3 years--\$85

_____ Enrichment Fund Contribution

_____ Total Enclosed: Paid for 1993 ____; 1994 ____; 1994-96 ____

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CONTENTS

THE ASB BULLETIN

VOLUME 41, NUMBER 3, JULY 1994

Rohde, F. C. and R. G. Arndt. Distribution and abundance of the sharphead darter, <i>Etheostoma acuticeps</i> (Percidae), in North Carolina	153
Association Affairs	160
Beta Beta Beta Abstracts	176
Reviews	182
News of Biology in the Southeast	190

Cover photo—Deborah L. Clayton, University, Al.

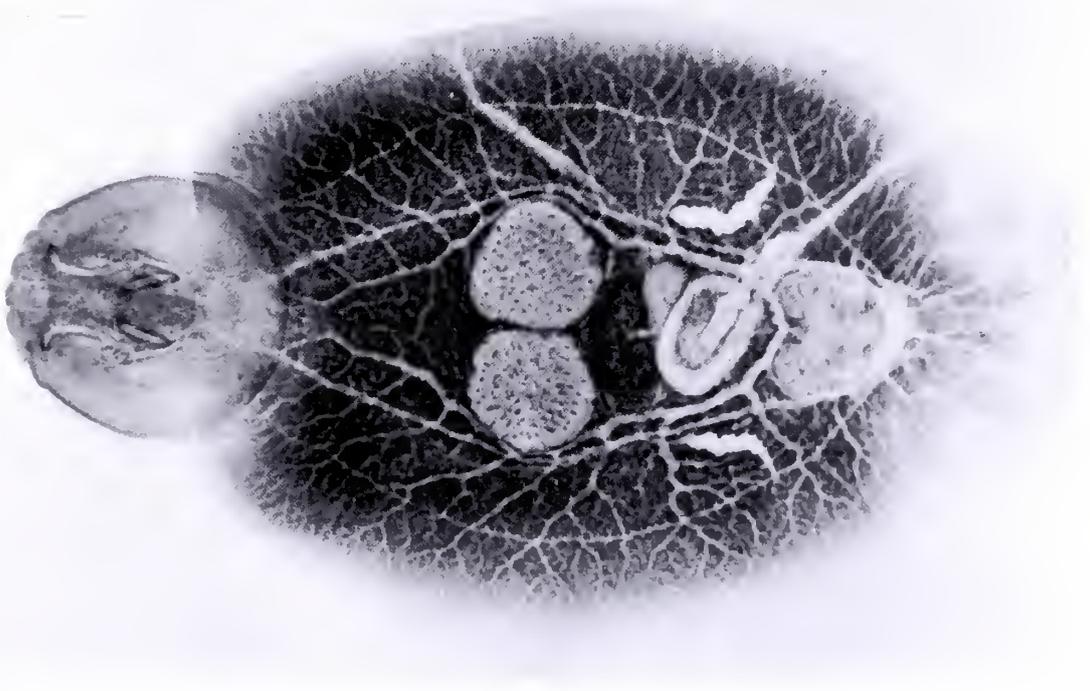
The ASB BULLETIN

Volume 41, Number 4

October 1994

CALL FOR PAPERS—DEADLINE: November 15

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Monogenetic trematode, *Benedeniella posterocolpa*

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The ASB encourages, in the broadest and most liberal sense, the advancement of biology as a science by: the promotion of research, the increase and diffusion of knowledge of biology, emphasis of the relationship of fundamental knowledge of biology to the solution of biological problems, the preservation of biological resources, and by its meetings, reports, discussions, and publications to promote scientific interests and inquiry, thereby adding to the health, happiness, and knowledge of all peoples. The Association meets annually on campuses of universities and colleges located throughout the southeast. Affiliated organizations meeting with the Association are: Southern Appalachian Botanical Society, Southeastern Section of the Botanical Society of America, Southeastern Region of Beta Beta Beta, SE Div. Amer. Microscopical Society, Southeastern Chapter of the Ecological Society of America, Southeastern Division of the American Society of Ichthyologists and Herpetologists, Southeastern Fishes Council, and Southeastern Society of Parasitologists. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. Members receive the Bulletin.

TIME AND PLACE OF FUTURE MEETINGS

1995 April 19–21 University of Tennessee, Knoxville, TN

1996 April 10–13 Ga. Southern College, Statesboro, GA

1997 April Furman University, Greenville, SC

1998 April Northeast Louisiana Univ., Monroe, LA

PATRON MEMBERS

Breedlove, Dennis and Associates, Inc., Orlando, FL

W. B. Brown Publ. Co., Dubuque, IA

Carolina Biological Supply Co., Burlington, NC

Martin Marietta Energy Corp., Oak Ridge, TN

Martin Microscope Co., Easley, SC

Saunders College Publishing Co., Philadelphia, PA

CALL FOR PAPERS

THE 56TH ANNUAL MEETING

HOST: THE UNIVERSITY OF TENNESSEE

MEETING SITE: KNOXVILLE, TENNESSEE

DATE: 19-21 APRIL 1995

Please note the following deadlines which are to be met before our 56th Annual Meeting hosted by The University of Tennessee, Knoxville.

- 15 November** Titles and abstracts of papers and posters (use blue abstract form). This will be the only call for papers. They must reach the program chairman by this date.
- 15 November** Nominations for ASB officers and executive committee.
- 1 February** Application for graduate student "travel awards."
- 15 November -
1 February** Submissions for research awards.
- Anytime** Membership application (see the October issues of the ASB Bulletin). Please encourage your graduate students, colleagues on the faculty, and your institutional librarian to join.

ASB MEETING

CALL FOR PAPERS & POSTERS FOR 1995 MEETING

DEADLINE: 15 November 1994

Individuals presenting papers or posters are expected to be members of ASB!

This form, with the original (blue) and one photocopy of the abstract must be addressed to the Chairman of the Program Committee, Dr. B. Eugene Wofford, Department of Botany, The University of Tennessee, Knoxville, TN 37996-1100 (615/974-2256), and **received** no later than **15 November 1994** if the title is to appear on the program and the abstract published in the April 1995 ASB Bulletin. All papers and posters should be presented. In the event of emergency absence, notify the **Program Chairman** before the meeting.

TYPE OR PRINT CAREFULLY

1. AUTHOR(S): _____

2. INSTITUTION(S): _____
PHONE: _____ FAX: _____
3. CHECK: PAPER _____ or POSTER _____ (see guidelines in January 1994 ASB Bulletin)
4. TITLE (Keep short and concise; omit higher taxa--see No. 6 below): _____

5. PROJECTION EQUIPMENT, unless specifically requested, is a 35-mm projector provided by the host institution:
[] 35 mm, [] Other _____
TIME LIMIT for presentations and questions is **15 minutes**.

6. **RECOMMENDED SECTION** to which paper should be assigned. Check appropriate one(s). **RANK** sections as to your preference (with "1" being first preferred) if you check more than one. Indicate **Higher Taxon** to help program committee in arranging papers (omit these from the title unless necessary):

_____ Aquatic ecology	_____ Ichthyology/Herpetology
_____ Microbiology	_____ Animal physiology
_____ Cytology/Genetics	_____ Plant ecology
_____ Animal ecology	_____ Parasitology
_____ Plant physiology	_____ Plant systematics
_____ Cell/Molecular biol.	_____ Cryptogamic botany
_____ Teaching biology	_____ Developmental biol.
_____ Invertebrate zoology	_____ Am. microscopical
_____ Other: _____	_____ Wetlands ecology

Sections will be established based on needs.

7. **ABSTRACT:** Since abstracts will be printed in the April ASB Bulletin by photo-offset, **it is critical that the abstract be typed carefully, with a good black ribbon, in the box on the blue form, following the directions there in detail. DO NOT USE A DOT-MATRIX PRINTER.** Additional copies of the form may be obtained from the **Editor** (Dr. Frank Schwartz; 919/726-6841). **DO NOT PHOTOCOPY** the blue form for an original. **Poorly prepared abstracts will be rejected and returned to the author.**
8. **AWARDS:** I intend to submit an abstract and manuscript, if appropriate, for the following (see January ASB Bulletin for instructions):
- [] ASB Student Research Award (\$500)
 - [] ASB Faculty Research Award (\$500)
 - [] Odum Award (\$250)
 - [] Aquatic Biology Student Research Award (\$100)
 - [] NC Botanical Garden Award (\$100)
 - [] SE Am. Soc. of Ichs and Herps [] travel, [] Best Student Paper

- 9. **NOTE:** If you wish to be notified of the day and time of your presentation, please include a self-addressed, stamped postal card with this Title Sheet. Indicate title, your name, and leave a blank for day and time.
- 10. **REPRINTS OF ABSTRACTS ARE NOT AVAILABLE.** You may duplicate the printed abstracts from the ASB Bulletin.
- 11. **IMPORTANT:** In case of error in your name or title when printed, or question about your presentation, please notify **PROGRAM CHAIRMAN** as soon as possible--not the moderator of your paper session.

NOMINATION FOR ASB OFFICERS AND EXECUTIVE COMMITTEE POSITIONS

DEADLINE: 15 NOVEMBER 1994

To members of the Nominating Committee: I wish to suggest that you consider the following ASB member(s) in selecting nominees for officers and executive committee positions. (Please include the institutional address of each nominee.)

PRESIDENT-ELECT _____

VICE-PRESIDENT _____

TREASURER _____

EXECUTIVE COMMITTEE (3-yr. terms) _____

MAIL TO: Dr. C. Ross Hinkle, Bionetics, BIO-2, Kennedy Space Center, FL 32899 (407/853-3281).

NAME & ADDRESS OF NOMINATOR: _____

"TRAVEL" SUPPORT AWARDS FOR GRADUATE STUDENT MEMBERS OF ASB

DEADLINE: 1 February 1995

Limited funds are available to partially defray the expenses of graduate students attending the Annual Meeting. The awards are for lodging and meals only. Departments are urged to provide transportation for their graduate students. Recipients must be member of ASB. Preference will be given to those students giving a paper or poster at the Annual Meeting. The guidelines for application are as follows:

1. Give information as to whether you submitted a title and abstract for a paper or poster.
2. Give a conservative, itemized estimate of meeting expenses excluding transportation. Student travel awards are granted on a competitive basis. Applicants must document expected expenses and list other sources of support for this meeting, including institutional aid, shared lodging and shared transportation.
3. In a paragraph, give a brief history of your education to date; indicate how many years you have been, and expect to be, in graduate school, your major field of interest, publications which have appeared or in preparation, degree sought, name of major professor, and any other pertinent professional details.
4. Give your source(s) of support while in graduate school, e.g., NSF, NIH, USDA, Teaching Asst., Research Asst., etc.
5. Have your major professor or department head provide a letter supporting your application, and enclose this letter with your application.
6. Send application, with supporting letter, all in triplicate, to: Dr. Armando de la Cruz, Department of Biological Sciences, Mississippi State University, Mississippi State, MS 39762 (601/325-3120).
7. Applicants will be notified of the decision of the Committee as soon as possible. Recipients of the award will receive their checks at the time of registration at the meeting.

"TRAVEL" SUPPORT AWARDS FOR SEASIH STUDENTS

A limited number of travel grants (\$50 each) are available to selected students presenting papers in ichthyology and/or herpetology. Students seeking travel awards should provide a brief justification for their request by 1 February 1995. Send to: Dr. Robert W. Van Devender, Department of Biology, Appalachian State University, Boone, NC 28608.

MERITORIOUS TEACHING AWARD NOMINATION

DEADLINE: 1 February 1995

Each year, the ASB recognizes one of its members for especially meritorious teaching. This award of \$1,000 is sponsored by Carolina Biological Supply Company, Burlington, North Carolina. The recipient is announced at the Annual Banquet and in the following July ASB Bulletin.

The recipient must be a member of ASB who is active or recently retired and who has taught biology in a southeastern institution for at least ten years, and must not have administrative duties beyond the departmental level. Among evidence of the qualifications of the candidate are the recognition in his/her institution (important assignments and other contributions specifically related to effective teaching, and teaching awards) and the number and quality of students for whom he/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, using the following form, and include a letter of nomination with supporting documentation (biographical sketch or CV, supporting letters, etc.). Send all of this, once compiled, to: Dr. James W. Hardin, Department of Botany, North Carolina State University, Raleigh, NC 27695-7612; 919/515-2226; FAX: 919/515-3436.

NOTE: Supporting letters for nominees should be sent to the nominator, not to the selection committee. Past unsuccessful nominees will not be reconsidered unless they are re-nominated with

up-to-date materials. Nomination materials of unsuccessful nominees will be returned to the nominator.

NOMINATION--ASB MERITORIOUS TEACHING AWARD, 1995

NAME _____

ADDRESS _____

TEACHING INTERESTS _____

NOMINATOR NAME/ADDRESS _____

Supporting documentation: _____ letter of nomination
 (enclosed--in triplicate) _____ supporting letters
 _____ curriculum vitae
 _____ additional information (list)

RESEARCH AWARDS

DEADLINES: 15 November 1994 and/or 1 February 1995

If you intend to present a paper at the Annual Meeting, you are encouraged to submit your manuscript, or abstract, in competition for one or more of four Research Awards. These cash awards are indicated below.

ASB STUDENT RESEARCH AWARD (\$500) AND ASB RESEARCH AWARD (\$500)

Rules are as follows:

(a) Given for especially meritorious manuscript presented orally by the author(s) at the Annual Meeting. In order to qualify for presenting the paper, the author(s) must submit an abstract by the **15 November** deadline. Papers submitted for the competition must be

received in **triplicate** and in their entirety by **1 February** and must be journal-ready manuscript worthy of publication. **Copies of the ASB abstract and the title form also must accompany the manuscript.** A short biographical sketch of each author must accompany the manuscript at the time of submission.

(b) Only ASB members are eligible. The student award is given to the senior author if he/she is a graduate or undergraduate student at the time of presentation.

(c) Papers may be in press but not published prior to the previous annual meeting.

(d) Papers are judged by eminent scientists selected by the committee from institutions either within or beyond the Southeast.

Every effort is made to keep authors of submitted papers, as well as the reviewers, anonymous. Judges will use a standard evaluation form that includes the following criteria: significance of ideas, soundness of hypotheses or objectives, originality (creativity), quality of methodology, validity of results, soundness of conclusions, clarity, completeness, organization, and contribution to the field. At the discretion of the Research Award Committee, the award may be withheld or it may be split in case of a tie.

(e) Winners will be announced at the annual banquet. The original copy will be sent to the sponsor, and the title, names and affiliations of all authors, abstract, and biographical information will be published with an announcement in the July ASB Bulletin. The appropriate box should be checked on the ASB title form.

Send manuscripts and other required materials to: Faculty - Dr. Dwayne A. Wise, P. O. Drawer FA, Mississippi State University, Mississippi State, MS 39762; 601/325-3120. Student - Dr. Claudia L. Jolls, Dept. of Biology, East Carolina University, Greenville, NC 27858-4353, e-mail bijolls@ecuvms.cis.ecu.edu.

ASB STUDENT RESEARCH AWARD IN AQUATIC BIOLOGY (\$100). The purpose of the award is to encourage excellence in research in aquatic biology by undergraduate and graduate students. The award is sponsored by Wildlife Supply Company (Wildco).

Rules are as follows:

(a) Students who are members of ASB and whose research is sponsored by a faculty member or biology professional who is also an ASB member are eligible.

(b) The paper must be based on research designed and completed by the student.

(c) The paper must be presented orally by the student as senior author in a regular paper session at the annual meeting. The student must submit an **abstract** in compliance with the **15 November deadline** in the call for papers. By **1 February** the student must submit three typed or printed copies of the manuscript, a brief biographical sketch, and a letter from the faculty/professional sponsor affirming student status and their sponsorship to the chair of the ASB Student Research Awards Committee.

(d) The manuscript must conform to the style and general content of peer-reviewed journals in the area of aquatic biology.

(e) Oral presentations will be verified by the Student Awards Committee and the manuscripts will be evaluated in accordance with the following criteria: significance of the research to the field, validity of hypotheses tested, innovativeness and appropriateness of methods, validity of conclusions, clarity of presentation of results, and quality of writing style.

(f) It is intended that aquatic biology be broadly interpreted; for example, the research could involve an entomological project on an aquatic insect.

(g) An award will not be given if in the judgment of the Committee there is no meritorious paper.

(h) The winner will be announced at the annual banquet.

The appropriate box should be checked on the ASB title form.

Send manuscripts and other required materials to: Faculty - Dr. Dwayne A. Wise, P. O. Drawer GA, Mississippi State University, Mississippi State, MS 39762; 601/325-3120. **Student** - Dr. Claudia L. Jolls, Dept. of Biology, East Carolina University, Greenville, NC 27858-4353, e-mail: bijolls@ecuvms.cis.ecu.edu.

EUGENE P. ODUM AWARD - \$250 and a plaque given by the Southeastern Chapter of the Ecological Society of America, for the best ecological paper presented by a student.

The paper will be evaluated by a panel of judges at the time of presentation on the following points: (a) Significance of Ideas; (b) Creativity; (c) Quality of Methodology; (d) Validity of Results; (e) Clarity of Presentation.

Eligibility Requirements:

- (a) Undergraduate and graduate students are eligible;
- (b) The student must be the sole or senior author;
- (c) The paper must deal with a clearly ecological topic and should be presented in any of the following sessions: Aquatic Ecology, Plant Ecology, or Animal Ecology;
- (d) The paper must be presented in a regular contributed session; papers presented in poster sessions or symposia are ineligible;
- (e) The student does not have to be a member of SE/ESA;
- (f) Submit title and abstract to Program Chairman by **15 November**. A second copy **must** be sent to the award coordinator by the same date. The appropriate box should be checked on the ASB titled form. **Send** to: Dr. Andy Ash, Dept. of Biology, Pembroke State University, Pembroke, NC 27832-1510; 919/521-6000, ext. 418.

THE NORTH CAROLINA BOTANICAL GARDEN AWARD - \$100 given by NCBG (through the Southeastern Section of the Botanical Society of America and the Southern Appalachian Botanical Society). This is awarded for a paper presented at the annual ASB meetings that best advances our understanding of the biology and conservation of southeastern plants and thus contributes to the mission of the North Carolina Botanical Garden. Of special interest to the Garden are the rare plant species of the Southeast: why they are rare; how they interact with plants, animals, and their environment; and what can be done to ensure their survival. As noted below, the paper may deal with a broad area including systematics, ecology, and conservation.

The presentation will be evaluated by a panel of judges at the time of presentation on the following points: (a) significance of ideas; (b) quality of methodology; and (c) clarity of presentation. The prize will be presented at the annual ASB banquet.

Eligibility Requirements:

- (a) All individuals eligible to present a paper at the ASB meetings are eligible for this award. They may be students, faculty or others.
- (b) The paper must deal with systematics, ecology, evolution, species biology (including population biology, pollination, dispersal, establishment, and maintenance), propagation, or conservation of vascular plants that are native in the southeastern United States.
- (c) The paper must be presented in a regular Plant Systematics or Plant Ecology contributed paper session; papers presented in poster sessions or in symposia are not eligible.
- (d) The title and abstract of the paper must be submitted to the Award Coordinator at the time of submission to ASB; this may be a copy of the same abstract submitted to ASB by **15 November**. The appropriate box should be checked on the ASB Title Form. Individuals interested in entering a paper for this award should submit the title and abstract to: Dr. Peter White, Department of Biology, CB3280, University of North Carolina, Chapel Hill, NC 27599.

**SOUTHEASTERN DIVISION OF THE AMERICAN
SOCIETY OF ICHTHYOLOGISTS AND
HERPETOLOGISTS
OUTSTANDING STUDENT PAPER AWARDS**

\$100 each will awarded to the best student research papers in both ichthyology and herpetology that are presented at the annual ASB meeting. Student must be the senior author and present the paper. All authors must be members of ASIH. The appropriate box should be checked on the ASB Call for Papers form. Please submit the title and abstract to the ASB Program Chairman by **15 November**. A second copy should be sent by the same date to the President of SEASIH: Dr. Peggy Shute, Tennessee Valley Authority, Regional Natural Heritage Project, Natural Resources Building, Norris, TN 37828. Winners will be announced at the ASB banquet.

ANNOUNCEMENTS

Delineation of the Landward Extent of Wetlands and Surface Waters

David W. Hall, Debra Segal and Don Deis

KBN Engineering and Applied Sciences, Inc. Gainesville, FL 32605

This new wetland delineation act will become effective 1 July 1994. It will decrease the number of dredge and fill permits to two which will include the U.S. Army Corps of Engineers (USACE) and either the Florida Department of Protection (FDEP) or the Water Management District (WMD). The intent of the new legislation, which will be the direct responsibility of FDEP, is to approximate the combined jurisdictional lines now claimed by FDEP and WMD's. The methodology will be similar to current rules for the landward extent of wetlands. Under the new legislation, an applicant will be able to submit an aerial map based on limited ground truthing. This new legislation will open the door for technology which includes a global positioning system (GPS), and computer mapping and drawing programs (e.g. AUTOCADD and geographical information system (GIS)). Grandfather language will affect declaratory statements, permits, mining, some development, etc.

Other methodology that will be affected by the new rules includes:

Determination—The first step in determining the jurisdictional boundary of a wetland is comparing the wetland types to those listed in the rule, i.e. swamps, sloughs, wet prairies, etc. The actual wetland boundary is determined by applying reasonable scientific judgement to evaluate all reliable information. Two methods can be used to evaluate vegetation: the "A" test and the "B" test. The "A" test dictates that the areal extent of obligate plants (listed in the vegetative index) be greater than the areal extent of all upland plants in that stratum. In addition to the requirement for a percentage of obligate plants, the "A" test requires that either: hydric soils or riverwash be present; the substrate be composed of non-soil, rock outcrop-soil complexes, disturbed soils which do not exhibit hydric indicators but evidence indicates that they are hydric, or the substrate is within an artificially created wetland area; or at least one hydrologic indicator, as listed in the rule, be present.

The "B" test has the same substrate and hydrologic requirements, but the percentage of the areal extent of the plant stratum changes. The "B" test states that the areal extent of obligate and/or facultative wet plants (listed in the vegetative index), be equal to or greater than 80% of all the plants in that stratum exclusive of facultative plants.

The landward extent of wetlands does not include pine flatwoods and improved pastures, but does include other areas with undrained hydric soils and areas with hydrologic indicators as listed in this act. Areas with natural or man-induced altered vegetation or soils which can not be identified using the above methodology shall be delineated by using the most reliable available information, i.e. aerial photographs, remaining vegetation, authoritative site specific documents, or topographical consistencies. Permitted or legal non-permitted activities shall not be regulated by this method.

Selection of and dominance within the appropriate vegetative stratum (canopy, subcanopy, or ground cover) is determined by the composition of the plants. The top stratum (canopy) shall be used to determine dominance, unless the canopy constitutes less than 10% areal extent, or unless a preponderance of evidence indicates that the canopy is not indicative of the hydrologic conditions. If the canopy is not appropriate, the stratum most indicative of on-site hydrologic conditions shall be used.

Vegetative Index—An extensive vegetative index lists all species of plants considered obligate, facultative wet, and facultative for purposes of this act. Any species not listed, exclusive of vines, aquatics and subsequent introduced species, is considered upland. The use of all plants in this act is based solely on scientific names. Specific publications intended to resolve any dispute about nomenclature are cited in the act.

Hydric Soils—Hydric soils are used in three different manners to delineate wetlands. First, a site is a wetland when wetland vegetation is present (using the A or B test described earlier) and one of the hydric soil indicators listed on the USDA-SCS approved hydric soil indicators for Florida is present. Second, a site is a wetland when one of 13 hydrologic indicators is present and one of the hydric soil indicators listed on the USDA-SCS approved hydric soil indicators for Florida is present. And third,

when wetland vegetation is absent and hydrologic indicators are absent, and the soil is undrained, then one of the following criteria must be met for the site to be classified as a wetland: certain soils classified according to United States Department of Agriculture's Keys to Soil Taxonomy; saline sands as found in salt and tidal flats; and soils designated by the USDA-SCS as frequently flooded or depressional, and which have been field verified using the USDA-SCS hydric soil indicators for Florida.

Hydrology—Hydrology of a jurisdictional wetland site must be indicative of long-term or periodic inundation or saturation. Inundation must occur for at least seven consecutive days and saturation must occur for at least 20 consecutive days. Hydrologic records or site specific hydrologic data (13 indicators are listed in the act) must be of such a duration frequency and accuracy to demonstrate these frequencies. When these records or data are not available an agreed upon site-specific, field-verified analytic or numerical model may be used to demonstrate the conditions. Any data deemed inadequate shall be reviewed by the agency, and a specific analysis will be provided to the applicant.

Surface Waters—The landward extent of Florida surface waters is the more landward extent of wetlands as determined by the methodology in this legislation. The landward extent of tidal waters is determined by the mean high water line elevation, non-tidal waters by the ordinary high water line and artificial waters by the top of the bank or seasonal high water line. Exemptions are listed for certain works, impoundments, reservoirs, and other watercourses.

Summary—The intent of this legislation is to simplify the permit process while providing the same protection to wetlands. The methodology for determining the landward extent of Florida wetlands has been improved and is easier to interpret. Additions to the descriptions of soils and methodology for determination of hydrology are very helpful. Even though the intent of this act is to parallel current jurisdictional lines, there will be some change because agency interpretations of the current rules vary somewhat. The new legislation averages the jurisdictional lines throughout the state and will result in some areas experiencing jurisdictional increase and a decrease in others.

Gibbs Award for Excellence in Systematic Ichthyology

Nominations are invited for the American Society of Ichthyologists and Herpetologists (ASIH) Robert H. Gibbs, Jr. Memorial Award for Excellence in Systematic Ichthyology.

Prizes are awarded for an outstanding body of published work in systematic ichthyology by a citizen of a Western Hemisphere nation who has not been a recipient of the award. The award is offered annually and consists of an appropriate plaque and a cash sum. The award recipient is announced at the annual meeting of the ASIH. The award for 1994, including a plaque and \$6,000, was presented to Dr. Robert R. Miller, Museum of Zoology, University of Michigan, Ann Arbor, for his pioneering work in the evolution, biogeography, paleontology, and genetics of North and Central American extant and Cenozoic fishes.

Nominations may be made by any ichthyologist, including self nominations, and should include the nominee's curriculum vitae, and detail the nominee's specific contributions and their impact on systematic ichthyology. Nominations must be received by 1 March of the year to be eligible for the award for that year. Nominations will be effective for three award periods. Four copies of each nomination should be sent to Dr. Dean A. Hendrickson, Secretary, American Society of Ichthyologists and Herpetologists, Texas Memorial Museum, 2400 Trinity, University of Texas, Austin, TX 78705.

Task Force Will Develop a Plan to Support and Conserve Commonwealth's Biological Diversity

Frankfort, KY (20 May 1994)—Kentucky has 2,000 to 3,000 species of plants, more than 200 species of freshwater fish, 105 species of amphibians and reptiles, 340 species of birds and 75 species of mammals. Add to this an unknown number of insects. Then consider the wide variety of ecosystems that support plant and animal life from hardwood forests and grasslands to caves and wetlands. This range and complexity of life and landscapes is known as biological diversity or biodiversity.

Kentucky's rich biodiversity contributes greatly to the Commonwealth's cultural and natural heritage

and to our economy and quality of life. However, these native species, natural communities, and entire ecosystems of Kentucky are not well known and are constantly threatened by a wide range of human activities.

In March, Gov. *Brereton C. Jones* appointed 32 Kentuckians to the Biodiversity Task Force. By October 1995, the task force is to submit to the governor a written report on the status of biodiversity in Kentucky with recommendations for its maintenance and conservation. In preparing this document, the group will look at factors affecting Kentucky's biodiversity; species, natural areas, and parts of the state that need special attention; how government agencies, universities, and private organizations can improve coordination of their biodiversity programs; and how to better educate the public on biodiversity issues. The group will recommend a comprehensive detailed strategy for sustaining and protecting local, regional, and statewide biodiversity.

By virtue of their offices, Dr. William H. Martin, commissioner of the Department for Natural Resources, and C. Thomas Bennett, commissioner of the Department of Fish and Wildlife Resources, will serve as co-chairs of the task force. The task force is comprised of scientists with expertise in biodiversity issues as well as representatives from agriculture, industry, environmental groups and government. ASB members are: Dr. William Bryant (Thomas More College), Dr. Jon Maki (Eastern Ky. University), Dr. W. Martin (Commissioner); Dr. R. Muller (University of Ky.), and Dr. D. White (Murray St. Univ.).

REVIEWS

Nelson, Joseph S. 1994. **Fishes of the World**, 3rd ed. John Wiley and Sons, Inc., NY. \$79.95 (hard cover). 600 p.

"Just because it looks the same doesn't mean that it isn't different." This expression, often heard from modern systematists in comparing fish specimens, also applies to Joseph Nelson's *Fishes of the World*, 3rd ed. At first glance the third edition looks like the second; the layout, trim size (one 28 pica column and 47 lines per page), type styles, and figures are the same (if it works, don't fix it). However, beyond a cursory inspection, this illusion quickly fades and one readily sees that the text of the third edition of *Fishes of the World* is indeed NEW.

Pages i–v contain, beginning on the inside front cover, a flow chart of the hierarchy of higher categories of fishes (*i.e.* subphylum to orders), followed by the preface, acknowledgements, and contents. The Introduction occupies 17 pages; the main body of the book is 431 pages, and it is followed by a 14-page appendix, 73 pages of bibliography, and 59 pages of index. The book has good quality binding, including an attractive three-color hard cover.

The Introduction contains interesting facts about numbers of fish taxa (57 orders, 482 families, 4,258 genera, and 24,618 species), statements regarding biological diversity, habitat diversity, and morphological diversity, as well as more lengthy discussions of classification and systematics, and distribution and biogeography. Regarding numbers, it was interesting to learn that there are 3 orders of fishes consisting of only one species each; 12 orders of 10 or less, 33 orders of 100 or less; 52 orders of 1,000 or less; and 5 orders each contain over 1,000 species. By far the largest order is Perciformes, with 9,293 species (38% of all fishes) according to Nelson's count.

The main part of the book covers all the fish taxa from jawless hagfishes to molas. Nelson uses 20 taxonomic categories as follows: phylum, subphylum, superclass, grade, class, subclass, infraclass, division, subdivision, superorder, series, order, suborder, infraorder, superfamily, family, subfamily, tribe, genus, and subgenus. Not all categories are employed in the classification of a particular taxon. The family is the principal taxon. For each family is given the scientific name and usually a common name, habitat (*i.e.* freshwater, marine, *etc.*), general range, brief diagnosis, and list of all genera or a representation of genera. Often interesting life-history notes are included along with the maximum size of the largest species. There are 473 well executed line drawings illustrating most families; in some cases subfamilies are illustrated.

Nelson's stated purpose in writing the book is to present a modern introductory systematic treatment of all major fish groups. His goal is admirably achieved. The classification as presented is "modern." Nelson adopted a cladistic classification, as he stated "... wherever I feel that there is reasonably sound phylogenetic information to present such a classification." He does not automatically accept the classification of the last revisor and, regardless of his selection, he presents alternative views. There is no dogma in this book. Nelson further states, "As long as there are active, creative ichthyologists, there will be major disagreements in our classification in the foreseeable future. . . ." My reaction to this statement is: I hope we never have agreement among ichthyologists regarding classification, lest our quest for the truth comes to a standstill.

All of the recent innovations in fish classification are too numerous to cite; however, I shall mention the following as an example. Within the superorder Acanthopterygii, Nelson recognizes three series—Mugilomorpha, Atherinomorpha, and Percomorpha (previously of two series, Atherinomorpha and Percomorpha)—as do Johnson and Patterson (1993). However, the latter authors and Nelson differ in opinions regarding interrelationships of some of the major taxa. Johnson and Patterson (1993) group the Mugilomorpha [mulletts], Atherinomorpha [silversides, flying fishes, killifishes], and the orders Gasterosteiformes [sticklebacks, seahorses, pipefishes], Synbranchiformes [swamp eels, spiny eels], and Elasmomatidae [pygmy sunfishes] in an unresolved polychotomy that they named Smegmamorpha. This grouping is of special interest to many of us who have advocated that pygmy sunfishes are sufficiently different from sunfishes (family Centrarchidae) to warrant family recognition. Although Nelson does not classify *Elasmoma* as a smegmamorph, he did remove it from Centrarchidae and placed it in its own family, Elasmomatidae, and suborder, Elasmomatoidei.

From the onset of cladistics, numerous papers dealing with systematics have appeared in the literature, especially in the past decade. Nelson's book illustrates this phenomenal surge in ichthyological literature. By actual count, 868 literature citations of a total of 1,453 (60%) were published in the past

decade. In other words, 60% of the literature cited by Nelson was published since his second edition of *Fishes of the World*.

There are a couple of minor changes that I think would benefit the user: The text, pages 19 to 23, includes invertebrate chordate taxa (*e.g.* Urochordata and Cephalochordata) but neither does the flow chart, Table of Contents, nor Appendix include invertebrates. In the Appendix, I find the checklist of classes, subclasses, orders, suborders, and families, with page numbers, very convenient; however, one of the first things that I did with my copy was to pencil in the higher taxa. To do so in print would lengthen the list by only half a page.

After omitting 23 pages (45 world maps, a significant loss), the third edition is 72 pages longer than the second. The extra pages are taken up by more orders (57 vs. 50), families (482 vs. 445), and figures (473 vs. 448) and by giving more space to family accounts.

Detecting misspelled words is certainly not my forte, but I did notice that the genus name *Scrombrolabrax* is misspelled *Scrombrolabrax* (page 424 and index). I believe that the number of species in the genus *Branchiostoma* is nearer 30 than 15 (page 22).

Fishes of the World, 3rd ed, is a must for the desk of ichthyologists. It places the latest thinking regarding classification of the world's fishes at our fingertips and, being thoroughly documented, the literature as well. It is a valuable reference for anyone interested in the diversity of life.

Johnson, G. D. and C. Patterson. 1993. Percomorph phylogeny: a survey of acanthomorphs and a new proposal. *Bull. Mar. Sci.* 52(1): 554–626.

HERBERT BOSCHUNG, *Professor Emeritus, Department of Biological Sciences, P.O. Box 870344, University of Alabama, Tuscaloosa, Alabama 35487.*

Tivy, Joy. 1993. **Biogeography, a Study of Plants in the Ecosphere**, 3rd ed. Longman Scientific and Technical, Essex, UK. John Wiley and Sons, NY. \$39.95 (paper). xix + 452 p.

The 20 chapters in this book, following the Introduction, (chapter 1) are divided into three parts: I) The Biosphere, 2–8; II) Ecosystems, 9–14; and III) Biotic Resources, 16–21. In the Introduction, the author tells the reader what (she thinks, see later) biogeography is about, explains its relation to other scientific disciplines, and briefly outlines the historical development of ecology and biogeography.

Part I discusses energy flow, mineral cycling (chapter 2); abiotic (*e.g.* light, temperature) and biotic (*e.g.* competition, herbivory) factors that affect the distribution and abundance of organisms (3); historical biogeography, *e.g.* biogeographic regions, centers of origin, continental drift, migration, species extinction (4); population (*e.g.* growth, survivorship, regulation), and community, *e.g.* structure, classification, ecology (5); photosynthesis, *e.g.* types (C₃, C₄, CAM), efficiency, and primary and secondary production (6); decomposition and nutrient cycling (7); and ecosystem development, *i.e.* biotic succession and soil development (8).

In Part II, Tivy describes various aspects of the earth's major biomes—*i.e.* tropical and temperate forests, but primarily tropical rainforests and temperate broad-leaved deciduous forests (9); boreal, including taiga and tundra (10); grasslands, including tropical savannas (11); deserts (12); islands (13); mountains, including the alpine zone (14); and aquatic (15). Topics covered in the discussion of the various biomes include physical environmental factors, biotic composition, structure, function (*i.e.* production, energy flow, mineral cycling), regeneration/succession, origin, and human impact. Other, special topics are discussed for some biomes, *e.g.* permafrost in the boreal zone, fire and grazing in grasslands, adaptations of plants and animals to high temperatures and drought in deserts, theory of island biogeography, and alpine timberline.

Part III includes chapters on stability of ecosystems in relation to the impact of disturbance, exploitation, and management [*i.e.* fishing, whaling, forestry (tree harvesting, coppicing), agricultural production] by humans (16–19), the urban ecosystem (20), and nature conservation (21). Sustainability of human-impacted ecosystems is given good coverage in the chapter on "Managed ecosystems" (19).

Following chapter 21 is a six-page assignment section with review questions, a six-page glossary, a list of 781 references, and an index. The text contains a good number of tables and figures.

The author, Emeritus Professor of Geography at the University of Glasgow (Scotland), obviously does not have a good knowledge/understanding of basic plant biology or of basic ecology, and this is especially obvious in parts I and II of the text. Thus, the book contains a considerable number of errors of fact and/or interpretation. Some examples follow. Chapter 1: Clements was a student of

Bessey, not Cowles (p. 5). Figure 2.2 is incomplete/inaccurate; it does not contain all the components of energy flow to and from the earth's surface (p. 15). *Alnus*, *Ceanothus*, etc., are genera, not families, of plants (p. 25). The greenhouse gases absorb long-wave (thermal), and not short-wave, radiation (p. 32). Chapter 3: Not all soil capillary water is available for uptake by plants, only that held with a tension of ca. 0.03 to 1.5 MPa (p. 39).

Chapter 4: Cycads are not the "so-called tree-ferns," and *Nothofagus* spp. are in the angiosperm plant family Fagaceae, not the gymnosperm family Podocarpaceae (p. 69). Chapter 5: The general formula for showing the components of population growth (P) on page 81 is $P = (B - D) + (I - E)$, not $P = (B - D) + (E - I)$. Broad-leaved coniferous forests are not the major vegetation type of northwest Europe (p. 94). Chapter 6: The following statement on page 107 is inaccurate and confusing, and it indicates that the author does not at all understand energy conversions in photosynthesis: "About a sixth of the light energy absorbed by the green plant is used in the process of photosynthesis; the remainder is converted into the chemical (or potential) energy of plant tissue." About 45%, not 1.0%, of the solar radiation reaching the earth's surface is available for photosynthesis (p. 109). All, not 50%, of the solar radiation within the 400–700 nm region is PAR (p. 109).

Chapter 9: Primary xylem is not equivalent to heart wood or secondary phloem to sap wood (Fig. 91, p. 175). When the bark peels off, it is not replaced by the growth of new epidermal cells (p. 175). *Tsuga*, not *Carya*, is the generic name of hemlocks (p. 190). The most diverse temperate forest flora is not in eastern North America, and the Eastern Deciduous Forest does not contain all the genera present in the Eurasian temperate forest or as many species of *Acer* as the Asian temperate forest (p. 191).

Chapter 10: The period without daylight at the poles is 6, not 9, months (p. 196). The specific epithets for white (*glauca*) and black (*mariana*) spruce are reversed (p. 203). Cyanobacteria do not form a nitrogen-fixing relationship with tree roots, only with those of some cycads (p. 204). Chapter 11: *Buchlœ dactyloides* is a C₄, not a C₃, plant (p. 217). Chapter 12: Dew does not fall; it forms by condensation when the temperature of a plant leaf (or other surface) cools to the dew point (p. 228). Chapter 14: Salinity in an estuary may be up to 32‰, not 32%.

Glossary: Incorrect or confusing definitions are given for the following terms: deme, dioecious, ecotype, facultative, greenhouse gas, heterozygosity, photoperiodism, polyploid, procaryote, and thermoperiodism.

References: "Nature and structure of the climax" by F. E. Clements was published in the *Journal of Ecology* 24: 252–284 (1936), not in *Ecology*. The correct title of the paper by A. G. Tansley published in *Ecology* 16: 284–307 (1935) is "The use and abuse of vegetation [not vegetational] concepts and terms."

Quite a few misspellings/typographical errors, especially with regard to the Latin names of plants, are scattered throughout the text—e.g. *Elaerngnus* for *Elaeagnus* and *Ginko* for *Ginkgo* (p. 25); Eastern area for eastern Asia (p. 57); E for Σ in the Shannon-Weiner index of species diversity (p. 80); *minvarita* for *minuartia* (caption for Fig. 5.1, p. 82); NO₂⁻ for NO₂⁻ (caption for Fig. 7.8, p. 146); *Pucinella* for *Puccinella*, *Spartinia* for *Spartina*, and *Ammophilila* for *Ammophila* (p. 158); gm² for gm⁻² [Fig. 8.3 (B), p. 160]; *Larix lavirinia* for *Larix laricina* (Table 10.1, p. 201); *Bouteliena* for *Bouteloua* (p. 217); poikilhydrous for poikilohydrous (p. 337); gm⁻² day⁻¹ for gm⁻² day⁻¹ (pp. 280–281); *Spartinia* for *Spartina* (p. 314); *Urtica diocica* for *Urtica dioica* (p. 315); *Poannua* for *Poa annua*, *Sagina procumbers* for *Sagina procumbens*, *Bullis perennis* for *Bellis perennis*, *Cenzya canadensis* for *Conyza canadensis*, and *Rumix cebtusifolius* for *Rumex obtusifolius* (Table 20.2, p. 376).

There are several misspellings in the References: Deevy for Deevey (also in text); penin for peninsula (in S. A. Graham reference); Sinqur Association for Sinauer Associates (in Pimm 1986 reference); Pala-biography for paleobiogeography (in Raven and Axelrod reference); Silvertown for Silvertown; Tranquilli for Tranquillini; Van Dyme for Van Dyne; Chapman for Chapin (in the L. R. Walker *et al.* reference); forst for forest [in the R. H. Whittaker *et al.* (1974) reference]; and L. B. Root for R. B. Root [in the R. H. Whittaker *et al.* (1975) reference].

The first edition (ed. 1, 1971) of this book has 16 chapters and the second (ed. 2, 1982) has 17. Titles of 16 of the 17 chapters in ed. 2 are identical to those in ed. 1. The additional chapter in ed. 2 is entitled "The Soil Ecosystem." Ed. 2 was a relatively minor revision of ed. 1.

The third edition (ed. 3, 1993) covers essentially all of the material discussed in eds. 1 and 2, and in addition a considerable amount of new material has been added. The new material includes a number of tables and graphs published since 1982 and chapters on island, mountain, and urban ecosystems. A major difference between eds. 1 and 2 and ed. 3 is the change in titles of chapters and redistribution of material among chapters. For example, some topics covered in chapters on "Atmospheric factors" and "Biotic and anthropogenic factors" in eds. 1 and 2 appear in a chapter entitled

"Environmental variables" in ed. 3. Material on Tundra and deserts in a chapter on "Biological deserts" in eds. 1 and 2 are in chapters on "Boreal ecosystems" and "Desert ecosystems," respectively, in ed. 3. In eds. 1 and 2, each chapter is followed by a list of references, whereas in ed. 3 they are put into a single reference list, after the Glossary. Tivy has made an honest attempt to make ed. 3 a real revision of ed. 2.

Contrary to what one may think upon reading the title of this book, it is not primarily about biogeography *per se*—i.e. the science that attempts to describe and understand the past and present distribution of plants and animals (Brown, J. H. and A. C. Gibson, 1983. *Biogeography*. The C. V. Mosby Company, St. Louis, xi + 643 pp.). Thus, it is not an appropriate text for an undergraduate course in biogeography. Rather, considering the topics discussed and their less than in-depth coverage, *Biogeography* comes closer to being suitable for use as a text in an ecology course for nonbiology majors. However, the book contains too many inaccuracies in parts I and II for me to recommend it for use as a text.

JERRY M. BASKIN, *School of Biological Sciences, University of Kentucky, Lexington, KY 40506.*

Rohde, Fred C., Rudolf G. Arndt, David G. Lindquist, and James F. Parnell. 1994. **Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware.** The University of North Carolina Press, Chapel Hill, NC. \$24.95. 222 pp.

The authors, at the beginning of the introduction, state that the book is not written for ichthyologists, but rather for an audience of amateur naturalists and others with an interest in a non-technical reference to the freshwater fishes, and their distribution, in the Mid-Atlantic states. Most of the information is from published data from the five-state region (and beyond), with augmentation of the authors' own observations. The first 39 pages are composed of seven chapters: History of Ichthyology of the Region, Characteristics of Fishes, Habitat, Zoogeography, Collection and Study of Fishes, Some Impacts of Humans on the Fishes of the Region, and Common Names and Scientific Names. The rest of the book contains keys to the 29 families of fishes in the region; short and varied descriptions of species (including some with natural histories) with shadow maps (no drainages) of their distributions, and a glossary of technical terms. There are 203 color plates of fishes and a good table of the technical and common names of fishes with their distributions listed by states. Also included is a brief superficial discussion of threatened and endangered species of fishes in the area.

This is not a field guide or a key to the species of freshwater fishes of these five states, nor was it intended to be. Because it is a well written, informative, easy-to-read book, it should have special appeal to the layman with more than just a passing interest in the natural world.

WILLIAM S. WOOLCOTT, *Professor of Biology, Emeritus University of Richmond, Richmond, VA 23173.*

Hall, David W. 1993. **Illustrated Plants of Florida and the Coastal Plain.** Illustrations by Edward H. Stehman. "Based upon the collections of Leland and Lucy Balzell." Maupin House, Gainesville, FL. \$19.95. 431 p.

Included are title page, publication reference, dedication, introduction, "About the Author," "About the Collectors," maps of Florida and the Coastal Plain, table of contents, family treatments of taxa, index of common and scientific names, index of taxa by flower color, glossary of terms, and selected references.

David Hall has prepared a charming treatment of a huge amount of botanical work undertaken by Leland and Lucy Balzell, transplants to Florida in the early 1960's, who together, and from 1966 to 1989 collected nearly 12,000 specimens (mostly from Florida) now present at the Herbarium of the University of Florida (duplicates present elsewhere, not surprisingly . . . I remember typing up some of the labels back in 1975). This book provides a treatment of southeastern U.S. Coastal Plain "Wildflower" species (plus the Characeae) from Lake Okeechobee in peninsula Florida northward (according to the provided map through Long Island, and westward as well through Mississippi embayment and on to southern Texas). Herbaceous plants are the focus of this work: "Most common shrubs are included, but grasses, rushes and trees are excluded." Plants are arranged alphabetically by family, and then by genus and species. Each family is treated with an abstracted description. Illustrations provided (every taxon is not illustrated) are from herbarium specimens collected by the Balzells. Each plant treated includes a description concerning habit, salient morphological features, origin if

non-native, frequency, distribution in Florida, and distribution otherwise in the Southeastern Coastal Plain. This book is intended as an identification guide for plants encountered by the reader, based on reference to the illustrations provided. It is obviously not intended as a comprehensive treatment, with 1,384 (my count) taxa, 247 of which are essentially present only in Florida.

The drawings provided are small, and in some cases (*Lobelia*, *Lechea*, *Lachnocaulon*, *Chrysopsis*, *Cuscuta*, and others) will only with some difficulty be useable in distinguishing taxa. The drawings themselves are done either in fine or broad pen-point; the consistent use of one or the other would probably be less distracting. Many of the drawings are provided with arrows (see species' accounts for the asterisks indicating an arrowed illustration) indicating particular features of concern. Occasionally arrows are provided that have no reference in the description (*Aristolochia littoralis*, p. 29; *Heliotropium amplexicaule*, p. 39; *Iris hexagona*, p. 185; *Smilax walteri*, p. 246). My annoyance with the illustrations is tempered by this: they are generally quite good. Many are remindful of those in the 2nd edition (1947) of Britton & Brown's *Illustrated Flora*, and also Batson's series for eastern and western U.S. genera. (In fact, I just used the illustration in this treatment to pin down *Anagallis minima* which I got in Orlando very recently.) Some of the distributions are questionable (*Befaria racemosa* and *Lobelia feayana* are "common all Fla."?). A couple of pages seem to have bled through onto each other in my copy (pp. 290–292, 302–304).

Despite these concerns, Hall's labor of love is a fascinating rendering of the work of two notable amateur botanists.

JOHN B. NELSON, *A. C. Moore Herbarium, Department of Biological Sciences, University of South Carolina, Columbia, SC 29208.*

Gibbons, Whit. 1993. Keeping All the Pieces: Perspectives on Natural History and the Environment. Smithsonian Institution Press, Washington, DC. \$16.95. 182 p.

For whatever reason(s) each of us became biologists, the one thing we all share is a profound respect for nature. Too many biologists, however, feel they should not get involved in environmental matters, and would rather leave such issues to activist groups. By doing so, we ignore the fact that we are specialists and are passing our responsibilities to others who often lack our training and experience. This is not respecting nature!

In "Keeping All the Pieces," author Whit Gibbons has put together a masterpiece of essays on why we are losing species at a staggering rate, reasons why we should be concerned, and what can be done to stem this tide of disaster, all packed with lots of fascinating information on the natural history of species many of us have never studied or noticed. Much of what is contained in this book appeared in newspaper articles authored by Gibbons in the *Aiken Standard* (Aiken, South Carolina) and *Tuscaloosa News* (Tuscaloosa, Alabama).

The book begins with a *Foreword* by Eugene P. Odum, properly emphasizing the importance of understanding ecology. Gibbons's *Preface* provides an analogy of removing bricks from a large building, until the building begins to break and finally collapses. The sections that follow continue this theme in both an entertaining and serious manner, showing that the bricks (=species) removed will dramatically degrade our own future.

The book is divided into four parts. The first deals with interrelationships of species, the second with endangered and threatened organisms, the third with what and who has caused extinctions, and the last on how we might alter or correct what seems to be certain doom at some point in time for many of the organisms we study. Parts One and Three each contain four essays, Part Two has five, and Part Four includes six, all beautifully written. Each essay is filled with natural history information that every reader will find fascinating, no matter what their specialty areas might be. Many essays contain information that is frightening as humans continue to disrupt and destroy non-human communities. To recognize that living species now inhabiting this planet represent perhaps only 10% of the species that were here before now is staggering, but our rate of continuing destruction of this last 10% is obscene (a better word than irresponsible)!

This book is a "must-read" item for all biologists interested in natural history and what we as humans are doing to the biological resources of this planet, and is proper for additional readings in introductory Conservation Biology courses. Gibbons suggests that specialists may find parts of the book too elementary, but his style of writing is guaranteed to appeal to experts as well as to many among the non-biologist public, its intended audience. I fear, however, that it may not be read or a

subject of concern by the news media, who seem to focus on wars, crime, and anything else that deflects our attention from “Keeping All the Pieces” on which we depend.

WALTER R. COURTENAY, JR., *Department of Biological Sciences, Florida Atlantic University, Boca Raton, FL 33431.*

Gibbons, Whit. 1993. **Keeping All the Pieces: Perspectives on Natural History and the Environment.** Smithsonian Institution Press, Washington, DC. \$16.95. 182 p.

Whit Gibbons uses a format of personal experiences interspersed with ecological history, education and politics to get his message across. He begins with clearly stated objectives in the preface and concludes with a best-case scenario of life on earth 100 yr from now. In between is a well organized text of natural history. Dr. Gibbons does an excellent job of verbally illustrating one of today’s ecology buzzwords—biodiversity. He has even created a new term—ecovoid—that defines a missing component of our environment that we wish were present but can never be replaced.

The book is divided into four parts of four to five chapters each. Part One includes basic ecology lessons that are presented in short story format. This easy-reading section captures your attention with the first tale of the blooming primrose. The second part covers both the history and future of extinction. Part Three is the “Who done ‘It?’” section of the book. Here we find that we have all done ‘It’ and are still doing ‘It.’ The ‘It’ is environmental abuse. The final section discusses ways to stop environmental destruction from the individual level all the way to international regulations.

One point that Gibbons stresses is the necessity of education if changes are to be made. My favorite line from this book is found in Part Three (The Search for Environmental Culprits) and reads: “The time has come for United States colleges and universities to develop twenty-first century attitudes about environmental issues.” Perhaps this book will be the catalyst for such changes.

Overall, I found the book to be very entertaining and educational. It has garnered quite a bit of attention and requests to be borrowed while sitting on my desk these past few months. I have already read several excerpts from the book to some of my classes and received feedback that lets me know the students are now thinking more along the lines of conservation. The book is well worth the asking price.

KIM MARIE TOLSON, *Department of Biology, Northeast Louisiana University, Monroe, LA 71209.*

Meyer, Peter. 1993. **Nature Guide to the Carolina Coast: Common Birds, Crabs, Shells, Fish, and other Entities of the Coastal Environment.** Avian Cetacean Press, Wilmington, NC. \$13.95. (soft cover). 148 p.

This book is a delightful and practical field guide for the many summer visitors as well as year round residents along the Atlantic Coast. Although written for the Carolinas, the book is equally appropriate for coastal beaches at least from Maryland to north Florida.

The author has limited his selections to the birds, fish, shells, crabs and other “entities” most commonly found along the seashore. Text descriptions of each of the 104 plants and animals are straightforward and include identifying characteristics for species identification, interesting details of behavior, and other tidbits.

Each category is covered in a separate chapter with species listed alphabetically by their common name. Most readers will find this organization very user-friendly. It might be somewhat disconcerting to those familiar with more comprehensive field guides since some closely related species are not discussed together such as herons and egrets or croaker and spot. But then those folks should know the connections anyway.

The color photographs, one for each species, are excellent and the reader should have no problem with confirming identifications. Many photos include a shark’s tooth in the picture: a clever way to show comparative sizes among the species. It would have been nice if species photos could have been placed alongside the written descriptions, but I am sure that publication costs precluded this. They are grouped together in one section and actually this works just fine as the photos and text are well cross-indexed and easy to locate. The text is also sprinkled with line drawings and explanatory diagrams.

Final chapters include brief discussions on a potpourri of subjects: the coastal environment, coastal environmental and conservation concerns, seafood and seafood cooking, and recommended readings.

The author is a practicing physician and avid naturalist and will gladly autograph each copy ordered by mail from his press.

ALICE JANE LIPPSON, *Bozman, MD* 21663. Co-author, "Life in the Chesapeake Bay."

Meister, Alton, (ed.). 1994. Advances in Enzymology, Vol. 68. John Wiley & Sons, New York, NY \$113.00. 210 p.

This issue contains excellent reviews on the structure and function of three different enzymes. W. Lipscomb's article on the activity and regulation of Aspartate Transcarbamylase is an excellent review covering in detail what is known about the structure of the enzyme and how it correlates with the activity and regulation of this very important enzyme which plays a very key role in the nucleotide biosynthesis. The possible mechanisms of action of CTP as a feed back inhibitor of this enzyme and how ATP binding to the same allosteric site can act as an activator are explained. This is a very comprehensive article which is easily understood even by those who are not working in the field.

Kim and Lipscomb's article on Bovine Leucine Aminopeptidase is a very comprehensive article on the structure of this enzyme and its relationship to the function of the enzyme.

Zhang and Dixon's article on Protein Tyrosine Phosphatases is a good reference article for those who are new to the field. However, this article could have been better organized. For example, section B, page 5 last sentence reads: "Indeed, the importance of this cysteine residue in catalysis has become evident as this residue was shown to be directly involved in the formation of a thiolphosphate linkage in a covalent phosphoenzyme intermediate." In section C page six, the first sentence begins with a question concerning whether a phosphoenzyme intermediate was formed when it is already stated that the cysteine forms such an intermediate! The second paragraph of the same section begins with a similar question with no reference to the earlier statement that cysteine plays a central role in the formation of the intermediate! The article is written more as a discussion than as a review. Even though the role of PTPases in the signal transduction pathway is mentioned in the article, the point is never elaborated. The article also contains many redundant statements.

M. Waterman's article on Heterologous expression of mammalian P450 enzymes is a good article as a reference for those who are working in the field. However, it will be of minimal use to those who are new to the field. The discussion is not detailed enough to be useful to students who are entering the field.

JACOB VARKEY, *Dept. Biol. & Life Sci., Savannah St. College, Savannah, GA* 31404.

NEWS OF BIOLOGY IN THE SOUTHEAST

JON R. FORTMAN—*News Editor*
Division of Science and Math
Mississippi University for Women
Columbus, MS 39701

ABOUT PEOPLE AND PLACES

MISSISSIPPI

Mississippi State University, Department of Biological Sciences. Jerome Jackson recently returned from five weeks on Sumatra and Java where he served as a consultant to U.S.A.I.D./H.E.D.S. Project, a joint effort by the U.S., Japan, and Indonesia, to improve undergraduate education of Indonesian universities. Jerome Jackson has been named acting Co-Editor for *Memoirs* of the Nuttall Ornithological Club, based at Harvard University.

Gulf Coast Research Laboratory, Ocean Springs. The Laboratory's summer field study program had 73 students from 27 institutions. Some of the institutions represented included Mississippi State University, Delta State University, Millsaps College, University of Mississippi, University of Southern Mississippi, Auburn University, University of Arkansas, Iowa State University, University of Iowa, Eastern Kentucky University, Morehead State University, Northeast Missouri State University, Southeast Missouri State University, Bowling Green State University, Radford University, and University of Wisconsin at Eau Claire. GCRL hosted the Mississippi Society of Histotechnology during the Spring conference in Biloxi. Retha Edwards received the President's Award from the Society for the second consecutive year. Fisheries biologist James R. Warren has been appointed as Mississippi's technical representative to the Gulf States Marine Fisheries Commission Spotted Sea Trout Fisheries Management Technical Task force.

NORTH CAROLINA

Pfeiffer College, Department of Biology. Dr. John Haesloop has retired after 34 yr service. Dr. Mark McCallum (Ph.D., Ga. Tech) has joined the faculty.

SOUTH CAROLINA

Wofford College, Department of Biology. The college has received \$700,000 from the Howard Hughes Medical Institute. The funded program is designed to attract students to careers in science research and teaching. The goals of the project will be accomplished through support of summer research projects, science experiences for sixth, seventh, and eighth graders, and the purchase of analytical equipment. Dr. Robert Moss will coordinate the summer science experiences and Dr. George Shiflet will coordinate the purchase of new equipment.

TENNESSEE

University of Tennessee, Knoxville, Department of Botany. Dr. A. J. Sharp was honored recently for his published book *The Moss Flora of Mexico*, co-edited with Howard Crum and Patricia Eckel. He received the first copy of the two volume set from Dr. Bill Buck of the New York Botanical Garden at a reception in Knoxville hosted by the Botany Department. The book is a comprehensive publication on Mexican mosses and represents 50 years of work begun when Dr. Sharp made the first of 18 trips to Mexico. He also received an award in appreciation for his work and support of the Great Smoky Mountains National Park. He was presented the honor at a symposium celebrating the Park's 60th anniversary. Dr. Sharp is one of the originators of the annual Spring Wildflower Pilgrimage held in the Smokies.

VIRGINIA

Lynchburg College, Department of Biology. Dr. J. Clancy Leahy joined the faculty in the Fall of 1994. He received his graduate degrees from SUNY Health Sciences Center. His area of expertise is in neuropharmacology dealing with neurotransmitter receptors in relation to cerebrovascular accidents.

MUSEUMS AND BOTANICAL GARDENS**ALABAMA**

Anniston Museum of Natural History. Events during the summer and Fall included: "A Celebration of Reptiles and Amphibians," "Collectors' Day," "Woven Vessels," "Whirligigs and Weathervanes," "Santa's Secret Wrap-Up," and "Songs of My People," a sweeping panorama of African-American life, documented through powerful and penetrating visual images.

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CONTENTS

THE ASB BULLETIN

VOLUME 41, NUMBER 4, OCTOBER 1994

56th Annual Meeting and CALL FOR PAPERS—Deadline 15

November	193
Announcements	204
Reviews	207
News of Biology in the Southeast	214

Cover: Monogenetic trematode, *Benedeniella posterocolpa*, from cownose ray, *Rhinoptera bonasus*, Photo by Dr. R. Overstreet, Gulf Coast Res. Lab. Ocean Springs, MS.

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