OCEANUS

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OCEANUS

EDITOR: JAN HAHN

Published quarterly and distributed to the Associates of the Woods Hole Oceanographic Institution and others interested in Oceanography

The interface between air and water is of prime importance to the seaman. In many ways sailing is akin to flying, both ships and planes move through a fluid medium, both are equally dependent upon air flow. Granted, that the age of power has diminished the ship's dependency in one way, on the other hand, ships still remain at the mercy of storms and waves driven by the wind, and capable of damaging even the mightiest of vessels.

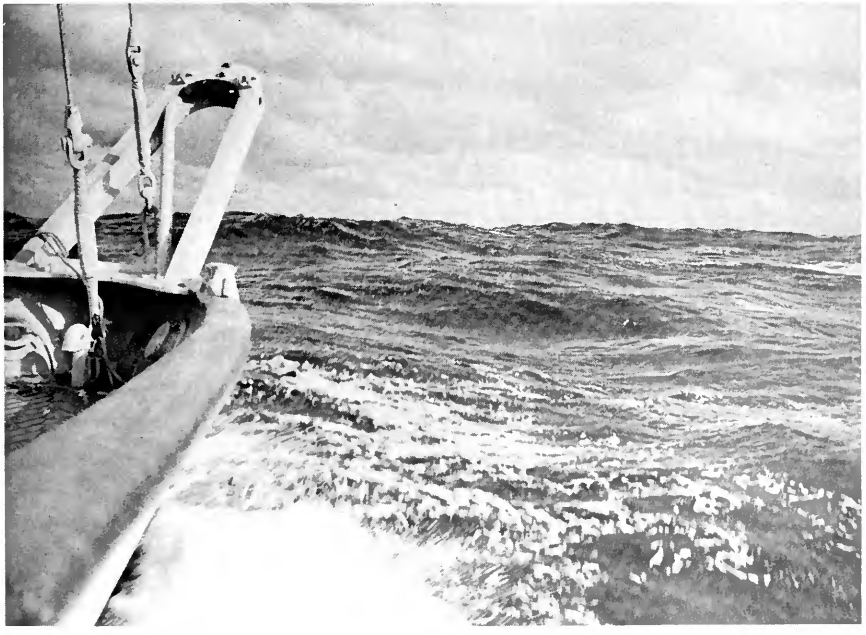
To the oceanographer the boundary layer is a constant source of fascination, posing innumerable problems. Here, is the beginning of much weather and climate. Here, on the smoothest, bluest surface the most brute hurricane finds the first breath of life. Here, minute salt particles spraying into the air, are bound upward, later and many miles away to form the nuclei for raindrops. Here, the winds in some unknown way thrust particle after particle into wavelets and thence into ever higher waves. Here, the steady blow of winds begins to impel the water, finally forcing immense, immeasurable power through ocean currents.

The air influences the water, the water influences the air.

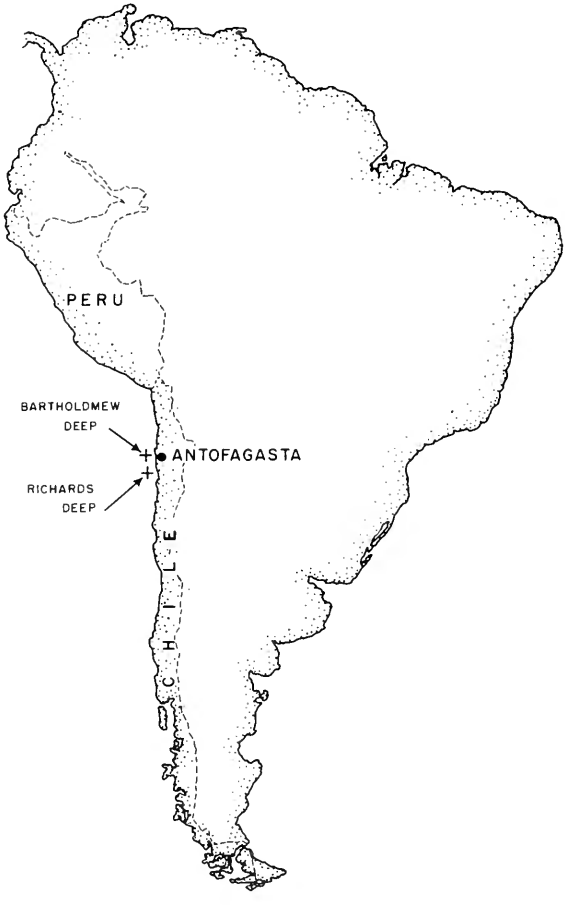
UNFORTUNATELY, Oceanus although growing, is not yet large enough to be able to contain all that happens at the Woods Hole Oceanographic Institution during a three months period. We believe it essential to publish more articles on the problems of the various sciences which together make up oceanography. Discussions are in order on the knowledge that has been obtained, and on the questions which need to be answered, particularly the latter.

An impatient reader wants to know what the next issue will provide. We are planning a meteorological issue for April and a geological one for August. Also, we hope that the August issue will contain an article on hurricanes and the prediction of sea levels to be expected along the coast.

To the outside world we present what the Institution is doing. To our associates and friends we present what Dr. Someone or Mr. The Other are thinking about. As Mr. Stevens, our President, said at a recent staff meeting: "The project or program is not important. It is the individual and his worth that count."



New Depth Record



A new deep in the eastern South Pacific was located by the Atlantis, according to a cable received from Dr. Parker D. Trask, chief scientist on board.

Thirty-nine miles off Antofagasta, Chile, in the Bartholomew Deep, the bottom was determined as 4,330 fathoms (25,880 feet). This figure is based on an estimate made in the field for the correction in the velocity of sound at the depth. The former deepest part of the eastern South Pacific was 930 feet shallower and found in the Richards Deep, 80 miles south of the new location. The general depth in the area is 2,300 fathoms.

The depth was determined with the aid of the echosounding recording system developed last year by S. T. Knott and others.*

The deepest point is situated in a narrow trough, 7,500 feet wide, bounded by steep walls, evidently fault scarps. The west scarp rises with a gradient of 1:4.

Although this narrow trough is deep enough, the sounding is about 10,000 feet less than the deepest spot in the ocean, located by H.M.S. Challenger in 1952 in the Mariana Trench, 200 miles southwest of Guam and recorded at 5,940 fathoms or 35,640 feet.

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*See: "New Instruments," Oceanus II, 2.

DEEP-SEA RESEARCH
Supplement to Volume 3

Papers in Marine Biology and Oceanography

Dedicated to

HENRY BRYANT BIGELOW

By His Former Students and Associates
on the occasion of
The Twenty-fifth Anniversary of the Founding
of
The Woods Hole Oceanographic Institution
1955

Distributed with the compliments of
the
Woods Hole Oceanographic Institution

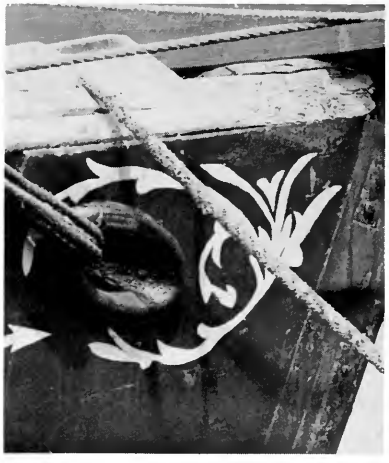
JUST about a year ago, a group of Dr. Bigelow's former students and associates decided to honor him for his contributions to marine biology and oceanography. The twenty-fifth anniversary of the Institution's founding appeared to be a fitting occasion. A volume, containing 48 scientific contributions was completed by the end of the anniversary year and a leather bound copy was presented to Dr. Bigelow at a gathering in the Director's Room at the Museum of Comparative Zoology, Harvard University on January 24, 1956.

We wish that space were available to reprint the foreword to the volume. In a few pages it is beautifully explained how much one man can do to motivate others to do their best. We quote: "Henry Bryant Bigelow, you broadened the vision, sharpened the perception, fortified the determination, simplified the outlook, improved the standards, and corrected the folly of each of us."

Almost everyone interested in some aspect of the sea will find an article with special appeal to him. Thus, one paper has implications of importance to atomic waste disposal, another can be applied to the manyfold problems to be investigated during the International Geophysical Year, and still others apply to practical fisheries problems.

As the volume will have wide appeal to the layman as well as to scientists, a copy is being mailed to each member of the Associates of the Woods Hole Oceanographic Institution.

On Fish and Fisheries



The behavior of fish populations has long baffled fishery investigators. The following are excerpts from Dr. H. B. Bigelow's remarks at a recent Friday luncheon meeting of the staff of the Institution.

FISH have not been our primary objective all these years, — some of us like to go fishing, some of us spend our spare research time on fish but, generally speaking, this Institution has thrown its major weight into physical oceanography and into other aspects of biology. Now, we find ourselves in a position where we have to pay some attention to fish because we have been granted the sum of $66,000 a year for three years, a total of $200,000, for an investigation of climatic and oceanographic factors influencing the environment of fish. I have not read the contract, but the general problem is: Why do the abundance and distribution of the great populations of fish change from time to time; to what extent are these changes related to shifts in the ocean circulation, and what climatic influences may actuate such shifts. We do not have to look at fish, but what we do have to do is to continue our physical investigations on ocean circulations with a mind to fish in the background.

We must not forget that the primary subject of the investigation is the biology of fish. People have been worrying about this subject for years and years. The countries of northwestern Europe are vastly concerned with fish. Their hydrographers and fishermen have been accumulating data actively ever since 1914 when Johan Hjort demonstrated that many fishes have only an occasional good year of production, and that the fisheries may depend for years and years on the product of that one year. The biologists, hydrographers and chemists have been collecting innumerable data on changes in salinity, in temperature and currents, and on the variations from year to year in the

abundance of fish, and have been trying to explain the one on the basis of the other, but no one has obtained conclusive results.

Now, perhaps, we can do better. We have attained a position where we have a very good working unit and are inventing many new ways of attacking problems in the sea. Let us hope, that in the first three years we will be able to show that we have done some constructive thinking and that we have taken data along lines that are apt to be productive in results. I do not think one can expect too much in three years.

Population changes

I should like to state briefly some of the things that happen to fishes that perhaps were caused by the physical environment. Down on Nantucket Shoals there is a big body of codfish and when October comes, about half of them swim away to the offing of New York and New Jersey to spend the winter. Then, in April, they come back to Nantucket Shoals, spend the summer there and next autumn they go west again. People say, "Oh, yes, they get out of Nantucket Shoals when the water gets too cold, they come back when the water warms up, etc." The trouble is that this migration is not north and south but west and east, and the temperature is just the same at one end of the migration route as at the other. Half the population does not move at all. Why? What is there in the environment? Is it something direct between the water and the cod or is it something indirect between the water and the food of the cod? Is it something entirely different?

Our colleague in England, Arthur Lee, who is primarily a physical oceanographer, goes to the Arctic every winter in connection with the British investigation on the distribution of the cod fisheries between Bear Island and the northern coasts of Europe. We have heard that the water is warmer there, and that the cod has shifted ground; it has been in every newspaper. Lee has suggested the direct cause has not been the change in temperature which has been perfectly good for cod all along. What has happened, is that a great influx of water from a warm source in the south, revealed by the warming trend, has so altered the circulatory pattern, carrying the codfish from one location to another. I do not know whether he is right or not but that is one hypothesis.

We hear no end of talk about the warming of the water and what has happened in a mass-way to fishes in our own region. But looking back at the old records, it is hard to see any evident correlation. Back in the eighties, there were big runs of bluefish, north of Cape Cod, big runs of menhaden and enormous runs of mackerel. Now, the bluefish and the menhaden are warm water fish. But there is nothing in the past record to suggest that the period during the early eighties had warm winters, it was rather the reverse. Why did

these southerly fishes appear in the Gulf of Maine? Was that temperature?

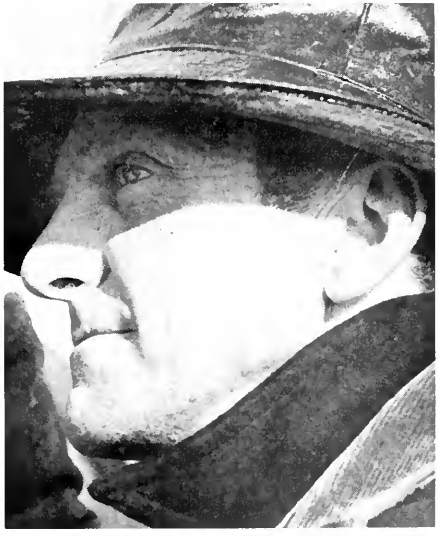
Bass, Cod and Crabs

Apparently there was a good production of striped bass around 1865 or 1870. In 1932 there was an enormous production of striped bass along the mid Atlantic coast, and this happened again in about 1942 or 1943. There has not been a really big year in production of striped bass since. Why not?

Fishermen have been at the mercy of fluctuations of this sort, from as far back as the record runs. Along the southwest coast of Norway, for instance, the spring herring fishery yielded more than a million hectoliters in 1866, only 208 hectoliters in 1875, but an average of more than 700,000 yearly from 1891 to 1893. The haddock provides an excellent local case since we have full data on the successive recruitment, year by year, through the work of the Fish and Wildlife Service, dating back to 1930. Every now and then a lot of haddock produce and survive, to be succeeded by a string of years in which there are not nearly as many. No one has been able to connect this plausibly to temperature changes. One theory is that during some years the eggs and larvae are swept off the banks by the prevalence of strong offshore winds. But how about the codfish which does not fluctuate as much? You cannot tell the eggs of cod from haddock eggs until they get pigment in them, also their breeding seasons overlap. Evidently something happens to the one fish and not to the other. It has been suggested that it may be very important at what level in the water the eggs are drifting. If they are in the upper-levels where the general tendency of the water on our continental shelf is to drift offshore, the eggs tend to drift off to deep water. If the eggs are floating deeper they tend to keep in on the fishing grounds because the general tendency is for the bottom water to move inshore, in an estuarine type of circulation. Does it work that way?

Another case that has been much discussed is that of the miserable little crustacean know as the green crab. He serves no useful purpose in human economy. But he is a great enemy of the clam, and has ruined the clam industry in several Gulf of Maine areas. This crab has always been plentiful here at Woods Hole, and as far south as Chesapeake Bay. In all ordinary winters, except for the last few warmer ones, the local green crabs have had to survive winter temperatures right down to the freezing point of salt water; for they were wintering here when Vineyard Sound was full of ice, and Buzzards Bay was frozen. Now these crabs have extended their ways northward until they have spread as far as the Bay of Fundy, and everyone claims that this is due to the warm winters in the north. Has their spreading north had anything to do with temperaature? And if so, what is the connection?

On considering how temperature acts as an environmental factor, do not run away with the idea that temperatures-per se-are useful to an animal. No animal can make a good dinner on temperature, but every animal has a certain range of temperature in which it can live and a rather narrow range within which it can do well. By and large, the only thing temperature does is to set a limit beyond which the animal cannot extend. The commercial fishes with which we are concerned all have a good leeway, a bigger leeway in fact than any fluctuation in average temperature over any period along this coast since colonial times. From the old Gulf of Maine investigations we have a fair picture of the general temperature from 1912 to 1923-24 and some data during recent years. I think we found an average warming by about 3°F., and there have been no very severe winters of late. But there has not been any enormous shift in fish populations. There is the shift northward, of course, in the case of the green crab, and there are a number of records of stray fishes from the south. But the events that have taken place during this period have not resulted in any general shift in fish populations; as far as we know, nothing that has happened has resulted in any general change in fish populations since Captain John Smith reported in the early 1600's. Fish population in this part of the world evidently is rather stable; but there are ups and downs all the time.



The fishermen are to benefit from our work.

Let me present just one more example of an up and down for which no explanation has been offered. People who like to go fishing—I think everyone ought to, but possibly there are some, who really do not care—know what a weakfish is. Weakfish never ranged regularly north of Cape Cod — in fact very few strays had been caught north of the Cape. But in 1890, long before the Cape Cod Canal was dug, people began to catch weakfish in Massachusetts Bay. More appeared in 1891 and by 1892 one or two million pounds were taken. By 1894 there were so many that they were a drug on the market and could not be sold. After 1896 there were none and there have never been any since. What is the story? There is no reason to suppose from the available air temperatures, (where no water temperatures are available), that the period from 1891 to 1895 was a warm time. We have no evidence that the current system was any more likely to bring weakfish eggs or little or big weakfish around the Cape, then than now. And the Cape Cod Canal did not exist. I could go on and on with similar examples.

The Way Ahead

What I have tried to hammer home is that things do take place in fish populations which cannot easily be explained. Now we have started a program with the assumption that somewhere in the background the shifting physical factors are the cause of these changes, perhaps not directly to the given fish but via some change in intermediate links. I do not know how we are going to attack it, others will decide this. But I am sure we are going to do it with full appreciation of what has been done before in other parts of the world. We are going to do it with full appreciation of why other people have not gone ahead very far. We are going to do it with the aid of all sorts of new devices that have been invented, and are being invented. We are going to do it with full co-operation with our friends down the street (The Fish and Wildlife Service, Ed.) and what is most important we are going to be able to publish our results immediately. We have a perfectly free hand, I believe, in a very large field, the whole field of the dependence of animals on their environment. It is not an easy field but I think we are going to make good headway.

Mr. Iselin remarked here: This is a tough problem all right. Dr. Bigelow has been feeding me this problem for thirty years. When the Institution was founded in 1930, Dr. Bigelow said that he thought marine biology could not proceed until it knew more about the movements of the water. The movements of the water always came into the problems one way or the other, either the eggs moved, the fish was moved or the food was moved. And so we tried here a good many years to advance physical oceanography to a point where it can be helpful to biology and I think we have succeeded.

Associates News

"THE SILENT WORLD"

First Showing in the United States
March 15

ASSOCIATES ANNUAL WINTER DINNER MEETING
at the
AMERICAN MUSEUM OF NATURAL HISTORY — NEW YORK

AT a joint meeting of the Executive and Corporate Committees of the Associates, held on December 7, 1955 at the New York Yacht Club, it was voted to hold the annual winter dinner meeting on March 15 at the American Museum of Natural History in New York. Through the courtesy of the Edo Corporation arrangements have been made to show the motion picture: "The Silent World." This picture was made by Commandant Jacques-Yves Cousteau, inventor of the aqualung, who will be present at the meeting. This will be the first showing of the picture in the United States. Release to commercial theatres will follow later in the spring.

Associates Fellowships

More than 700 announcements of the 1956-57 Associates' Fellowships were sent to colleges, universities, societies, institutions and to individuals suggested by the National Academy of Sciences, Office of Scientific personnel. Two fellowships will be awarded this year and will be announced not later than May 15th.

New Corporate Associates

We are pleased to announce that the following have joined the Corporate Associates of the Woods Hole Oceanographic Institution:

Alcoa Steamship Company, Inc.....New York, N. Y.
Bath Ironworks Corp.....Bath, Maine
American Airlines, Inc.....New York, N. Y.
Bethlehem Steel Company.....New York, N. Y.
Daystrom, Inc.....Elizabeth, N. J.
Grumman Aircraft Engineering Corporation...Bethpage, L.I., N.Y.
Humble Oil and Refining Company.....Houston, Texas
Raymond Concrete Pile Company.....New York, N. Y.

Associates may feel proud that their funds, in part, supported the Pacific cruise of the ATLANTIS reported elsewhere in this issue. It already is clear that significant scientific contributions will be forthcoming from this winter's work off the South American coast.

Henry Crosby Stetson

October 10, 1900 - December 3, 1955

Henry Stetson, Alexander Agassiz Fellow in Oceanography in the Museum of Comparative Zoology at Harvard University, and submarine geologist on the staff of the Institution since its early days, died unexpectedly while serving as chief scientist aboard the Atlantis on the geological survey off the Peruvian and Chilean coasts. The plan for the cruise, as described in the last number of **Oceanus,** had progressed well under his leadership and only two more sections remained to be worked. Just seventeen miles off Antofagasta, Mr. Stetson had a sudden heart attack of short duration. After services in the Anglican church there, Atlantis put to sea again, to finish the work with Dr. Parker D. Trask of the University of California as chief scientist.

Henry Stetson was born on October 10, 1900, in Cambridge, Massachusetts. There he went to school and was graduated from Harvard University in 1923. As a graduate student in paleontology and subsequently as an assistant to the late Professor Percy E. Raymond at Harvard, Stetson made significant contributions to the knowledge of trilobites, anaspids and fossil fishes. In his first paper, "The distribution and relationships of the Trinucleidae," there can be seen his interest in the way this group had spread from one land mass to another. He concluded that ocean currents could afford the only plausible mode of transportation. In this paper, too, he was concerned with the environment in which these trilobites lived. In other words, he early had an appreciation for the necessity of knowing something about the sediments themselves and the conditions under which they were laid down.

As we shall see later, these questions were ever present in his mind, despite the fact that his next papers were chiefly concerned with clarification of structural details of certain anaspids and somewhat allied groups. With Professor Raymond and his daughter, Ruth, Stetson and his wife visited the old localities of Traquair in Lanarkshire and Ayrshire, in the south of Scotland. Poor preservation of the specimens there had led Traquair to misinterpret certain features of the anaspid anatomy. Stetson, on the other hand, largely with clues provided by Kiaer's more recent description of well preserved specimens of a similar group from Norwegian beds, was able to reconstruct these classical specimens in a more satisfactory way.

About this same time, Stetson acquired an old Friendship sloop, "Neva," which he based at Cohasset. Thereafter during the Easter holidays at the University, he cruised sometimes as far as Casco

Bay, taking water temperatures for Dr. Bigelow and collecting sediment samples (usually accompanied by William Schevill and sometimes by Columbus Iselin). From the "Neva," he observed floating layers of sediments which aroused his curiosity. He devised a truncated sediment trap with doors that could be tripped by a messenger. Despite serious interference from the Coast Guard, who suspected that his buoys marked the cache of some rum-runner, he secured enough samples to ascertain that the sediments which settled in his traps were encased in an amorphous jelly-like substance (Raymond and Stetson, 1931). On his surveys from the "Neva," he also used a gravity coring tube and a Petterson grab to sample the bottom, the sort of work he was to continue later from Atlantis. At this time, too, he became interested in beach formation, particularly one on the coast of Maine where, contrary to the usual concept, calcium carbonate was being deposited in cold water (Raymond and Stetson, 1932). Thus, his interest and effort gradually shifted from the fossils found in sediments to the formation of the sediments themselves and to submarine geology, a field in which he was to pioneer.

It is a small wonder, then, that Dr. Bigelow was impressed by Stetson's ideas and his energy in attacking these fundamental problems. Therefore, when assembling the staff for the newly formed Oceanographic Institution, Dr. Bigelow asked Stetson to become the submarine geologist. His bibliography* which appears below proves the wisdom of this choice.

Four of his longer papers were published in the Institution's "Papers in Physical Oceanography and Meteorology" and may be termed "best-sellers." One was so much in demand that it has long been out-of-print and the others are still much sought after. "Patterns of deposition at the continental margin" in "Papers in Marine Biology and Oceanography," the volume just published to honor Dr. Bigelow, is Mr. Stetson's reappraisal of the terms "continental shelf and slope," "continental terrace" and "continental platform." He considers "critically whether the term should be applied to the submerged margin of any large land mass, no matter how dissimilar the topography and the structure may appear to be." Obviously, this draws largely from his own experience at sea and indeed summarizes the work described in greater detail in his earlier papers in the most fitting way for his ultimate work. He also left the work on a survey of the eastern Gulf of Mexico well advanced so that this too will probably be a contribution to his memory.

By the time this is read, Atlantis will have returned from her first venture into the Pacific. We feel sure that the results to be worked up in the next three or four years by Mr. Stetson's close associates will be a fitting memorial to him. This is as he would have wished it — to see the job well done.

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*The gap in the appearance of published papers between 1941 and 1949 represents the period when he was actively providing information in numerous unpublished manuscripts and charts for the Navy.

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The Institution recently acquired the ex-Coast Guard cutter CRAWFORD. The 125 foot vessel is seen here moving through the Cape Cod Canal, tied alongside the BEAR, on her way to the Munroe Shipyard in East Boston for a hull inspection prior to being converted for oceanographic use.

Fish, Fisheries and Environmental Factors

by J. N. Carruthers
British National Institute of Oceanography

Fish catches may be predicted through a knowledge of wind conditions during and after spawning.

THE news that the sum of 200,000 dollars has been granted to the Woods Hole Oceanographic Institution for three years, to investigate climatic and oceanographic factors influencing the environment of fish, makes exciting and enviable reading. To a man on the other side of the "herring-pond" whose strong interests have long lain in just such investigations, reading of the award brings first to mind the fine work done by Walford on the dispersal of haddock fry over Georges Bank, and invests with promising extra importance the censuses made by the Fish and Wildlife Service over the past one quarter century, of the relative strength of each year-class of that fish. The present writer greatly regrets not knowing at the time this was written, what was said by Dr. Bigelow in a talk he is known to have given about the investigations which should be carried out under the award, but would not be in the least surprised to learn that he had dwelt upon the discovery by Mr. J. Chase of a variable factor which could, at times, all but wipe out a year class of the Georges Bank haddock.

To present any adequate recital of his own views which are relevant in the present interesting and very-important connection, the writer would have to repeat many things already said in full detail a year ago in his paper contributed to the "Festband" which appeared in honour of Professor A. Defant's seventieth birthday*, or in his essay "An Attitude on Fishery Hydrography" published three years earlier (June, 1951) in the Sears Foundation Journal of Marine Research. The contents of these two papers and of others referred to in them, shows that in respect of various important North Sea food fish, the present writer holds fast to the following thesis:- "that annual fish fortunes can hardly fail to be materially dependent upon those year-from-year differences in the total commotion of the sea which can be attributed to the year-from-year differences in the wind conditions which reigned during the individual spawning seasons." It would take much more space than is

*Some Inter-relationships of Oceanography and Fisheries: Archiv. fur Met., Geophys., und Bioklim. Ser. B. Band 6, Heft 1-2, Wien, 1954, pp 167-189. This article is available also as Contribution No. 75 in the Collected Reprints of the British National Institute of Oceanography.

There are many difficulties facing those who toil the sea. Science may aid by eliminating some of the uncertainties that plague the fisherman.

available here fully to discuss again the grounds for holding extremely strongly to the view that wind is a very powerful causative agency indeed in determining whether fish broods shall grow up successfully or otherwise, but, in the writer's own view, the presented evidence points overwhelmingly that way in the cases of all the kinds of fish studied by him and his associates.

It is not surprising that amongst his professional brethren, some have supported the writer enthusiastically in the work he and his associates have carried out towards the establishment of prediction procedures based upon fish/-wind interrelationships, whereas others have been adversely critical.

Amongst the very numerous accessions to oceanographical literature which pour from the presses these days, papers in which attention is paid to the all-important role exercised by wind in making and ruling sea-currents are legion. This is a fact which gives good support to the original thesis which contended that, to make a side-by-side study of fish events and currents, is tantamount to relating the former to an umbrella factor including a large number of individual factors. Whereas these might severally exercise some determinative influence upon upgrowth fortunes from fish fry to adult, it could never be possible to investigate them individually and separately in their presumed connection with fish fortunes. In earlier papers the writer has described what was done in England to provide information on currents, having what seemed, on practical grounds, as good a distribution in space, dura-

Fish are caught by the few, as by this Bermudian skiff.

Fish are caught by the many, as by the New Bedford fleet.

tion, and freedom from weather-dependence as possible. He has described why he ultimately preferred to seek the establishment of correlations between fish events and wind conditions rather than currents. Within the consideration paid to wind, attention is paid to more than the horizontal water movements produced by it; this fact explains the inclusion of the words "total commotion" in the thesis detailed above.

Forecasting of Harvests

For different North Sea fish, associations were worked out between the wind conditions reigning during, and after, spawning seasons, and the subsequent harvests of adult fish. The writer and his associates were more than content with the results, all of which have been published, which came from forecasting procedures based upon the worked-out associations, and have found no reason at all to be discouraged by certain assaults made by statisticians. Somebody must try to establish acceptable prediction techniques, and whether success or failure attends the forecasts made can be seen without any recourse to weighty mathematics.

Thanks to valuable help from German colleagues, an excellent half century-long body of suitable wind information was available. This was good for large areas of fish interest being computed from mean atmospheric pressure distributions over triangular regions stretching over the North Sea, the English Channel, and other waters. There is, of course, no implication that the fish/wind associations established by the writer and his colleagues and used by them in prediction procedures, were the first of the kind, but it is thought that they had special advantages not possessed by earlier workers.

One thing in particular

needs emphasizing: The writer has always contended that it is not essential to be able to explain the workings of the linkage between the fish events and the wind events correlated with them. He and his associates put forward various tentative hypotheses as suggestions only. It is quite possible that better hypotheses could have been advanced, and a warm welcome is accordingly given to the ideas of K. M. Rae of Edinburgh who has laid certain work of D. P. Wilson under contribution to provide explanatory linkages between the fish and the wind events. Five years ago, Wilson showed that waters which were quite similar chemically and physically, could be very different in biological properties. From one and the same position, there could even be a marked difference between bottom and surface waters in so far as development chances of certain larvae were concerned. In years past, the present writer had been unable to venture a "guess" on environmental grounds, why those conditions of current which had occurred most frequently from year to year at spawning times, had been followed, at the requisite time interval, by the best accessions of adult fish. K. M. Rae now pictures the haddock larvae in the northern North Sea as always "starting off" at the same established spawning grounds, year after year, but whereas the most often occurring wind conditions achieve that the grounds are bathed by the beneficent incoming water, if there is a more than average component of wind directed away from England the beneficent water flows by on the far side. Inversely: too little wind away from England results in the beneficent water keeping inside the spawning grounds. For the sake of brevity the ideas are only given crudely in what has just been said, but Rae has put figures to them. On the supposition that the addition of Atlantic water to the haddock spawning grounds enhances the chances of larval survival, Rae has computed the wind-ruled position of the Atlantic drift eastwards of the river Forth for 27 spawning seasons of the haddock and has found that thirteen of them when the drift position was average, gave rise to brood strengths twice as strong as those which came from spawning seasons during which the drift was either inside or outside its most-usual track.

The "fits" obtained by the writer and his associates between haddock and wind before Rae attacked the problem, could now be re-examined in the light of what is probably a much better linkage hypothesis.

About 30 years ago, Willer of Konigsberg was writing illuminatingly about "Wind und Fischwasser," and during the ensuing years a good deal of progress has of course been made. All that the writer himself has attempted in his endeavours to relate the fortunes of fish to their wind-ruled environment, has had prophesy as its aim, and it is thought

that few will disagree with what Professor H. U. Sverdrup said at the meeting of the International Council for the Exploration of the Sea held at Amsterdam in 1951. He gave it as his opinion that "the most important goal of fisheries research is to prepare predictions of value in fisheries problems" — and that the question before us today, may, therefore be formulated as follows: "generalizing, it may be stated that the predictions to which hydrography can contribute fall in two groups, the prediction of availability and the prediction of the size of the stock."

The writer wonders whether, when the Woods Hole Oceanographic Institution work gets well under way, it will be possible to use the new artificial islands as sources of the best-obtainable wind records. Perhaps if they are not sufficiently far apart to provide atmospheric pressure triangles from which wide-area wind data of the kind earlier refered to can be computed, it might be possible to site upon them simple and robust totalising anemometers of the kind the writer pressed for when writing in the July 1947 issue of the journal of the International Council for the Exploration of the Sea. The installation of such instruments both on prominent points of coast and aboard lightships was advocated.

If, in line with the advocacy of this small paper, more and more work is done towards the establishment of fish/-winds interrelationships good enough to base prediction procedures upon, the mere fact of taking wind into consideration as an umbrella factor of great importance, negligible expense, and singular convenience, will mean that important wind effects discussed by Sverdrup in his paper: "Some Aspects of the Primary Productivity of the sea," under the heading: "Plowing the Sea Surface"* will be covered.

Bottom fish

In addition to what has been said so far, thought needs to be given to the environment of bottom-living fish which spend their lives mostly in waters beyond direct wind influence. It is quite possible that conditions which are genial to them, or the reverse, are expressible in terms of temperature, salinity, oxygen content and so forth — either considered individually or as a summation of some kind.

Whatever the conditions may be which the fish seek or flee, they will be dependent in some, perhaps in a marked, degree upon deep near-bottom currents. This is the view of A. J. Lee of Lowestoft who is so much concerned with seeking possible hydrographical explanations for cod concentrations in Arctic Waters.

To ascertain whether there is or is not a causative interrelationship between demersal fish concentrations and near-bottom currents of which practical fisheries use could be made, required, in the view of the present writer, the provision of an apparatus of simple type which could be used to measure off-bottom currents without having to anchor ship. Such an apparatus has been

*F.A.O. Fisheries Bulletin, Vol. 5, No. 6, Rome, 1952.

provided and already used to some extent in Arctic waters. Used without line contact with a ship, difficulties due to the ups-and-downs occasioned by waves are escaped. However, since, in many areas, much current-measuring **could** be done from lightships or other anchored vessels, a special modification of the simple apparatus in question has been made. This, which will serve to measure current speeds and directions at various depths, will be suspended from anchored ships and operated without the trouble due to wave motions which so often attends such work. Using this instrument it should be possible after ample experimentation, to discover whether interrelationships between demersal fish and their environment which will serve practical fisheries interests, do exist.

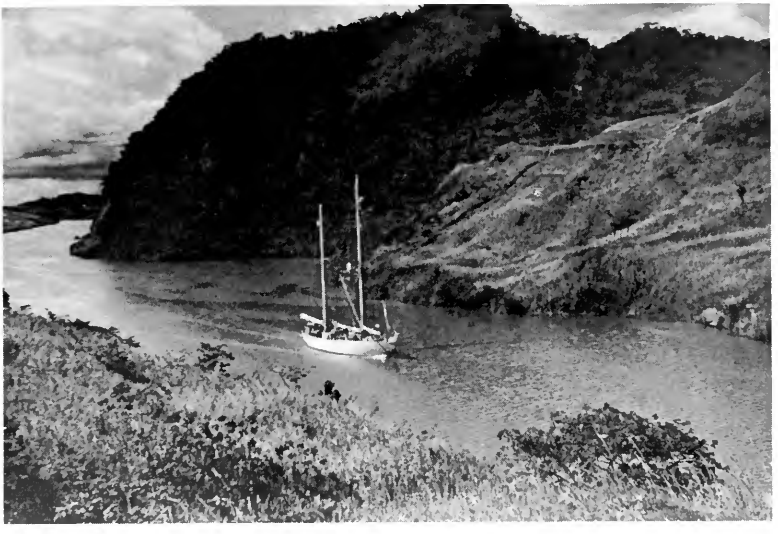
Mid-depth trawls

Where, in pursuance of the investigations, fish have to be caught at mid-depths with non-bottom trawls, it will be useful to know at what depths such nets have fished during a tow.

The telemetering depth meter devised by Willard Dow of the Oceanographic Institution will doubtless serve for use from research vessels, but ordinary commercial fishing vessels are hardly likely to possess it. Accordingly, a simple instrument has been made to measure what had been the slope of each warp during a tow. This, a perspex-encased directional rolling clinometer, operates through the congelation of a hot solution of gelatine. A number must be used to reveal the slope of the warps since each tells the obliquity at one point only. Illustrations and descriptions of the simple devices will be found in the Autumn 1955 issue of the F.O.A. Fisheries Bulletin.

Finally: so that information on bottom water movements can be gathered in large amount and over the large areas without the need to operate current-meters, and with the added advantage of learning something of the regional distribution of ground fishing intensity, a current-indicating system of bottles has been thought out and is being developed. This intended practice will involve coupling a pressure-resisting empty bottle to one made of heat-resisting glass (pyrex) bound to a thin stranded copper cable uniting the former to an anchor weight of non-perishable earthenware such as a brick. The pyrex bottle will be half-full of hot liquid gelatine topped up with kerosene, and a magnetised rod impaled through a cork will "float" at the liquid interface. When such objects reach the sea floor they will cant over in a current and solidification will preserve the degree and direction of slope which will be easily convertible into current speed and direction. Some of them will remain on the sea bed until trawled up, but others will leave their "anchors" after a time and will float away to strand on distant shores. There will be a simple means whereby a finder of no scholarship can furnish the few facts which it is necessary for the investigating office to know.

Pacific Geology



Atlantis passing through the Panama Canal.

Although the ATLANTIS will not return to Woods Hole until about February 2, the geological program in the Pacific was finished by the beginning of January and the scientific party has returned. The ship traversed the Panama Canal in November 1955 and worked in the Pacific Ocean for the first time since she was built in 1931. The cruise was not unmixed with sadness, for the chief scientist Henry C. Stetson died at sea off the coast of Chile. He had been interested for many years in the great deep trenches which lie close to shore near the arid highlands of the Andes Mountains. His primary objectives for the Pacific cruise were the study of the sedimentary patterns and the shape of these trenches.

The ATLANTIS occupied seven profiles at right angles to the shore, 90 to 150 miles in length and also made several short profiles in shallow water near the coast. About one-hundred cores of sediment were obtained for later analysis, this work will take considerable time before any conclusions can be reached.

Soundings were recorded on the Woods Hole echo sounder recording system, developed at the Institution and operated by Herbert Small. In addition to the Depth mentioned on page 2 of this issue, a submarine canyon was charted, north of Mollendo in Latitude 16°4′ N. More than 3,000 feet deep in some places, the canyon was crossed four times. Dr. Parker D. Trask, who took over as chief scientist, has proposed the name Stetson Canyon for this feature.

In the Humboldt Current, Robert A. Lufburrow took about 250 temperature observations with the bathythermograph, which may represent the most detailed study so far obtained in this current. Lufburrow also made a dozen current observations with Dr. von Arx's Geomagnetic Electrokinetograph, the first time this method has been applied south of the magnetic equator, which limited the use of the instrument in the area.

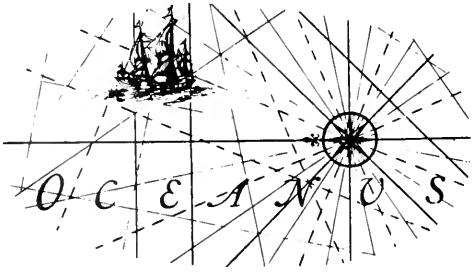
Although it was expected that many fish would be caught in the region, famed for its productivity, only two fish were caught, despite the fact that lines were trolled for hundreds of miles. One nine-foot marlin was taken by Bo'sun Carl Speight, the other fish was a corbina. Both small and large squid, up to four or five feet were seen in large numbers. Captain W. Scott Bray tried repeatedly to catch one of the large squid but after much falling around in the dark and unsuccessful attempts at gaffing he had to give up. Dr. John W. Zeigler reported that the steward spent the rest of the night pacing the deck and muttering about squid, spaghetti and meat sauce. Large schools of whales were repeatedly en countered and frequently spotted around the ship when hove-to on station.

Strong targets, evidencing large animals, were repeatedly seen on the sound recorder although not seen on the sea surface. Jellyfish and larvae covered the sea at many times and the enormous numbers of sea-birds continued to amaze everyone.

The ATLANTIS received the most friendly attention in South America and made many friends. Some hundred participants of the First Latin American Geological Congress, meeting in Lima, Peru, came down to Antofagasta to visit the ship and discuss the scientific program. Exceptional hospitality was shown by the members of the recently formed Yacht Club of Antofagasta. Dr. Zeigler reported that their boats used copper as ballast!

In addition to those already mentioned, other members of the scientific party were: Victor Benavides of the International Petroleum Co., Lt. José Carvajal of the Peruvian Navy, Senor José Stuardo of the Biological Station at Valparaiso, Chile, Dr. Bernhard Kummel of Harvard and Wm. D. Athearn, of this Institution.

After the departure of the geologists at Callao, Peru, Mr. David H. Frantz, Jr., took over to obtain measurements of the thermal gradients in the sediments with the aid of recovery buoys.



Gifts and Grants

NATIONAL SCIENCE FOUNDATION — $30,000 for three years

Game fish investigations in the Atlantic Ocean have been carried out for a number of years by Frank J. Mather, III, through the Institution's Endowment Fund and were necessarily on a small scale.* Now, a grant has been received from the National Science Foundation to study the biology of the large pelagic fishes of the western Atlantic. Mr. William C. Schroeder, co-author with Dr. H. B. Bigelow of: "Fishes of the Gulf of Maine," and many other books and contributions, is the principal investigator for this program. Mr. Mather is on a leave of absence to investigate the game fishing potentialities in the Virgin Islands region for the U. S. Fish and Wildlife Service.

NATIONAL SCIENCE FOUNDATION — $9,700 for two years

The above grant has been awarded to Dr. Gordon A. Riley, Associate in Marine Physiology on our staff and Associate Director of the Bingham Oceanographic Laboratory at Yale University. With his co-worker, Dr. H. L. Sanders, Research Associate in Marine Biology, Dr. Riley will investigate the productivity of the seabottom communities in coastal waters. Field work will be carried out in Vineyard Sound and in Buzzards Bay with the aid of the ASTERIAS.

ROCKEFELLER BROTHERS FUND — $10,000

This gift has been received as a contribution toward our educational motion picture on oceanography: "SCIENCE OF THE SEA." The motion picture presently is in the final editing stage and will be ready in late Spring for distribution to High Schools, Junior Colleges and other educational outlets. The title was selected after a contest among the personnel at the Institution. Tied for the prize were: Miss Jeanne M. Backus, Front Office secretary and Alan J. Faller, Research Associate.

Gifts were also received from the TI-GSI Foundation in Dallas, Texas and from C. A. Woolsey Paint & Color Co., Inc., of New York City.

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*See: "The Swift and the Roving," OCEANUS, Vol. II, No. 1, 1953

Currents and Tides

Dr. Waldemar Ohle, of the hydrobiological department, Max Planck-Gesellschaft in Plon, Germany, visited the Institution in December and gave a Monday night lecture: "Ion exchange and the origin of ion relations in waters."

"Photosynthesis by marine plankton algae in relation to light intensity" was the title of a paper read by Dr. John H. Ryther at 122nd meeting of the AAAS in Atlanta, Georgia.

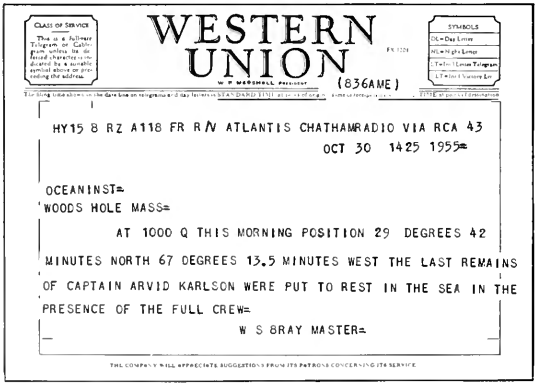
Drs. Willem V. Malkus and Joanne S. Malkus returned to Woods Hole after a year's leave of absence. The wife, lecturing at the Imperial College of Science in London, the husband doing research at the National Institute of Oceanography.

Drs. A. C. Redfield, B. H. Ketchum, F. A. Richards, and Mr. L. V. Worthington flew to Hawaii in November to read papers at the mid-Pacific regional meeting of the American Geophysical Union.

Following the meeting, Dr. Redfield made an aerial survey of the shores and waters of the Gulf of California, with Dr. Gifford C. Ewing of the Scripps Institution of Oceanography.

Senior Scientist C. O'D. Iselin lectured on the general circulation of the ocean to the American Physical Society. The meeting was held in December at the University of Southern California.

Dr. John Kanwisher, Research Associate in Biophysics sailed on the Horizon of Scripps Institution of Oceanography during the 11 week Eastropic expedition.



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AT 1000 Q THIS MORNING POSITION 29 DEGREES 42 MINUTES NORTH 67 DEGREES 13.5 MINUTES WEST THE LAST REMAINS OF CAPTAIN ARVID KARLSON WERE PUT TO REST IN THE SEA IN THE PRESENCE OF THE FULL CREW=

W S BRAY MASTER=

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