OCEANUS

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WOODS HOLE OCEANOGRAPHIC INSTITUTION

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EDITOR: JAN HAHN

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THE COVER

This aerial view of Woods Hole shows graphically why the village is a world center of marine sciences.

The nearness of the ocean, the frontage on deep water and the absence of pollution make Woods Hole a desirable location for marine research.

The Woods Hole Oceanographic Institution, and its docks, is located in the center of the photograph. The building to the left is the Marine Biological Laboratory which occupies a whole block, while the sole Federal Institution, the Fish and Wildlife Service of the U. S. Department of the Interior is located at the lower right.

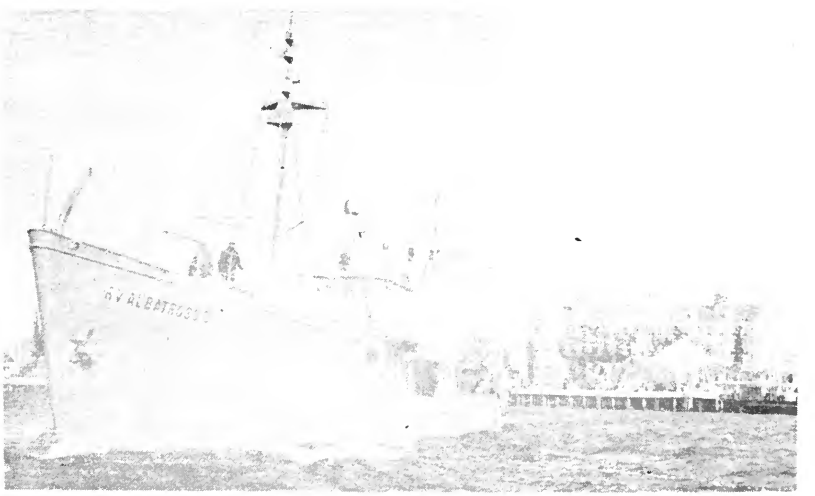
This summer our public exhibits again will be located at the aquarium building situated at the lower right hand corner of the photograph. By next year it is hoped that we shall have more space and additional exhibits in a building of our own.

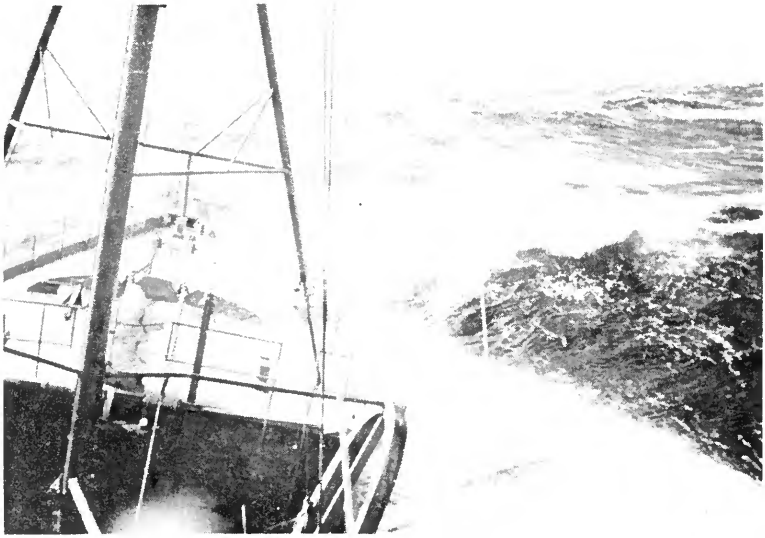
EDITORIAL

On May 20th The Woods Hole Oceanographic Associates gave a dinner at the New York Yacht Club. The addresses given after the dinner are of such general interest that they are printed in this issue of "OCEANUS", so that the speeches may be brought to a wider audience.

We hope the reader will be stirred as we were while reading the discourses. May this be so, for the future of oceanography and the future of man's growth and development are inexorably connected.

Working in the exploration of man's last frontier we feel akin to those who opened the West. Through "OCEANUS" and other activities we hope to be able to impart some of this fervor to the public, without whose support and interest - so ably developed by the Woods Hole Oceanographic Associates - our work could not proceed at the present pace.





THE WOODS HOLE OCEANOGRAPHIC ASSOCIATES

By Gerard Swope, Jr., President of the Associates

The organization of the Associates is just one year old this Spring. The Institution itself has just recently attained its majority. It was organized in 1930 as an outgrowth of the Woods Hole Marine Biological Laboratory and, in fact, the land on which the scientific buildings are situated was made available by the Laboratory and purchased through a gift from the Carnegie Corporation. The laboratories have always been closely associated. While the Marine Biological Laboratory's work is devoted to fundamental research in the biological field, the Oceanographic Institution is principally engaged in the study of the sea in all its phases.

Two years ago the scientists at the Institution may have become a bit lonely in the confines of the laboratories on shore and the sea, but more likely after 20 years of work, they felt that they were working in a field so big,

so challenging and so fascinating, that others, not so fortunate as to be able to spend all their time in exploring the depths of the sea, would be interested in seeing what goes on, and in being able to keep in touch with its future development. They felt that the science of oceanography could better grow and mature through wider knowledge in the community in general. They felt a need for an understanding group akin to the alumni of a university. This was given a tremendous impetus by an Associate, Rachel Carson, in her book "The Sea Around Us".

So it all started when Admiral Smith asked some of the neighbors of the Institution at Woods Hole to come in and look around. Many of us did, anxious to satisfy our curiosity as to what went on in the laboratories and on the ships. Out of that visit was born the Associates.

It is not a money-raising organization and no funds are being solicited. It is purely and simply an opportunity for those interested in the science of the sea to become better acquainted with its vast possibilities and to follow and encourage its future development.

The dues of the Associates will be used to support, in a modest way, special projects relating to the work of the Institution, with emphasis on those which will bring a greater understanding of oceanography to the layman. Last fall we were particularly fortunate in having one of our new Associates, Mr. Samuel Peck, quite out of the blue, donate to the Institution a Sports Fisherman. It was hoped that it could be used to make coastal studies of the habits, whereabouts and movements of pelagic fishes. However, it proved to be too light for this purpose and it is planned to dispose of it and the Associates have proposed that consideration be given to using a portion of the proceeds to make it possible for the Con-

servation Foundation to make a documentary film on the sea with emphasis on the oceanography and its future possibilities which will be used for educational purposes throughout the country and will be available generally for use by any interested group.

Other projects which are being considered for the future are to help establish a museum devoted to the sea at Woods Hole. To further bring to the layman information on the work and activity of the Institution it is proposed to hold meetings and also to issue a semi-annual publication called "OCEANUS", the first copy of which was published last winter.

The annual meeting to be held at Woods Hole each summer will give the Associates an opportunity of becoming directly and intimately acquainted with the facilities and work of the Institution. This year the meeting will be held on Saturday, August 1 st, at which time it is planned to take all the Associates to sea for a day on one of the Institution's ships and to demonstrate some of the devices and equipment used to bring to light

"Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear."

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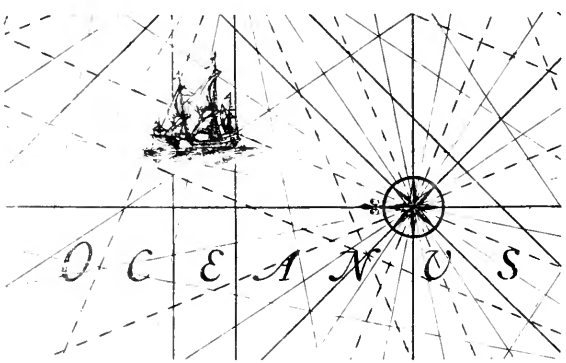

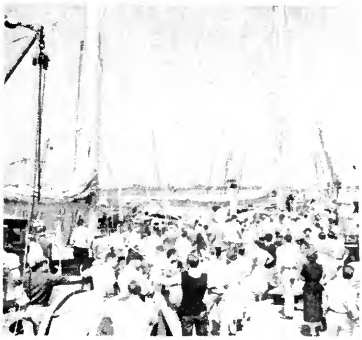

WORLD POPULATION

From the address by Dr. Fairfield Osborn
President Conservation Foundation

"Why man needs the ocean" was the subject of Dr. Osborn's discourse. Unfortunately, his speech was not in manuscript form so that we are unable to print his remarks in full.

Dr. Osborn explained that the enormous increase in world population-expected to reach a total of 3600 million people by the end of this century-has made it adamant that we obtain a better knowledge of the world's marine resources.

There is no doubt but that man will have to turn toward the ocean for additional food and raw materials. Unfortunately little is being done to learn more about the possibilities of supply and harvesting the sea so that we shall be able to obtain optimum results on a long range basis.

The increase in food supply is not keeping up with the increase in population, Dr. Osborn continued. Since 1935 the population is up by 12%, while the food supply has been expanded by only 9%.

The World Population:

Middle 17th century -	450 million people
Opening 19th century -	800 million people
Opening 20th century -	1600 million people
Since 1900	800 million people
Presently	2400 million people

Present rate of increase - 30 million people a year.
Expected at the end of the 20th century - 3600 million people.

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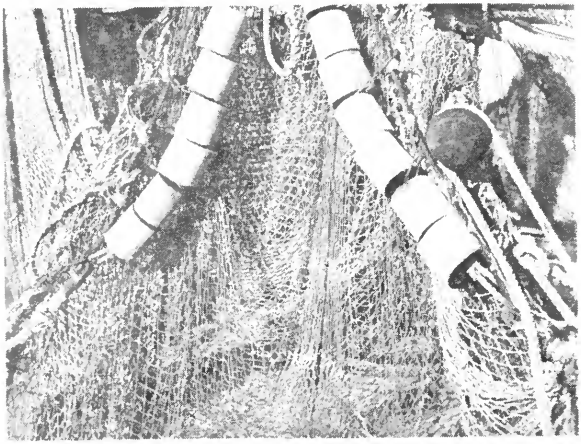


THE DEVELOPMENT OF WORLD FISHERIES

By Columbus O'D. Iselin, Senior Oceanographer

Man is basically a land animal and more or less afraid of the sea, and this perhaps is one of the reasons that we know so little about it. Mr. Osborn has said that we need to make more effective use of the ocean's resources. I will try to explain how ready and how unready oceanography is to meet this challenge.

At the outset, at any rate, the problem of how better to make use of the resources of the sea is only in part a scientific problem. The chief difficulties retarding the world fisheries are social and economic. Scientifically, we know enough about the sea and its inhabitants to make it safe to say that several times the present world's fish landings of 25 million tons annually could be obtained before there need be any worry about conservation measures. For example, at present only a small percentage of the total fish crop is obtained from the southern hemisphere which, of course, contains a high percentage of the world's salt water covering. On the other hand, to land fish cheaply is the crux of the problem and this involves knowing when and where they are to be found in exceptional concentrations. In this respect our knowledge of the southern hemisphere oceans is very deficient indeed.

A scientist is not supposed to be concerned about the potential usefulness of his subject, yet this is mainly what I want to discuss. Although they seldom admit it, I believe that most scientists think that what they are doing will someday turn out to be useful. It is very gratifying to me, at least, to find that our little subject of oceanography is beginning to attract attention because some successes have already been achieved in its practical applications, although we have hardly made a beginning at the very large problem of harvesting the sea efficiently.

To date the greatest practical successes have been in connection with undersea warfare and this is of course the reason that the Navy has been giving us generous support during the past ten years or more. Yet clearly there are many other aspects of oceanography that will turn out to be useful in one way or another.

Before discussing the oceanographic aspects of commercial fishing, I would like to mention briefly some of the other promising applications of oceanography. There are, of course, interesting applications to other fields of science. Of recent years, it has become clear that geology can greatly benefit through studies of the processes of marine sedimentation and through a general exploration of the ocean areas by conventional geophysical methods. Such investigations are now being actively pursued and consume a considerable fraction of the time of our vessels. It is less generally realized how closely oceanography and meteorology are linked. I think that we would all agree that it would be useful to be able to predict the trends of the weather and better still to learn how to influence these trends. At Woods Hole we have a group that has pioneered in the marine aspects in this field.

Together the hydrosphere and the atmosphere constitute a huge heat engine in which currents, winds and weather are only means of dissipating the energy received from the sun. Of the two halves of this system, the ocean is much less variable and therefore acts as a sort of fly wheel. The energy transfer between the water envelope and the air envelope takes place in many subtle ways and only when these are thoroughly understood will man be able to predict the weather, let alone attempt to modify it.

Of recent years we have had two main lines of attack in marine meteorology. One group has been measuring in detail the exchange of heat and water vapor between the ocean and the atmosphere. Another has been studying the important role which salt particles play as condensation nuclei in the atmosphere. Meteorology has been backward in the development of instrumentation and we have also tried to improve this deficiency. We have learned to use an aeroplane to explore the details of the processes taking place over the ocean and we have learned to use the plane to observe some of the accompanying oceanography.

Besides measuring the temperature and humidity of the air as a function of altitude and of the length of time that the air has been flowing over the water surface, through accelerometers, the plane is able to detect not only major updrafts and down drafts, but also the degree of turbulence in the air. In addition, through an infra-red sensitive device the plane is able to measure sea surface temperature sufficiently accurately to locate the margins of ocean currents and other important thermal discontinuities of the air-sea interface.

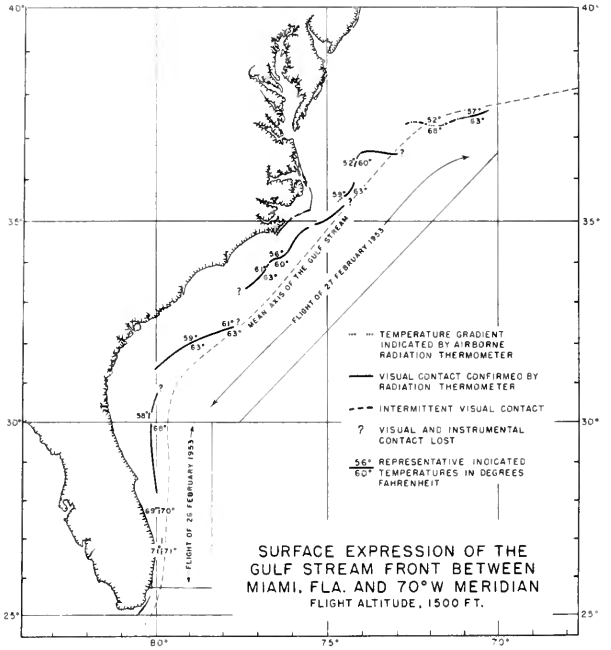
Furthermore, the plane can be used to scout ahead for our research vessels so that they can develop the three dimensional physical structure of the ocean with a minimum of confusion and a great economy in time.

In such ways physical oceanography is approaching the synoptic stage. Not only are we beginning to develop a reliable picture of the structure of the Gulf Stream, for example, during a given period of time, but also we are beginning to learn how this structure gradually changes and it can be expected that before long, to some degree at least, we will be able to predict changes in the current system and to forecast some of their consequences.

In these studies, the continuous measurements now being obtained of the transport of water through the Florida Straits will play an increasingly important part. With the cooperation of the cable companies, a record is being maintained of the difference in electrical potential between the two side of the Florida Straits. These are not only fundamental oceanographic observations for studies of North Atlantic circulation, but it seems likely that they will become a valuable meteorological record as well. In all probability the transport through the Florida Straits reflects the total recent energy of the easterly winds over the tropical Atlantic.

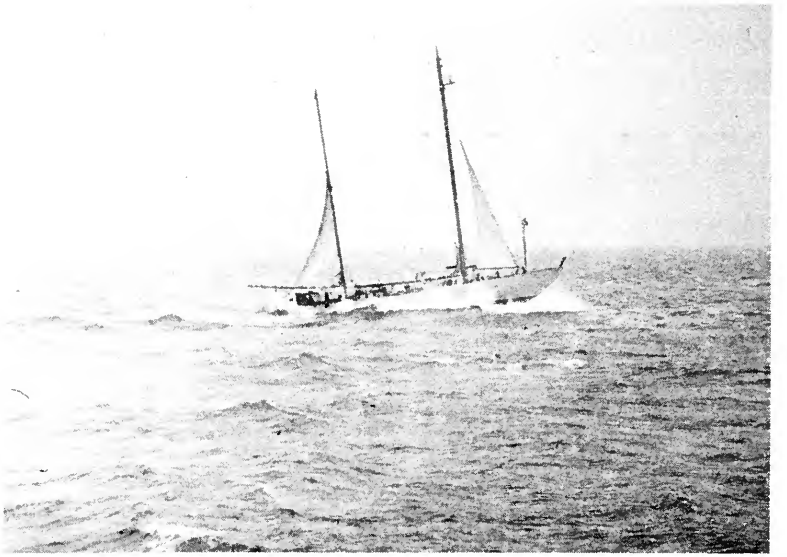
Having very briefly sketched the directions in which our researches in physical oceanography and meteorology are proceeding, I will be so bold as to make some guesses as to the practical applications that may develop out of these studies.

We have found that the Gulf Stream consists of a number of narrow filaments of swiftly moving water. On a statistical basis along the average axis of the Gulf Stream one can expect to find currents approaching three knots, but in the narrow swift streaks velocities of five or even six knots will be encountered. If a tanker carrying oil from the Gulf of Mexico to New England, for example, could learn how to remain in the most swiftly moving water,as much as 60 or 70 additional miles could be made good each day. From the air we are beginning to find



that there is a certain order to these filaments or streaks of current. They seem to be arranged in an overlapping manner like the shingles on a roof, but they are very big shingles, each at least 150 miles in length. Following the Gulf Stream northward with the plane, we find that when the radiation thermometer can no longer detect a warm streak of swiftly moving water, the thing to do is to turn left, that is towards the coast and within 10 or 15 miles a new and more vigorous streak of swift current will be encountered. It seems likely that navigators can learn to make use of such characteristics of the major ocean currents now that we are beginning to be able to describe them in a reliable manner.

Studies and measurements of the characteristics of ocean waves have been particularly active of recent years. It seems likely that the new understanding gained in this field will have most useful applications in naval architecture. Until now it has been difficult to include wave effects in towing tank tests. In any case for large ships traveling at moderate



speeds, waves are not too important a design factor. At Woods Hole we have recently undertaken a study of ship motion in relation to natural waves and I for one believe that the results of this study will be far-reaching in naval architecture. We hope to learn what makes one vessel so much more comfortable than another. We hope to show how sea kindliness can be much improved, both in small vessels and in large ships traveling at the high speeds that will soon become possible.

It has been thought for many years that the Gulf Stream exerts a considerable influence on the climate of Northern Europe, but until recently there has been no easy way whereby its fluctuations in transport could be recorded. Now that we have learned to use the submarine cables for this purpose, it may well become possible to relate the flow through the Florida Straits to subsequent climatic trends in Europe. In all probability the time lag will turn out to be a matter of several years.

The arrival of varying amounts of warm water off the

European coast not only must influence the climate ashore, but even more directly it must exert an influence on the fisheries.

To date, attempts to predict fluctuations in the yield of the fisheries have mostly assumed that some biological variable controlled the yield; for example, the number of potential spawners or variations in the food supply. However, it seems likely that the large scale physical variations in the system usually exert more pronounced effects.

A recent study by Mr. Chase at Woods Hole will serve to emphasize this point and at the same time illustrate how oceanography will become of assistance when and if it becomes feasible to direct the fishing effort more efficiently. For the last 25 years, the Fish and Wildlife Service has been keeping track of the relative strength of each year class of haddock on Georges Bank. This curve is a reliable one, for each time there is a successful spawning, this particular year class will show up strongly in the landings at Boston for a number of years beginning about 3 years later. Many attempts have been made without success to explain the marked fluctuations which occur from year to year in the number of young haddock being added to this heavily fished stock. Moreover, it was shown that little or no recruitment of haddock come to Georges Banks from other areas. Thus the influence must be a local one.

Haddock spawn from early in March to about the middle of April. During about a three-months period the eggs are floating at all levels. After this brief pelagic stage, the baby haddock swim to the bottom where they remain for the rest of their lives. Mr. Chase's problem was to look for some variable factor that could at times all but wipe out a year class. He reasoned that northwest gales might do this and it turned out that such is indeed the case. He studied the difference in

barometric pressure between Yarmouth, Nova Scotia and Nantucket. This gave him a day by day record of the presence or absence of strong northwest winds over the bank during the critical three months period each year when the young haddock are in danger of being blown off the bank and of finding themselves in 2000 fathoms of water, rather than in 40 fathoms, when the time comes to swim to the bottom. Having established the correlation between the number and duration of northwest gales and the lack of success of the year class, Mr. Chase has shown how three years in advance one can know the amount of fishing effort that will be required to produce a given quantity of haddock from Georges Banks.

One reason that commercial fishing fails to attract capital and to become organized into sizable units is that the success of each type of fishing has been so unpredictable. Fishermen have remained hunters rather than harvesters of the sea. Their equipment has remained primitive and to them luck seems much more important than the design of their vessel and its equipment. Compared to agriculture, very little engineering effort has been devoted to the production end of the fishing industry. If oceanography can remove some of the mysteries and uncertainties that have plagued commercial fishing, it will be much easier to plan the fishing effort wisely and to justify the expense of engineering effort.

In short, in an expanded and intensified fishery, the first duty of oceanography will be to provide reliable predictions concerning the natural fluctuations of the various commercially important species. So far as we know, at present, in only a few cases is overfishing a serious problem. The essence of the situation is that fish produce a great many eggs and a great abundance of young fish will survive each time the physical and chemical circumstances are favorable. Some years

one species will be plentiful, other years another, but over a considerable area the total production will remain nearly constant.

It is true that near the shore overfishing sometimes occurs, but economic factors alone are usually sufficient to relieve the situation, for when one species becomes scarce the fishermen in time turn to others which are more plentiful. It must be remembered that in fishing man is not in any way reducing the total productivity of the sea. In fact, he is increasing it for he is removing the enemies of the young fish. Many fish habitually eat their young.

Another general consideration is that, unlike the land, the sea contains a vast reserve of nutrient chemicals that have been accumulating since the beginning of time. Its productivity depends on the physical processes, that is winds and currents, whereby these chemicals are returned to the surface layer where plants can convert them into living matter. In the sea there is no danger of man destroying the equivalent of the forests or the soil.

If one can agree with these general conclusions that overfishing will seldom become a serious problem, then there are no serious objections to employing more efficient fishing techniques, provided these do not destroy too many young fish.

What are some of the ways in which oceanography could help fishermen to harvest the sea more cheaply and to spread the fishing effort more widely?

At present fish are taken in quantity, either at the surface or on bottom. Only in a few cases are the mid-depths being successfully exploited. It is for the fish living at mid-depths that an effective fish locating device would be of great help to the fishermen, for here the catching problem is a three dimensional one. The net must be not only at the right

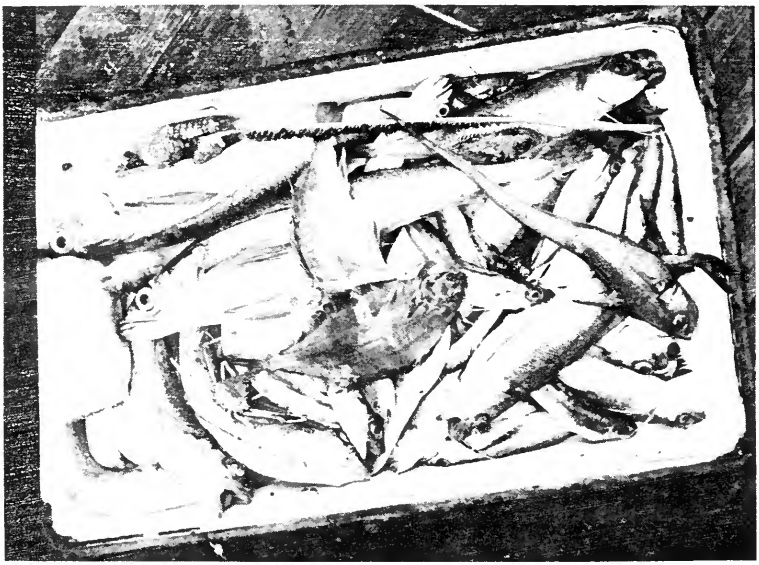
place but also at the right depth.

The understanding that we have gained of underwater acoustics during the last 10 years or so has shown that it is entirely practical to use acoustical techniques to locate schools of fish and even to distinguish between different species. In fact this is now being done somewhat crudely in several European fisheries. What is needed is to make the equipment more convenient and less expensive, and this can perhaps be accomplished when we know a little more about the characteristics of echoes produced by fish. Which frequencies are the most favorable to distinguish between fish and the great mass of smaller acoustical scatterers that swarm at mid-depths, for example?

At present we know very little about the reactions of fish to stimulae of various kinds. Could we not learn to attract fish or to herd them? Could we not establish the equivalent of fences in the sea which would require fish to converge towards a trap? This could perhaps be done acoustically, electrically or with lights. Some small beginnings are being made in this field, but before the engineering phase can be successfully carried out we need to know far more about the reactions of fish to their natural environment, as well as to such modifications of the physical or chemical situation as might be contrived.

In short, the science of fishing remains very primitive, but I believe that if a rather modest effort could be properly organized and effectively backed up with engineering development, very great gains might be rather quickly achieved. We need to study the biology of fishes and to break away from the classical philosophy of fisheries biologists who from the outset were convinced that over-fishing was likely to be a serious problem. Even if this danger is much nearer than I think it is, this is no reason that fishing methods should not be made more efficient.

If by chance it should become economically feasible to fish in the deep ocean basins, instead of just along the coast as is now the case, the resulting gain in protein production would be almost unlimited.



Caught at a depth of 300 fathoms.

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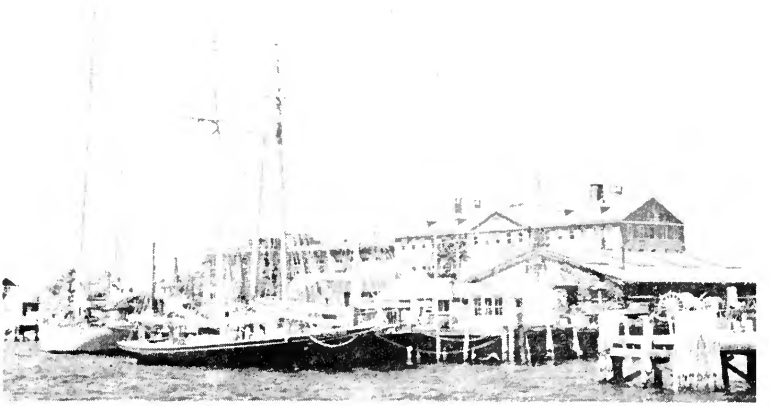
The cover photograph was made by D. M. Owen, our underwater photographer, while flying with John F. Holmes who has made many landings on the Arctic Ice-pack.



THE WOODS HOLE OCEANOGRAPHIC INSTITUTION

By Rear Admiral Ed. H. Smith, U.S.C.G. (Ret.), Director

The Woods Hole Oceanographic Institution is very appreciative of the interest and plans which the Woods Hole Oceanographic Associates have for the spreading of a better and wider understanding of the relatively young science of oceanography.

It is a pleasure, therefore, as Director of the Institution, to say something to the Associates' friends, and possible future members of the organization, concerning the Institution, such as its location; how it came to be founded; its scientific objectives, and a brief description of some of the field work.

The Institution's shore facilities, consisting of a main laboratory building, shops, smaller buildings and a dock-side pier, are located on the picturesque harbor of Woods Hole, Cape Cod, Massachusetts. The establishment was initiated in 1927 by the National Academy of Sciences when it was realized that this country was falling far behind Europe in its scientific study of sea problems. No station at that time existed along the Atlantic Coast. In 1930 the Rockefeller Foundation responded with a three million dollar grant which provided for the erection of the shore plant; an ocean going research vessel, and the income from the balance

to be used for operations. What was adequate, however, twenty-three years ago to maintain a modest effort, falls short of the work today, and were it not for the support which is now received from naval sources, it would be quite impossible to carry on but a fraction of the present scale. We take pride in noting, however, that after twenty-three years, the Institution is still the largest private, non-profit laboratory in this country devoted to the study of the sea, and that during the quarter century just passed, the contributions of scientific facts about the sea which have emanated from Woods Hole are second to none.

Popular conception of an ocean pertains to its waves and watery expanse, yet that which does not meet the eye; its internal thermal and chemical structure; its myriad of living forms; the geological aspects of its containing basin, and finally the atmosphere in contact with its surface, all give their particular challenge to the oceanographer.

The collection of observations at sea upon which the scientific findings and results depend, obviously requires the use of sea-going ships. In fact ships are as necessary to an oceanographic laboratory as a high-powered telescope is to an astronomical observatory, and of the former the operating costs are far greater. The practice of oceanography has the unenviable distinction of being the most expensive of all the sciences. The arduous collection of field observations by both ship and airplane, take our scientists as far away as the tropics, and even in flights over Arctic ice to near the Pole.

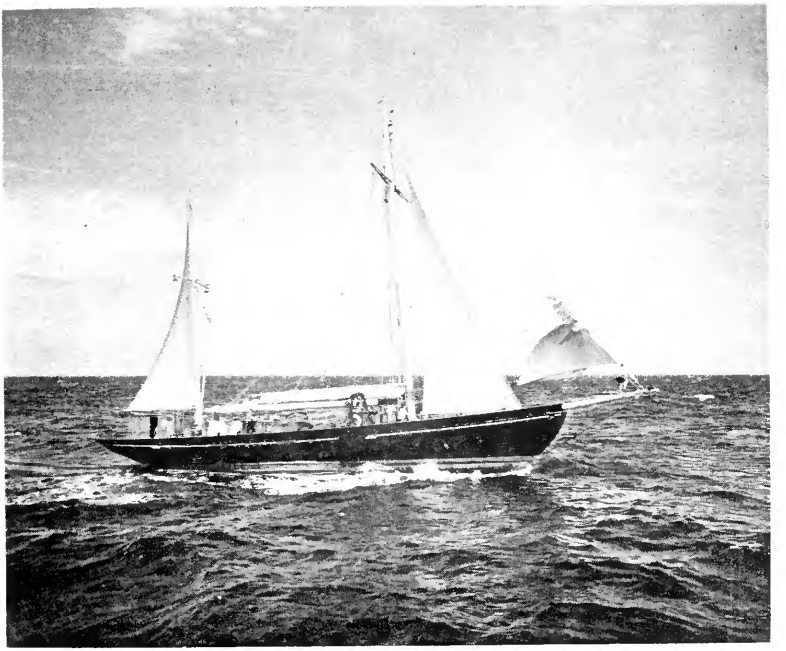
ATLANTIS, our flagship, is an auxiliary steel ketch, 142 feet over all, with a main mast which until shortened a few years ago, was said to be the tallest single spar of any

sailing craft under the American flag. The sails add many miles to the fuel's endurance, which is an important factor where great sea expanses must be traversed. Isolated ocean areas, seldom crossed by ships, must often be visited, and in case of a lost propeller, sails can be very useful. Once ATLANTIS had such an experience and sailed from the Cape Verdes to New London in quite an easy voyage. A year ago off the mouth of the Amazon, ATLANTIS' mizzen mast and sail went by the board. The wreckage was soon cleared away, and the work resumed with only the stub of the mast to show the scar. A prompt refit and another deep-sea expedition followed the return of ATLANTIS to Woods Hole. ATLANTIS has spent 250 days at sea per year.

One of the unique and fascinating features of ATLANTIS is the special instruments and equipment employed to probe the depths. The work requires the use of many miles of strong flexible cables (from 3/32 inch to 1/2 inch in diameter) upon which to lower and hoist the various recording instruments. Among other observations the oceanographer must measure the thermal and other physical and chemical conditions beneath the surface. Electrically operated deck winches of several sizes handle the cables. The largest one of all, embedded in the bowels of ATLANTIS, contains 20,000 feet of 1/2 inch cable. This winch is used to trawl in deep ocean and to lower a heavy steel tube which when driven into the ooze of the ocean floor, brings up a long core of sediment that required thousands of years to deposit. The sediment examined under the microscopes of our staff helps to determine the extent of geological ages and changes in climate which have taken place in the past. Collections are also made of the plant and animal populations found floating or swimming in the sea. People little realize the stupendous masses of

planktonic life that exist in the sea. The land has nothing comparable. One of the major fields of oceanography deals with the ecology of this living material of the ocean on which all life in the sea depends.

Painstaking, meticulous research by members of the scientific staff is required, each one an expert in his field. In oceanography the scientist must be hardy, and have a strong stomach with no predilection to sea sickness. He must be resourceful, and of a cheerful disposition to live closely associated with his fellows in a small ship during prolonged absences from home and family. It is often the case too, that the same scientist who has put to sea, and worked long hours on the pitching rolling deck, is the same person who carefully fits together the story of the subject of investigation back in the laboratory on shore.



The field work of the Institution is not restricted to ATLANTIS, and some of the smaller vessels, but observations are carried out in the air over the sea by an airplane loaned to us by the Office of Naval Research. Significant studies in marine meteorology are being made by our scientists flying with their instruments to record data aloft. For example, there are the studies on the manner of formation, and the structure of marine clouds, as moist air evaporated from the sea is carried from the lower layers of the atmosphere up to cloud heights. Direct flight observations on the escape of salt particles from the sea surface, and their ascent to form the nuclei of water droplets, and the role of these particles in clouds and precipitation, are some of the exciting discoveries taking place at Woods Hole.

Not only are the observations directed into the sea, and into the air above the sea, but also members of the Institu-

tion's staff have flown hundred of miles over the Arctic ice and experienced dangerous landings to cut holes through the ice and plumb the depths of the Polar Sea beneath. Little or nothing is known of the movement of the ice pack, and the oceanography of the Arctic, one of the earth's last frontiers.

The end products of the Institution are its published scientific papers and reports which are distributed to libraries in this country and abroad. During its twenty odd years the Woods Hole Oceanographic Institution has published a total of 635 technical papers representing original theses of oceanography, which are distributed to more than 600 universities and institutions throughout the world.

The scientific, economic, and cultural need of continuing, expanding oceanographic research is gradually becoming realized and receiving endorsement. Our country, facing as it does on two great oceans, cannot afford to be heedless of its maritime responsibilities, nor of its opportunities which knowledge of the ocean offers to the general welfare of its people. Oceanography is an immense subject, whether considered with reference to its geographic extent; to the variety of its scientific disciplines, or to the enormous economic interests of the civilized world.

The Woods Hole Oceanographic Institution is confident as it enters its second quarter century of service to science and the Nation, it will be joined by more and more adherents who realize the significance of the great work yet to be accomplished. It is for these, and other reasons, that the support and assistance of the Woods Hole Oceanographic Associates, and its future members, is cordially welcomed.

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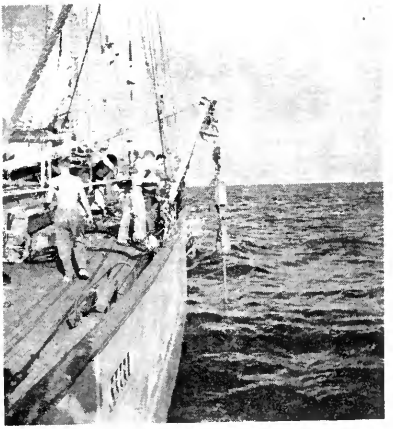
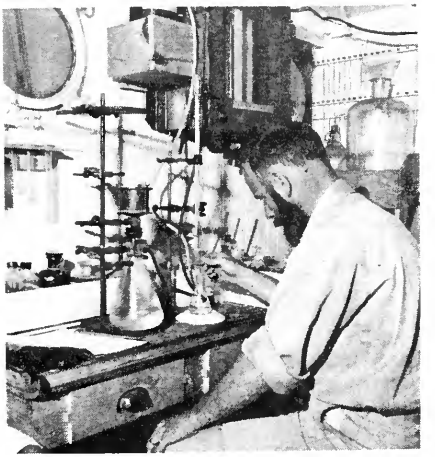


Lowering a coring tube to obtain sediment from the ocean bottom.



Oceanographer Dean F. Bumpus determining the oxygen content of a water sample in the upper laboratory of ATLANTIS.

U. S. Navy PBY6A on loan to the Institution landed at a Greenland Airbase during a flight to Iceland.

Gerard Swope, Jr., whose summer home at Juniper Point is a well-known landmark, is vice-president of the International General Electric Company. Mr. Swope has been instrumental in the organization of the Woods Hole Oceanographic Associates and is the first President of that organization.

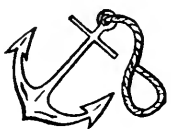
Fairfield Osborn is President of the New York Zoological Society and President of the Conservation Foundation as well as a member of numerous other organizations principally devoted to the natural sciences. He is also a Trustee of the Resources for the Future. His new book "The Limits of the Earth" will be published in the fall.

Columbus O'D. Iselin is Associate Professor of Physical Oceanography at Harvard. He was Director of the Woods Hole Oceanographic Institution from 1940 to 1950 and was directly instrumental in solving some of the more difficult problems of the Navy during the war. He is now senior physical oceanographer at the Institution.

He is recognized as an outstanding pioneer, leader and authority in the science of Oceanography.

Rear Admiral Ed. H. Smith, U.S.C.G. (Ret.), is the Director of the Oceanographic Institution. He also serves as Chairman of the Board of Governors of the Arctic Institute of North America. He is a graduate of the U. S. Coast Guard Academy and received his Doctorate in Oceanography at Harvard University.

After the tragic sinking of the TITANIC he was instrumental in creating, organizing and operating the International Ice Patrol, and in recognition of his leadership in this work he is better known among his associates as "Iceberg Smith".



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