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Field Stations of the United States

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Field Stations of the United States

Arranged by F. John Vernberg

FOREWORD

This issue of *American Zoologist* is presented to the members of the XVIth International Congress of Zoology with the compliments of the American Society of Zoologists and the field stations whose contributions have made its publication possible. For various reasons this issue does not contain descriptive material from all of the field stations and laboratories in the United States which are of interest to zoologists. However, this issue should serve as a valuable reference on zoological stations to investigators throughout the world. The suggestion that *American Zoologist* publish this special issue on the occasion of the Congress came from its Secretary General, Dr. G. B. Momen. Since the production of the issue involved work and diplomacy beyond the capacities of the regular editor, Dr. F. John Vernberg was persuaded to assemble and edit the descriptions of the stations. We are all, therefore, indebted to him.

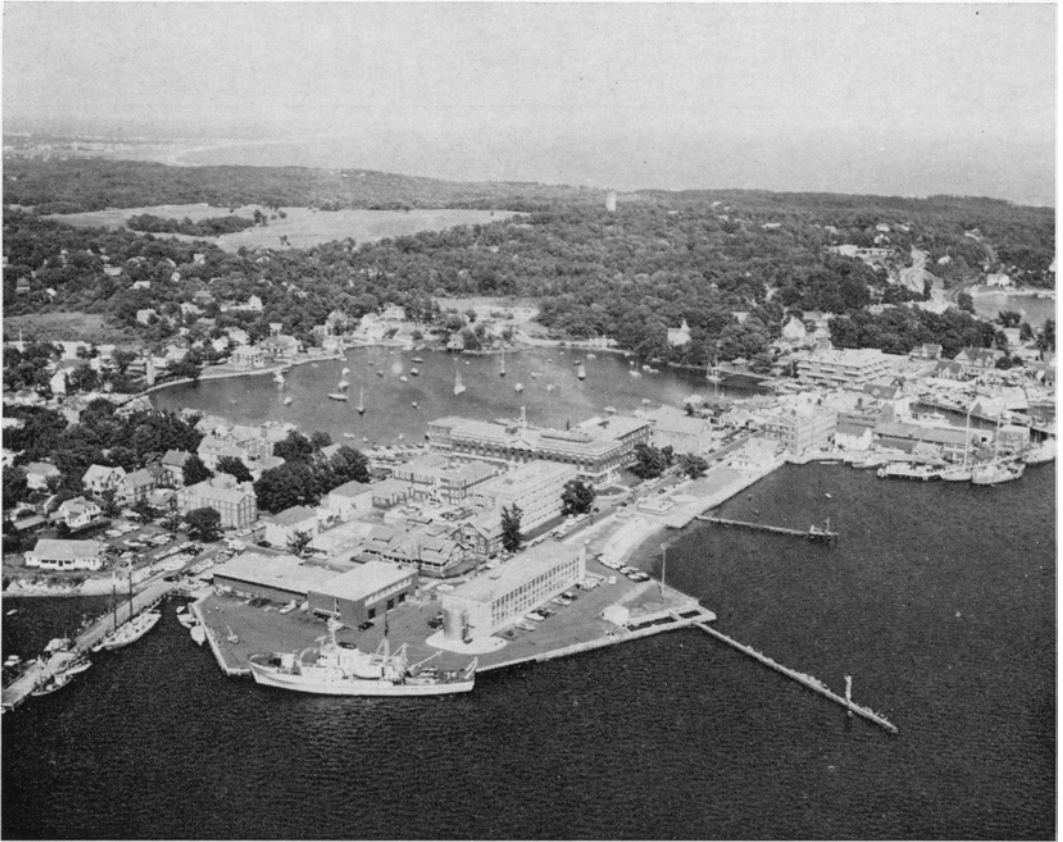
The list of members of ASZ is printed every two years and it was arranged to include this in the special Congress issue.

The American Society of Zoologists is only one of many societies serving as sponsors and hosts for the Congress. Strangers might assume that our Society is the major, primary, or mother association representing all American zoologists. In all honesty such a claim cannot be made. There has been much fragmentation of zoological organizations in the United States. Many American zoologists have their principal

interest in societies concerned with a particular group of animals, for example birds, insects, parasites, etc. or in societies whose interests embrace more than animals, as for example comparative and cellular physiology, genetics, ecology, evolution, and developmental biology. Even with these reservations the American Society of Zoologists comes closest to being the central organization for professional zoologists. In recent years this has been emphasized by new activities of the Society: the sponsorship of summer institutes, regional conferences, refresher courses, special symposia, publication of a brochure describing opportunities in animal biology, and the establishment of a journal for the Society. In addition provision has been made for Divisions within the Society, each Division having partial autonomy, officers, and responsibility for programs in its area.

American Zoologist is a new venture of the American Society of Zoologists. It was felt that many excellent reviews and symposia, particularly the refresher courses, deserved publication but were not quite appropriate for any other journal nor for commercial publication. We hope that Members of the Congress will examine other, more typical issues of *American Zoologist* and will find its contents so useful to themselves and their students that they will urge subscription by their own libraries. Information is given on one of the advertising pages.

SEARS CROWELL
Managing Editor



The Woods Hole Laboratories, Photograph by C. Spooner, July 5, 1963.

The village of Woods Hole in the town of Falmouth, Massachusetts, is the site of three well known institutions — often confused with one another. Although there is a separate article for each it seemed likely that a view of the group would be useful. Also the author-editor shares with many other zoologists both American and otherwise a prejudice for the biological traditions of Woods Hole. Mr. C. Spooner, photographer of the Woods Hole Oceanographic Institution, made a special effort to obtain this photograph for use here.

The Bureau of Commercial Fisheries, Biological Laboratory is the oldest (1875) and it is under the authority of the Fish and Wildlife Service in the United States Department of the Interior. It is still locally referred to by its earlier names: "Fish Commission," "Bureau of Fisheries," or "The Fisheries." Its two new major buildings, replacing the original ones, are in the foreground of the picture surrounded by parking areas and extensive dock space. The new fisheries-oceanographic research vessel, *Albatross IV*, is at the dock. The major office building and laboratory is to the right, to the left is a shop and the Aquarium. The Aquarium is open to the public only in the summer and is used for research in other seasons.

The Marine Biological Laboratory, incorporated in 1888, is a self-governing institution whose primary functions are to make adequate facilities available to professional biologists for investigations requiring marine animals and other special facilities, and to provide instruction for students. In the picture, above the Bureau of Commercial Fisheries building is a block which includes the newest research laboratory, facing the harbor, to its left the Old Main (original) building, and other frame buildings for teaching, research, and living and dining quarters. Across the street, in the center of the photograph, is the main laboratory building, and several accessory buildings.

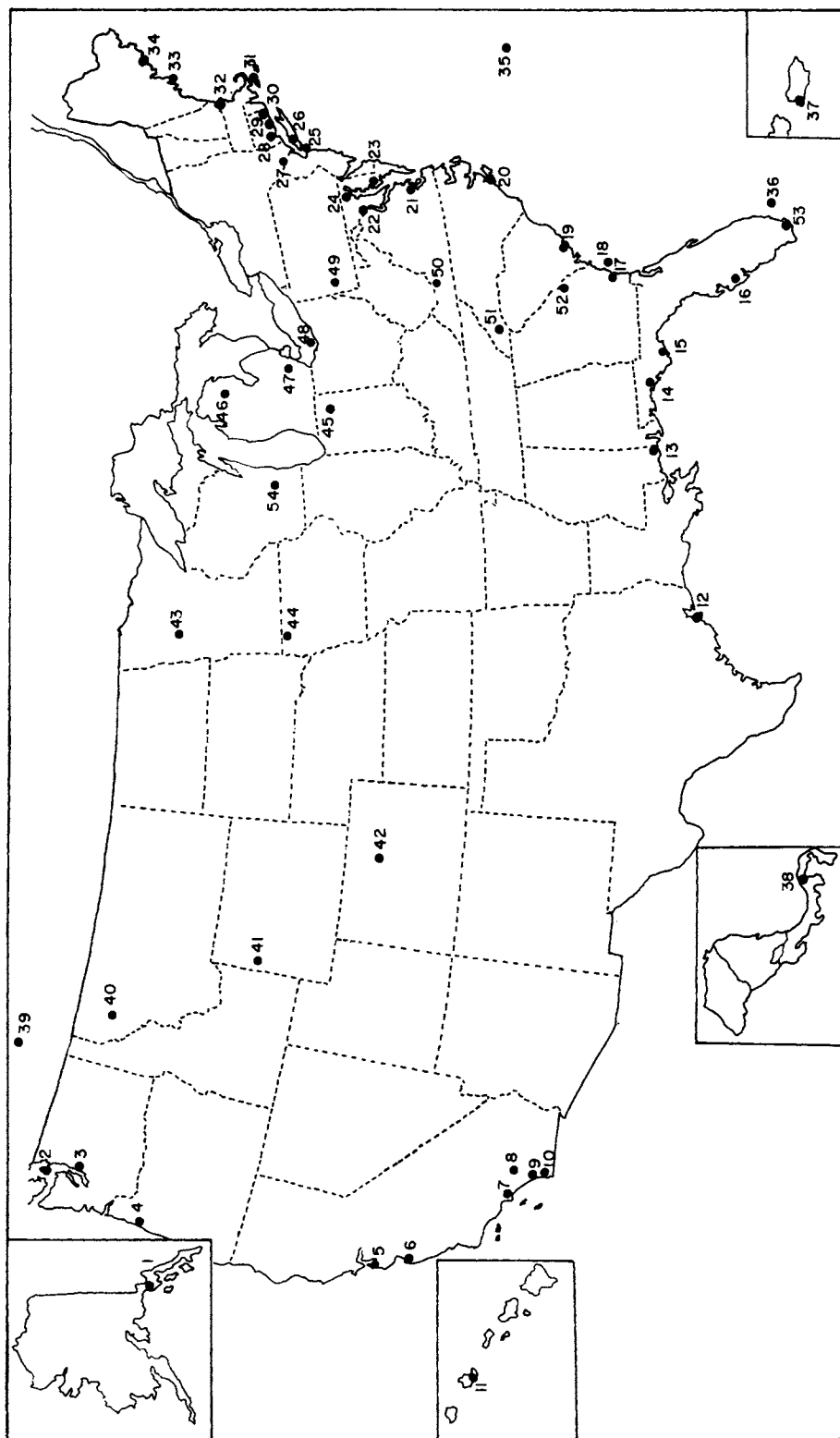
The Woods Hole Oceanographic Institution is a self-governing corporation, the youngest (1930) and largest of the three. It conducts an extensive year-round program in all aspects of oceanography. Much of its current work is in cooperation with the United States Office of Naval Research. At the right of the photograph are its docks and dock facilities and two large research buildings. Farther up and across the street is its new (1963) research building. Additional storage and work areas are nearly concealed by trees. Research Vessels *Atlantis*, *Gosnold*, and *Crawford* are at the dock. *RV Chain* and *RV Atlantis II* are not shown.

TABLE OF CONTENTS

	Page
Frontispiece—The Woods Hole Laboratories	246
Foreword	245
Map of geographical location of stations	250
 Marine Laboratories	
The Allan Hancock Foundation, University of Southern California	252
The Bermuda Biological Station for Research	255
Bingham Oceanographic Laboratory, Yale University	258
California State Fisheries Laboratory	260
Cape Haze Marine Laboratory	263
Chesapeake Bay Institute and Department of Oceanography, The Johns Hopkins University	265
Marine Research Laboratory of the University of Connecticut	267
Duke University Marine Laboratory	270
Oceanographic Institute, Florida State University	272
Fort Johnson Marine Biological Laboratory, College of Charleston	274
Friday Harbor Laboratories, University of Washington	275
The Gulf Coast Research Laboratory	279
Hawaii Marine Laboratory, University of Hawaii	282
The Hopkins Marine Station of Stanford University	284
Lamont Geological Observatory of Columbia University	286
The Lerner Marine Laboratory	288
Institute of Marine Science of the University of Miami	290
The Mount Desert Island Biological Laboratory	292
National Oceanographic Data Center	294
Institute of Fisheries Research of the University of North Carolina	297
Department of Oceanography, Oregon State University	299
The Institute of Oceanography and Marine Biology, Oyster Bay, New York	302
Institute of Marine Biology, University of Puerto Rico	303
The Sandy Hook Marine Laboratory, Bureau of Sport Fisheries and Wildlife	305

	Page
Sapelo Island Research Foundation, Inc.	308
Scripps Institution of Oceanography, University of California	311
Department of Oceanography and Meteorology, A & M College of Texas	314
Virginia Institute of Marine Science	315
The Fisheries Research Institute of the College of Fisheries of the University of Washington	318
Marine Biological Laboratory (Woods Hole, Massachusetts)	319
Woods Hole Oceanographic Institution	322
 Fresh-Water Laboratories	
Canal Zone Biological Area (Barro Colorado Island)	324
The Indiana University Biological Station	326
The Iowa Lakeside Laboratory	329
The University of Michigan Biological Station	331
The Lake Itasca Forestry and Biological Station, University of Minnesota	334
The Biological Station of the Ohio State University	335
Pymatuning Laboratory of Field Biology, University of Pittsburgh	336
Laboratory of Limnology and Associated Field Units at the University of Wisconsin	337
 Mountain Laboratories	
The Alberta Biological Station, University of Alberta	341
The Highlands Biological Station, Inc.	342
Jackson Hole Biological Research Station, University of Wyoming	345
The Montana State University Biological Station	346
The Mountain Lake Biological Station, University of Virginia	348
Science Lodge Mountain Research Station, University of Colorado	350
 Desert Laboratory	
Deep Canyon Desert Research Area and the Philip L. Boyd Desert Research Center	353
 Special Laboratories	
The Institute for the Study of Natural Species, The Catholic University of America	355
Laboratory of Radiation Ecology, AEC Savannah River Plant	357

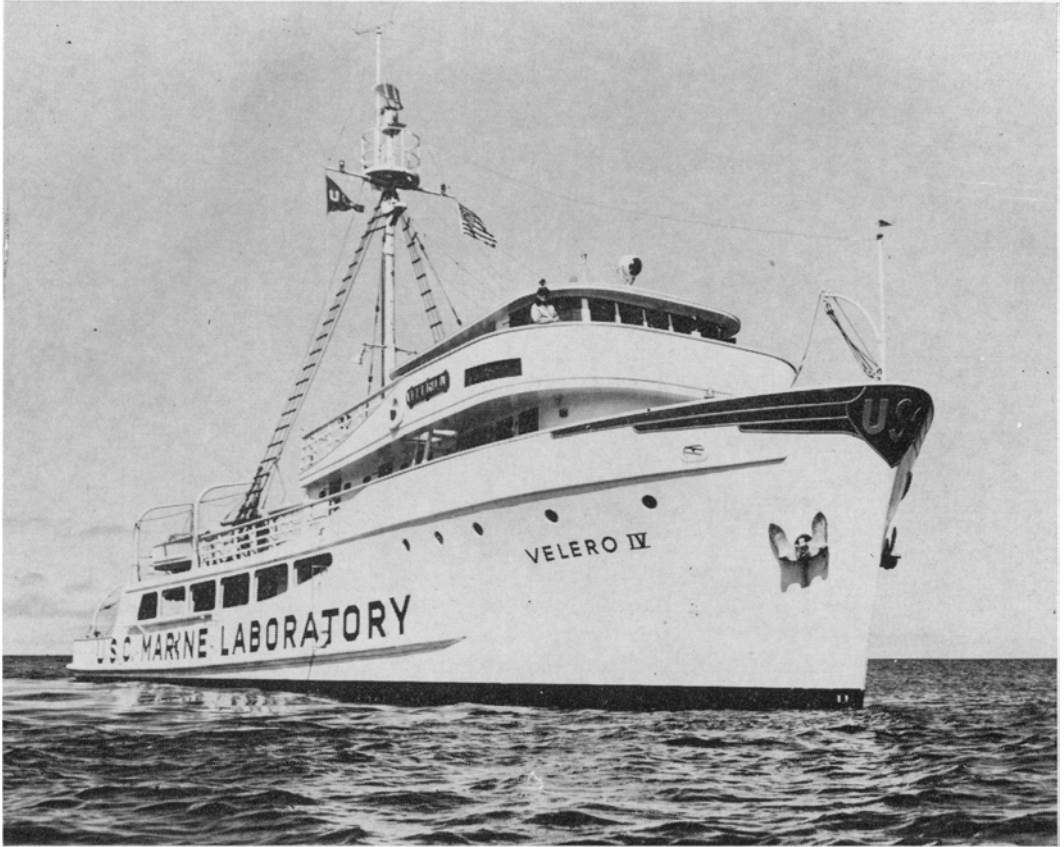
	Page
Roscoe B. Jackson Memorial Laboratory	358
Bureau of Commercial Fisheries	361
Biological Laboratories	
Seattle, Washington	362
Fish Passage Research, Seattle, Washington	363
Marine Mammal Research, Seattle, Washington	364
Beaufort, North Carolina	365
Brunswick, Georgia	366
Gulf Breeze, Florida	367
Galveston, Texas	368
Boothbay Harbor, Maine	369
Woods Hole, Massachusetts	371
Milford, Connecticut	372
Oxford, Maryland	373
Ann Arbor, Michigan	374
Auke Bay, Alaska	375
Stanford, California	377
La Jolla, California	377
San Diego, California	378
Honolulu, Hawaii	379
Ichthyological Laboratory, Washington, D.C.	380
Washington, D.C.	380
Exploratory Fishing and Gear Research Bases	
Seattle, Washington	383
Pascagoula, Mississippi	384
Ann Arbor, Michigan	385
Juneau, Alaska	385
Gloucester, Massachusetts	385
Proceedings of the annual meeting	387
Treasurer's report	389
Constitution and bylaws	390
List of members	394



The Geographical Location of Some North American Field Stations and Laboratories

1. Biological Laboratory, Bureau of Commercial Fisheries
Exploratory Fishing and Gear Research Base, Bureau of Commercial Fisheries
2. Friday Harbor Laboratories, University of Washington
3. Fisheries Research Institute of the College of Fisheries of the University of Washington
4. Department of Oceanography, Bureau of Commercial Fisheries
Exploratory Fishing and Gear Research Base, Bureau of Commercial Fisheries
5. Biological Laboratory, Oregon State University
6. Hopkins Marine Station of Stanford University
7. California State Fisheries Laboratory
8. Allan Hancock Foundation, University of Southern California
9. Deep Canyon Desert Research Area and the Philip L. Boyd Desert Research Center
10. Scripps Institution of Oceanography, University of California
11. Biological Laboratory, Bureau of Commercial Fisheries
12. Hawaii Marine Laboratory, University of Hawaii
13. Biological Laboratory, Bureau of Commercial Fisheries
14. Department of Oceanography and Meteorology, A & M College of Texas
15. Biological Laboratory, Bureau of Commercial Fisheries
16. The Gulf Coast Research Laboratory
17. Exploratory Fishing and Gear Research Base, Bureau of Commercial Fisheries
18. Biological Laboratory, Bureau of Commercial Fisheries
19. Oceanographic Institute, Florida State University
20. Cape Haze Marine Laboratory
21. Biological Laboratory, Bureau of Commercial Fisheries
22. Sapelo Island Research Foundation, Inc.
23. Fort Johnson Marine Biological Laboratory, College of Charleston
24. Institute of Fisheries Research of the University of North Carolina
25. Biological Laboratory, Bureau of Commercial Fisheries
26. Duke University Marine Laboratory
27. Virginia Institute of Marine Science
28. National Oceanographic Data Center
29. The Institute for the Study of Natural Species, Catholic University of America
30. Bureau of Commercial Fisheries: Headquarters
31. Biological Laboratory, Bureau of Commercial Fisheries
32. Ichthyological Laboratory, Bureau of Commercial Fisheries

33. Biological Laboratory, Bureau of Commercial Fisheries
34. Chesapeake Bay Institute and the Department of Oceanography, The Johns Hopkins University
35. The Sandy Hook Marine Laboratory, Bureau of Sport Fisheries and Wildlife
36. The Institute of Oceanography and Marine Biology, Oyster Bay, New York
37. Lamont Geological Observatory of Columbia University
38. Biological Laboratory, Bureau of Commercial Fisheries
39. Bingham Oceanographic Laboratory, Yale University
40. Marine Research Laboratory of the University of Connecticut
41. Woods Hole Oceanographic Institution
42. Marine Biological Laboratory
43. Biological Laboratory, Bureau of Commercial Fisheries
44. Exploratory Fishing and Gear Research Base, Bureau of Commercial Fisheries
45. Biological Laboratory, Bureau of Commercial Fisheries
46. The Mount Desert Island Biological Laboratory
47. Roscoe B. Jackson Memorial Laboratory
48. The Bermuda Biological Station for Research
49. The Lerner Marine Laboratory
50. Institute of Marine Biology, University of Puerto Rico
51. Canal Zone Biological Area (Barro Colorado Island)
52. The Alberta Biological Station, University of Alberta
53. The Montana State University Biological Station
54. Jackson Hole Biological Research Station, University of Wyoming
55. Science Lodge Mountain Research Station, University of Colorado
56. The Lake Itasca Forestry and Biological Station, University of Minnesota
57. The Iowa Lakeside Laboratory, State University of Iowa
58. The Indiana University Biological Station
59. The University of Michigan Biological Station
60. Biological Laboratory, Bureau of Commercial Fisheries
61. Exploratory Fishing and Gear Research Base, Bureau of Commercial Fisheries
62. The Biological Station of the Ohio State University
63. Pymatuning Laboratory of Field Biology, University of Pittsburgh
64. The Mountain Lake Biological Station, University of Virginia
65. The Highlands Biological Station, Inc.
66. Laboratory of Radiation Ecology, AEC Savannah River Plant
67. Institute of Marine Science of the University of Miami
68. Laboratory of Limnology and Associated Field Units at the University of Wisconsin



The *Velero IV*, 110-foot, diesel-propelled research vessel currently operated by the Hancock Foundation. Captain Allan Hancock, master mariner, on the bridge.

MARINE LABORATORIES

THE ALLAN HANCOCK FOUNDATION, UNIVERSITY OF SOUTHERN CALIFORNIA

JOHN S. GARTH,
CURATOR

The Allan Hancock Foundation represents the outgrowth of the Hancock Pacific Expeditions, conducted annually from 1931 to 1941 by Captain Allan Hancock of Los Angeles and Santa Maria, California, aboard the *Velero III*. Located on the campus of the University of Southern California, it was established in 1940 to serve as a repository for marine collections gathered from Mexico, Central and South America, and the Galapagos Islands. In addition to providing storage facilities for

marine biological and geological specimens, the four-story brick and reinforced-concrete structure houses the Hancock Library of Biology and Oceanography, and provides research space for a number of university departments.

The Foundation's early preoccupation was with the identification of marine plant and animal species. In recent years it has sought through the judicious selection of staff members to enrich the teaching program of the university at the graduate level

and through public lectures and other cooperative endeavors to emphasize the interdisciplinary aspects of the sciences. The newer approach to systematic studies, using the techniques of genetics, cytology, ethology, biochemistry, and biophysics, is also finding increasingly wide application.

The Allan Hancock Foundation is an integral part of the University of Southern California, a privately supported institution governed by a Board of Trustees. Captain Hancock, as donor and first director of the Foundation, is a Lifetime Trustee. Dr. Leslie A. Chambers, the present director, has equivalent status to a dean of one of the University's several colleges. Unlike the teaching divisions of the University, the Foundation offers no courses and grants no degrees. Its staff members, however, hold academic appointments in the appropriate university departments, through which courses leading to the M.S. and Ph.D. degrees in marine biology, marine geology, and oceanography are given. Furthermore, staff members serve on guidance committees of graduate students, whose research may be done in whole or part in the Hancock Foundation, with the assistance of its magnificent collections and extensive library.

The staff of the Hancock Foundation consists of a director, 24 senior scientists, and about 80 additional personnel. The *Velero IV*, the Foundation's floating marine laboratory, carries a captain and a crew of seven.

Although the University of Southern California maintains no permanent laboratory on the seacoast, a wide variety of marine habitats are to be found within easy driving distance of the campus. In addition, the *Velero IV* gives access to coastal waters between Monterey and San Diego, the Channel Islands, and the unique series of deep basins lying off southern California. With careful handling, specimens from half a mile deep can be brought to the campus laboratories for examination in the living state. No checklist of animals from such an extensive and diversified area is maintained, but the re-

sults of almost continuous collecting are constantly finding their way into the literature through Hancock and similar publications.

The major research program in which the Hancock Foundation has been engaged is the identifying, cataloguing, and monographing of the marine animals and plants collected by the *Velero III* on a series of expeditions covering the Panamic faunal province. The *Velero IV* has been used on shorter expeditions, in quantitative surveys of the benthic fauna of the basins and canyons off southern California, in studies for the State of California and County of Los Angeles on pollution in coastal waters, in productivity and eddy diffusion studies in Santa Monica Bay, and in ecological studies of the meso- and bathypelagic animals of the more accessible deep basins. For the past two summers staff members have participated in an Institute of Tropical Biology, jointly sponsored by the University of Southern California and the University of Costa Rica. The Foundation is also responsible for certain biological aspects of the U. S. Antarctic Research Program, and maintains one senior scientist and two graduate student assistants aboard the *Eltanin* in the Antarctic on a rotating basis. Programs in biophysics and biochemistry with marine emphasis have been staffed, are being equipped, and will be functioning shortly.

The principal facility for systematic research is the Hancock Library of Biology and Oceanography, one of the finest in the natural sciences on the Pacific coast. Basic to its holdings are the foreign and American serials and books purchased by Captain Hancock for the Foundation from the library of the Boston Society of Natural History, the second oldest natural history library in America. With additions to this basic acquisition by purchase and exchange, the Hancock Library now comprises over 85,000 volumes and 125,000 pamphlets. Special effort has been concentrated on the "Expeditions Room" in which are grouped the published results of the great explorations of all time.

Publications of the Allan Hancock Foundation consist of four series: (1) the Hancock Pacific Expeditions, 26 volumes; (2) the Atlantic Expedition of 1939, 9 reports; (3) the Occasional Papers, 25 numbers; and (4) the Contributions, or collected reprints by staff members from other journals, 250 titles. Hancock publications are exchanged with 500 libraries in 66 countries.

The collections of the Allan Hancock Foundation are exceptionally rich in marine invertebrates and fishes, and in marine algae from the eastern tropical and temperate north Pacific. Outstanding among the former are the Crustacea, Mollusca, Echinodermata, and Polychaeta, each housed on a separate floor of the building, each with a recognized specialist as curator, and with an entire laboratory devoted to its study. Similar status and treatment are accorded the marine algae in the fourth floor herbarium. Collections are used principally for research rather than for teaching, and have attracted investigators from

many countries, some of whom have come by invitation to work on a particular group for publication, others of their own inclination to serve their individual purposes. Close working relations are maintained with the Los Angeles County Museum adjoining the university campus, which has curators in ornithology, mammalogy, and ichthyology.

The Foundation is located on the campus of the University of Southern California at 36th Street and University Avenue, in the south-central part of Los Angeles. It adjoins Exposition Park, in which are situated the Los Angeles Memorial Coliseum, the Los Angeles County Museum of History, Science, and Art, and the California State Museum of Science and Industry.

A limited number of research assistantships and associateships are available. Correspondence concerning these should be addressed to The Director, Allan Hancock Foundation, University of Southern California, Los Angeles 7, California.



Aerial view of Bermuda Biological Station

THE BERMUDA BIOLOGICAL STATION FOR RESEARCH

JOHN R. BEERS

The Bermuda Biological Station for Research was established in 1903 through the joint efforts of the Bermuda Natural History Society, Harvard University, and New York University. Under the direction of Professor E. L. Mark of Harvard University, summer sessions were held at the Frascati Hotel in Flatts. In 1907, Agar's Island near Hamilton Harbour was leased by the Bermuda Natural History Society, and the station then took up quarters on the Island. Continuing under Professor Mark's direction, summer sessions were held there until 1930, except when Agar's Island was requisitioned for military purposes in 1917 and the Station activities transferred to Dyer's Island nearby.

Following a meeting in 1925 at Woods Hole, Massachusetts, to consider reorganization and the provision of better facilities, the Station was incorporated in 1926 under the laws of the State of New York.

Responsibility for ascertaining that the property and investments of the Station are managed, according to the purposes for

which it was established, is vested in the Members of the Corporation. This body elects the Board of Trustees, who form the governing board. An annual meeting of the Members of the Corporation and the Board of Trustees, at which time members pass on amendments to the By-laws and other matters, is held in early December in New York City. In addition, the Board of Trustees meet in Bermuda during the summer.

At the time of reorganization, plans were prepared for a new laboratory to be built on St. George's Island. Assisting in the proposal, the Bermuda Colonial Parliament passed the Biological Station Act of 1927 granting the Corporation (1) the privilege of holding real estate on the Islands, (2) the conveyance of the so-called Hunter Tract to the Trustees when £50,000 endowment had been raised, (3) exemption from customs duties on supplies and equipment imported for the Station, and (4) an annual grant of £200 for a period of ten years. The £50,000 endow-

ment required by this Act was granted in 1929 by the Rockefeller Foundation. At about this time the property of the Shore Hills Hotel adjacent to the Hunter Tract became available, and appeared to offer many advantages for the Station. In 1930, therefore, the Hunter Tract was reconveyed to the Government and the purchase price was used in converting the Shore Hills property into the present headquarters of the Biological Station. The Station was opened officially January 6, 1932, by His Excellency the Governor of Bermuda, Sir Thomas Astley-Cubitt, K.C.B., C.M.G., D.S.O.

The new Station operated the year around until 1941, the facilities being utilized by a number of investigators for a wide variety of marine biological research. A supporting grant was made for several years by the Woods Hole Oceanographic Institution, of which the Station became the oceanic base. At the end of 1936, the Development Commission of Great Britain, acting upon the recommendation of the Bermuda Oceanographic Committee of the Royal Society of London, made a grant to initiate and maintain an investigation into the variations of the Gulf Stream and North Atlantic drift in cooperation with the Woods Hole Oceanographic Institution.

The Station was entirely decommissioned during World War II, at which time it was leased to the United States Army for use as a hospital. Reopened in 1946, the Station has since undergone a period of extensive growth and development.

The Station operates as a research facility for visiting investigators as well as having its own permanent staff in residence throughout the year. It is open at all times to qualified investigators concerned with any phase of marine research, whether biological, chemical, or physical, and to others concerned with scientific investigation in the Bermuda Islands. In addition to the research facilities, several graduate-level courses, made possible by grants from the National Science Foundation, are offered

each year. Included are courses in experimental embryology under the direction of Dr. H. E. Lehman, University of North Carolina; sedimentation geology, Drs. K. E. Chave and S. Barber, Lehigh University; and an introduction to oceanography, Dr. G. A. Riley, Yale University.

Members of the permanent staff carry on an extensive program, sponsored by the Atomic Energy Commission and the Office of Naval Research, dealing with the hydrography, primary and secondary production, and problems related to the biochemical circulation of phytoplankton nutrients in the Sargasso Sea.

The Station property consists of a 14 acre tract on St. George's Island and fronts on Ferry Reach. It is approximately $1\frac{1}{2}$ miles from the town of St. George's and about 12 miles from Hamilton. Fifteen laboratories in the main building and three in another building accommodate from one to several workers each. Two darkrooms, a cold room, and dry rooms are available for general use. A wing of the main building, constructed in 1961 with funds granted by the National Science Foundation, houses four modern air-conditioned dehumidified laboratories and an instrument room. In addition, the Station maintains well-equipped metal and woodworking shops, and an electronics shop, as well as a general maintenance shop. Trained and experienced personnel are in charge of these facilities and can assist investigators in the construction and repair of equipment.

Running salt water with a salinity of about 35‰ is distributed through plastic lines with vulcanite taps to salt water tables on the verandahs outside the laboratories, and to four large concrete tanks and two aquarium racks in the aquarium rooms. Outdoor tanks provide additional space for holding live material.

Stocks of routine glassware and chemical reagents are maintained. Equipment such as pH meters, microscopes, microtomes, balances, spectrophotometers, Geiger counters, centrifuges, and cameras are available

in limited quantities for the visiting investigators.

The Bermuda Islands offer a wide variety of collecting grounds which are readily accessible from the Station. These include coral reefs, rocky and sandy shores with varying degrees of exposure, shallow bays and lagoons, and mangrove swamps. The marine biota, in general, resembles most nearly that of the West Indies and Antilles. There are somewhat fewer species, but all the major groups are well represented, and some species are unique to Bermuda. One of the chief attractions are the reefs, with their rich fauna of corals, gorgonians, and associated forms. Many local species have long breeding periods, and the reproductive seasons of several in the same group sometimes overlap, so that eggs and similar experimental material commonly can be obtained more or less throughout the year.

One of the chief attractions of Bermuda is the proximity of deep oceanic waters which can be reached within an hour. Depths of approximately 1,000 fathoms (1 mile) occur within 5 miles of land.

The Station's collecting equipment includes two 30-foot launches, one fitted with a live well, and several dingies and skiffs. In addition, the station has the use of a 60-foot diesel-powered, ocean-going, research vessel, the *Panulirus*, on loan from the Bermuda Government. This boat is equipped with winches, echo sounder, radio, radar, etc. Equipment such as grabs, seines, hydrographic gear, dredges, plankton nets of various sorts, water glasses, and diving equipment are available. Experienced crews and collectors are available to aid the investigators in obtaining this experimental material.

While no collections of the Bermuda flora and fauna are maintained at the Station, there is a limited museum collection of the marine invertebrates housed at the Bermuda Government Aquarium at Flatts. The Aquarium also maintains an extensive

collection of living Bermuda fishes and coral reef animals and plants.

The E. L. Mark Memorial Library contains a limited number of journals, primarily those concerned with the marine sciences, expedition reports, and standard reference works on biology and, in particular, marine research. There is, in addition, a reprint collection. An effort has been made to acquire literature of particular relevancy to Bermuda. Periodically, bound collections of reprints of papers on the scientific work done at the Station are issued.

Living accommodations for permanent staff and visiting investigators are provided on the Station property. Furnished house-keeping apartments and cottages are available for couples and families. In addition, there are approximately 25 single rooms in the main building.

Dining-room facilities, open to all investigators and their families, are operated during the summer and at other times when there is sufficient demand.

The Bermuda Islands consist of about 365 small islands in latitude 32° 19' N and longitude 64° 49' W, some 600 miles south-east of New York. The climate is considered mild. Winter temperatures occasionally fall below 50°F, but are not generally below 60°F for any extended period. Summer temperatures rarely exceed 90°F in the shade. Surface water temperatures range from about 60°F to about 85°F.

Bermuda is readily accessible by air transportation from several North American points and the United Kingdom. Steamer service includes weekly sailings from New York City.

Various Fellowships or Grants-in-Aid are available from time to time for those wishing to work at the Station. Inquiries for additional information or applications for accommodations may be made at any time of the year and should be addressed to: The Director, Bermuda Biological Station, St. George's West, Bermuda.



The Bingham Oceanographic Laboratory

BINGHAM OCEANOGRAPHIC LABORATORY, YALE UNIVERSITY

GORDON A. RILEY,
ACTING DIRECTOR

The Bingham Oceanographic Laboratory was founded in 1928 under an endowment fund established by Harry Payne Bingham, a financier and amateur scientist, whose observations and collections aboard his yacht *Pawnee* were a valuable addition to oceanographic knowledge of that era, and were the *raison d'être* of the Bingham Laboratory as a shore-based facility for preparing this material for publication. Under the leadership of the first Director, Albert E. Parr, the laboratory began to expand into a general oceanographic facility. As a result, the name of the original publication outlet, the "Bulletin of the Bingham Oceanographic Collection," has become something of an anachronism in view of the varied nature of the material now covered.

Technically, Bingham is a semi-independent research foundation sponsored by Yale University; in actual fact it works in close coordination with teaching departments and with the Yale Peabody Museum in training graduate students and in curatorial duties. The staff teaches courses in oceanography and ichthyology and supervises thesis research of graduate students, in any department, requesting direction along lines of marine endeavor. Five members of our staff have joint appointments in Bingham and in teaching departments, and upwards of fifteen former graduate students are now professionally employed oceanographers. The staff consists of one physical and one chemical oceanographer; seven marine biologists of varying specialties including plankton biology, ichthy-

ology, fish endocrinology, and benthic invertebrate work; five research associates and technicians; an administrative assistant, a secretary, and a librarian; several part-time undergraduate technical assistants; and maintenance help supplied by the University.

The present Director, Daniel Merriman, is aided by an advisory committee consisting mainly of university professors and administrative officers. Funds are provided by the original endowment, from general University sources, and from federal grants and contracts, the latter constituting about half of the total income.

The laboratory occupies two floors of a new annex to the Peabody Museum, located at 41 Sachem Street, in the heart of the Yale University area. In addition to offices and laboratories for research staff and students, the facilities include: four constant-temperature rooms, three with aquaria and recirculating fresh or salt water, and one for microbiological culture with subsidiary constant-temperature boxes for maintaining a variety of conditions; walk-in refrigerator and deep freeze; "hot lab" and supporting equipment; specimen storage facilities and a working collection that includes representative local material and other collections in the process of being analyzed; shop; seminar room; and library. The latter is a working oceanographic library containing some two thousand periodicals and an extensive reprint collection. Other university libraries are available nearby for collateral reading.

A major theme in the work of the Bingham Laboratory has been the study of the southern New England coastal waters. This work has been going on for more than twenty years, varying in its emphasis from time to time, but adding up to a fairly comprehensive picture of the physical and chemical oceanography and the

various components of the biota in these waters. The area encompasses open coastal areas (Block Island Sound and its seaward extension), the semi-enclosed waters of Long Island Sound, which have somewhat reduced salinity (24-30‰, as well as a variety of estuarine situations.

Other major research programs include the taxonomy and ecology of deep sea fishes, fish endocrinology, experimental work on the ecology of marine phytoplankton and bacteria, and the chemistry of deep sea sediment cores.

We have chartered ships or have worked in cooperation with other institutions to support sea going collections. We are particularly indebted to the Milford Biological Laboratory of the U. S. Bureau of Commercial Fisheries, both for the use of their ship in studies of Long Island Sound, and in satisfying occasional needs for space in a seaside laboratory with running sea water.

Space for visiting investigators is available on a rather limited basis. In general, we encourage visitors whose research specialties ably supplement our own interests, and we make some effort to obtain grant aid to support them, but do not have funds specifically allocated to this purpose.

With regard to publications, the Bingham Bulletin is intended primarily for monographs and for collected papers on inter-related topics. Additional papers by the staff appearing in other journals are available in reprint form for exchange with other laboratories. In addition to our own publication outlet, the Bingham Laboratory houses, but is administratively separate from, the Sears Foundation for Marine Research, which publishes the *Journal of Marine Research* and the *Sears Memoir Series*, the latter being primarily a series of monographs on the fishes of the western North Atlantic.



California State Fisheries Laboratory, Terminal Island

THE CALIFORNIA STATE FISHERIES LABORATORY

PHIL M. ROEDEL

The California Department of Fish and Game has for over 45 years conducted biological investigations of the sea. Although organizational patterns have changed many times over the years, the California State Fisheries Laboratory, established in 1917, has remained and grown, and now for practical purposes consists of four installations. The laboratory has been on Terminal Island, Los Angeles Harbor, since 1921. It was enlarged in 1937, 1953, and again in 1962. Soon after its founding, needs in the central portion of the State required men on the scene, and arrangements were made with Stanford University in 1919 to house one or two investigators at Hopkins Marine Station, Pacific Grove. In the mid 1930's, additional requirements led to establishing a small laboratory on the Stanford Campus, and another in the northern port of Eureka. The Stanford Laboratory moved into its own building in nearby Menlo Park in 1961.

In 1957, the Department reorganized its marine fisheries function, establishing a new section, Marine Resources Operations, (MRO) which has statewide responsibility for ocean research and for certain aspects of management. This organization is centered at Terminal Island and administers the several laboratories, a function formerly exercised by Department headquarters. Salmon research, now focused largely on freshwater problems, remains a responsibility of Department headquarters and operates out of the Department's field station in Sacramento. The Menlo Park and Eureka laboratories provide space for salmon investigators, but do not direct their work.

In California, general policies for all fish and game work, including research, are established by the Fish and Game Commission in accordance with legislative statutes. These policies are implemented by the Department through its Director.

MRO has responsibility for carrying out approved programs and for developing new projects to meet changing needs. Basic objectives are laid out in State law which requires expending funds for biological research, field investigations, and for collecting and diffusing statistics and information pertaining to conserving and perpetuating the State's fish and wildlife. By its nature, the research work must be "practical" in that it must attempt to answer definite management problems.

Specifically the primary objectives of the State's marine research are:

A. To obtain the necessary information, (1) on which to base recommendations for such management as may be necessary to allow continued harvest at the optimum level or, (2) upon which predictions can be based.

B. To advise and make specific recommendations to the Fish and Game Commission and the Legislature, and to keep the interested public informed.

C. To determine the extent of latent marine resources and to suggest means by which they can be utilized.

D. To publish the results of research as quickly as possible.

The permanent staff consists of 110 persons of whom 44 are professional biologists. Research vessel crews total 27, another 22 are in various classifications concerned with completion of fisheries statistics, and the remainder render library, business management, stenographic and subprofessional services. The staff is augmented seasonally with temporary help, chiefly upper division or graduate students. The majority of the staff, including 30 biologists, is at Terminal Island.

Major long-term research programs are concerned with studying the population dynamics of the sardine-mackerel-anchovy complex, the albacore and bluefin tunas, shellfisheries (particularly market crab and ocean shrimp), and bottom fisheries (various soles and rockfishes). The first two are conducted at Terminal Island, the latter two at the northern laboratories. Smaller short-term projects are presently

directed toward life-history studies of blue rockfish and California halibut, an analysis of southern California sportfishing intensity, and a program designed to evaluate the feasibility of improving barren portions of the inshore environment with artificial reefs. The blue rockfish study is carried on at Menlo Park, the latter three at Terminal Island.

The major and some of the smaller projects are financed almost exclusively by State fishing license and tax monies accruing to the Department. Federal Aid in Fish Restoration funds provide the only substantial outside revenue, financing three-fourths of the cost of three of the short-term studies. To supplement its program the Department occasionally gives financial support to specific university programs under contract, and is now sponsoring an NSF-supported study by a non-affiliated scientist.

The sardine-mackerel-anchovy studies form a part of the California Cooperative Oceanic Fisheries Investigations sponsored by the California Marine Research Committee. The other major participants are Scripps Institution of Oceanography and the U. S. Bureau of Commercial Fisheries. This investigation has provided a wealth of information on the physical and biological oceanography of the California current system, the value of which goes far beyond the specific problem at hand.

Other programs are, whenever appropriate, coordinated in varying degrees of formality with those of several agencies and universities. The Pacific Marine Fisheries Commission in particular coordinates work being done by all Pacific Coast states on resources of common concern.

Our area of interest includes the entire marine environment that may influence the State's fisheries. This extends from brackish estuaries well onto the high seas, and in the case of albacore tuna encompasses the entire north Pacific. Currently, research at sea is generally confined to areas within 50 miles of the California and Baja California coasts. Occasional

cruises extend into the Pacific Northwest and offshore up to 1,000 miles.

The Department owns two 100-foot research vessels, each with a cruising radius of 5,500 miles, and a 50-footer with a 1,400 mile range. The larger vessels are capable of handling virtually any conventional or experimental fishing gear, have extensive bait-well and refrigerator capacity and are equipped with trawl, hydrographic, and bathythermograph winches. Physical oceanographic data, except for routine BT's, are not usually collected, the staff relying on other organizations, particularly Scripps Institution of Oceanography, for such data.

Shoreside experimental facilities are very limited. The nature of the work is such that biological data generally are obtained at sea or at landing places of the fishing fleets, and the laboratory buildings consist largely of office space where the investigators can analyze their material.

The State Fisheries Laboratory maintains a large and complete fisheries library at Terminal Island with good coverage of the marine sciences generally. It now contains some 10,000 volumes and 90,000 unbound publications, and obtains over 400 serials, largely technical journals, although trade magazines are well represented. Most of the material is obtained through exchange arrangements with organizations throughout the world; additional exchanges are welcomed. The Department publishes two scientific serials which carry marine material: the quarterly *California Fish and Game*, and the *Fish Bulletin* series, issued at irregular intervals. Popular and semitechnical papers appear in the monthly *Outdoor California* and in booklets and pamphlets.

A biostatistical unit is a significant section of the State Fisheries Laboratory. This

unit compiles statewide raw data on commercial fish landings, which have been required by law since 1916, and compulsory catch records from the "party boat" fleet which carries recreational fishermen for hire, these going back to 1936. A primary function of this unit is to provide fisheries statistics to the scientific staff in the form most useful to them. It is also in a position to provide technical assistance to the biologists in problems involving advanced mathematics and statistics. The unit currently has two, 402 IBM tabulators which are adequate for routine compilations, but has available to it several advanced computers at nearby universities and businesses.

The laboratory does not maintain a museum; unusual specimens are normally deposited in university collections. Staff members do collect material desired by other organizations whenever possible.

Shoreside facilities are not available to visitors, except for the library. Space is occasionally available aboard the research vessels and arrangements can be made to carry visiting scientists on cruises.

Addresses:

California State Fisheries Laboratory
Terminal Island, California

Department of Fish and Game
Menlo Park Laboratory
411 Burgess Drive
Menlo Park, California

Department of Fish and Game
Eureka Laboratory
127 "G" Street
Eureka, California

Department of Fish and Game
Pacific Grove Laboratory
Hopkins Marine Station
Pacific Grove, California



Cape Haze Marine Laboratory

CAPE HAZE MARINE LABORATORY

EUGENIE CLARK, DIRECTOR

At the south end of Siesta Key near Midnight Pass, where Little Sarasota Bay meets the Gulf of Mexico, stands the Cape Haze Marine Laboratory, an incorporated, non-profit making institution dedicated to basic research in the field of biological oceanography.

Founded in 1955 by Alfred Gwynne Vanderbilt and William H. Vanderbilt, the Laboratory was originally a part of the Cape Haze development near Placida, Florida, between Sarasota and Fort Myers. The Laboratory was moved in 1961 to its present location in the Sarasota area, but retained its original name. The move was necessitated because of construction plans for the Intercoastal Waterway, and the

ideal new site was possible through the generosity of the Potter Palmer family.

The Laboratory is supported with contributions and membership dues of individuals, foundations, and corporations interested in marine biology, and research grants from Government agencies concerned with oceanography and marine biology, mainly the National Science Foundation and the Office of Naval Research.

The full time staff of the Laboratory consists of an Executive Director, a Collector, a Business Manager and a Secretary. As in most marine laboratories, the duties of the resident staff include much more than is implied by their titles.

The Laboratory grounds of about eight

acres comprise a strip of land covering 800 feet along the Gulf of Mexico and running through to an irregular shoreline on Little Sarasota Bay. The Laboratory consists of a main building of approximately 2,150 square feet and a combination tool house-workshop of 300 square feet. The main building has a library-office unit, laboratory rooms for staff and guest investigators including a reference collection room, an aquarium room, and a small dark-room.

Laboratory facilities and equipment include running salt water as well as fresh water, a refrigerator, freezer, microscopes, scale reader, and most of the standard equipment of a field station for marine biological work. The library contains more than 500 bound volumes and 8,000 reprints on marine biology and related subjects, and subscribes to 40 journals. The Laboratory does not sponsor a formal periodical publication. Its first volume of collected reprints will be available in late 1963. An informal newsletter detailing activities in progress is mailed to interested persons several times a year.

A boat dock on the bay side of the grounds has facilities for hoisting and weighing large marine animals up to 1100 pounds. Four pens for housing large marine animals, used mostly for sharks, are connected and open to the bay water through slatted walls. Near the dock is a pressure chamber for experimenting with sizeable marine animals (small sharks) at pressures up to 150 p.s.i.

The Laboratory has a 33-foot boat available for oceanographic work in the Gulf of Mexico. Several smaller boats including a specimen tow boat for transportation of large sharks are also available. Outboard motors, nets of various sizes, shark lines and equipment for SCUBA diving are part of the Laboratory's field equipment.

The Laboratory is open all year. Laboratory space is mainly for senior investigators and their assistants, although some graduate students have studied there and occasionally college and high school students study and work as volunteers during the summer. In the summer of 1962

a science training program was conducted for 14 outstanding secondary school students. This program, sponsored by the National Science Foundation and the Selby Foundation, lasted for eight weeks. There are no funds available to support visiting investigators other than funds granted by foundations and similar institutions for specific purposes. No living accommodations are available on the Laboratory grounds, but convenient living accommodations are available nearby.

The waters of Little Sarasota Bay and the Gulf of Mexico provide excellent collecting grounds for the marine biologist. The Gulf shoreline is of white sand and mixed shell. Shallow reefs of calcareous sandstone cemented together mostly by bryozoans and covered with sponges, tunicates and algae are located close to shore in the Gulf. There are various inland shallow bays with sand bars and mangrove trees. Low tides expose extensive mud flats suitable for collecting invertebrates.

To facilitate research projects and experiments in marine biology, the Laboratory's main project during its first years of operation was to begin a general survey and collection of the local biota. Records were kept of the common marine animals and plants, their abundance, distribution, seasonal variations, etc. This is a continuing project, and a sizeable reference collection of local marine animals and algae is now available.

Fish physiology and behavior, with the necessary taxonomic background, has been the chief work of the Laboratory staff. Sharks have been made a focal point of many of these studies. Facilities developed at the Laboratory for obtaining and maintaining sharks have drawn numerous visiting investigators wishing to work with these fishes.

Current staff research programs at the Laboratory include experimental tests to study the behavior of sharks and rays, particularly the ability of various species of sharks to develop certain conditioned responses, make visual discriminations and adjustments to pressure changes. A study

of the structure and function of the abdominal pores in sharks and rays include a variety of experimental and histological techniques. In collaboration with the New England Institute for Medical Research, studies are being conducted on certain lipids of shark livers which show potentialities of increasing resistance to disease through stimulation of the reticuloendothelial system.

A study of the hermaphrodite fish, *Serranus subligarius*, is one of the major projects of the Laboratory. A study of

blood parasites and blood cytochemistry of sharks and other fishes is another expanding project of staff and visiting investigators.

An increasing number of foreign investigators visit the Laboratory and take part in the Laboratory's research programs.

The Laboratory may be reached by air, train and bus, the terminals of all being in Sarasota. Prospective visitors should write to the Director, Cape Haze Marine Laboratory, 9501 Blind Pass Road, Sarasota, Florida.

CHESAPEAKE BAY INSTITUTE AND THE DEPARTMENT OF OCEANOGRAPHY, THE JOHNS HOPKINS UNIVERSITY

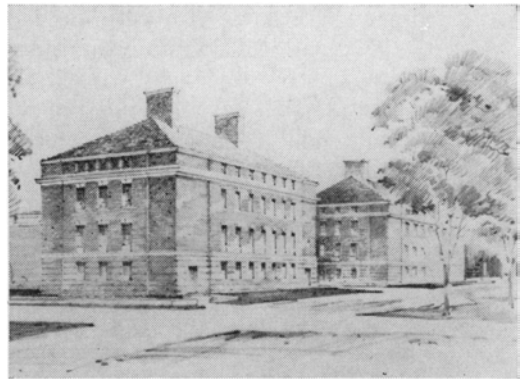
SUSAN S. RAUP

The Johns Hopkins University

The Chesapeake Bay Institute is a research organization affiliated with The Johns Hopkins University; the Department of Oceanography is within the academic structure of the University. The two organizations can for most purposes be considered as a single research and teaching institute, for they are housed in the same office and laboratory space and share all facilities; the teaching staff of the Department make up the senior research staff of the Institute. Dr. D. W. Pritchard is both Chairman of the Department and Director of the Institute.

CBI was established in 1948 for the purpose of conducting physical and chemical investigations in the Chesapeake Bay and its tributaries. Although biological studies were added shortly, CBI is not, and has never been, primarily a biological station. Until recently, field work has been limited mostly to the Chesapeake Bay, but the scope is currently being extended to include studies of water circulation on the inner continental shelf and in other estuarine systems on the middle Atlantic coast.

A curriculum leading to the M.A. and



Architect's drawing of new research laboratory of Chesapeake Bay Institute to be constructed in 1963.

Ph.D. in oceanography was established in 1949. The Johns Hopkins University is at present the only institution on the Atlantic seaboard between Florida and New York which offers a rounded research and graduate training program in all three areas of chemical, physical, and biological oceanography. It is planned to add teaching and research staff personnel in the areas of geological oceanography and air-sea boundary processes as soon as increased office and laboratory space is available.

Institute personnel include 14 scientists

on the senior and associate research staff, 17 research assistants and technicians, and 22 on the support staff, including captains and crew of the research vessels, members of the data reduction and graphic arts groups and secretarial and office personnel. The teaching staff of the Department numbers six.

A variety of habitats ranging from full sea water to fresh water is available. Collections are made in Institute vessels using standard techniques. There is no permanent system of aquaria with running sea water for maintenance of animals, although tanks can be set up and sea water obtained for special projects.

Various faunal lists for the Chesapeake Bay have been published (see Maryland Natural Resource Bibliography, by Romeo Mansueti, Maryland Department of Research and Education, Chesapeake Biological Laboratory, Resource Study Report No. 7, April 1955; and Bibliography of Maryland Fisheries, by Frank J. Schwartz, Chesapeake Biological Laboratory, Contribution No. 144, June 1960). No up-to-date checklist is available from our laboratory.

Plankton ecology is the main zoological research area. Uptake and metabolism of trace metals by various planktonic organisms are being studied in the laboratory, especially for those elements having radioisotopes actually or potentially present in the marine environment. A chemical sampling program in the upper Chesapeake Bay has been initiated to study the distribution and seasonal variation in abundance of the same trace elements used in the laboratory growth experiments. The special field sampling augments the Institute's regular hydrographic surveys of physical and chemical properties of the Bay waters.

The Chesapeake Bay Institute and the Department of Oceanography are housed in Maryland Hall on The Johns Hopkins University campus in suburban Baltimore. Here are located staff offices, chemical and biological laboratories, darkroom and drafting facilities, electronic and instru-

ment-development laboratory and shop, and facilities for data reduction.

The Institute maintains a field laboratory on the Severn River near Annapolis, less than an hour's drive from campus. The field survey director has his office at dockside, together with an instrument laboratory, shop, chemical preparation room, and facilities for testing, maintenance, and storage of equipment.

Largest of the Institute vessels is the 68-foot *Maury*, designed and built for the Institute in 1950. There are bunks for a crew of three, and four scientists. Ship-board laboratory facilities have recently been expanded considerably and new equipment has been installed.

The Institute also operates a 39-foot cabin cruiser equipped with chemical and electronic oceanographic gear, and several smaller craft for limnological and shallow-water studies.

Construction of a new shore facility, located on campus close to other science departments, will begin in 1963. Funds in the amount of \$1,150,000 have been secured for the building, which will provide gross floor space of about 35,000 sq. ft., or nearly triple the present space.

Funds recently obtained will provide for construction of a \$1,300,000 catamaran-hulled experimental research ship of 150 tons displacement. A preliminary design study for the vessel has been completed.

Desk space is available for visiting investigators, but laboratory facilities for visitors are very limited at present because of lack of space. This situation will be alleviated when the new building is ready for occupancy. There is a University-owned apartment building within easy walking distance of campus. Other living accommodations are arranged on an individual basis. Research funds are not normally available unless the investigator has arranged to collaborate with an Institute staff member on a project supported by a research contract or grant.

The Institute publishes the following report series:

Technical Reports: results of field and laboratory research projects, together with technical data on analytical procedures and instrumentation.

Data Reports: tabular hydrographic data from regular surveys made by Institute vessels. Data include temperature, salinity, pH, dissolved oxygen, turbidity, current velocity, phosphate concentration and certain minor nutrient components.

Graphical Summary Reports: charts depicting graphically the vertical and horizontal distributions of the same properties presented in tabular form as data reports.

Special Reports: research results of a specialized nature which receive more limited distribution than technical reports,

but are otherwise similar.

Collected Reprints: bound collections of staff contributions to scientific journals.

Biological collections are made for research purposes only. The Institute does not maintain a museum. Specimens which should be in a museum are forwarded to such places as the Smithsonian. The Institute is not interested in general exchange arrangements with other laboratories, although specimens may be requested for specific research problems.

Location. Shore Facility: The Johns Hopkins University, Baltimore 18, Maryland. Field Laboratory: Box 32A, Back Creek and Edgewood Road, Annapolis, Maryland (open all year).

MARINE RESEARCH LABORATORY OF THE UNIVERSITY OF CONNECTICUT

JOHN S. RANKIN, JR.,
DIRECTOR

The Marine Research Laboratory was established in 1957 at Noank as a separate institute within the University. It provides research facilities for staff and graduate students. Research and graduate programs of staff from the main campus at Storrs involve use of the Laboratory throughout the year, or just during the summer months. The Laboratory, therefore, cooperates with any faculty member who is interested in utilizing the facilities for research and teaching. It is used regularly for field trips in both undergraduate and graduate courses given on the main campus. Summer courses at the Laboratory are being developed for both undergraduate and graduate students.

Facilities are made available to a few visiting investigators without charge. Those investigators needing special equipment, including microscopes, must furnish it themselves. Housing will be available soon.

Noank is located at the mouth of the



The Marine Research Laboratory of the University of Connecticut, Noank, Connecticut. Main building facing east to Block Island Sound.

Mystic River which opens into Fishers Island Sound to the south, and Block Island Sound to the east. It is five miles from the Thames River, New London, and 22 miles from the Connecticut River. It is in a center of marine research — Electric Boat Division of General Dynamics Corp., Pfizer Pharmaceutical Co., Dow Chemical Co., U. S. Submarine Base, and

the U. S. Navy Underwater Sound Laboratory — all are within ten miles.

Noank is in a region of varied habitats, from freshwater to open ocean, protected estuaries, marshes, mud to rock substrates, all of which are easily accessible. Most of the plants and animals which occur around Woods Hole are found in relative abundance. Many of these are well known through the early works of Verrill, Smith, Coe, Conn, Kunkel and Hylander. The nearness to other laboratories, the relative nearness to the main campus, and the physical and biotic characteristics, make this an ideal location to investigate marine problems.

The main building is a two-story brick structure, 55 feet square, separated from the water's edge by an open concrete deck about 50 feet square. It has eight large laboratory rooms, dark room, histological technique room, balance room, two constant temperature rooms, library, shop and store-rooms; a continuous flow salt-water system supplied through plastic pipes with part of the salt-water system being thermally controlled; chemistry benches in three rooms; the deck on the roof houses climatology instruments; and, a reference collection of local fauna and flora for teaching and research (exchange encouraged). Two large laboratory rooms for teaching and research of microbiology and ecology are being added to the main building. Two small buildings are used for storage of collecting gear and for the salt water pumps. Three houses, adjacent to the Laboratory, are being remodeled for rooms and apartments.

Most of the laboratories are supplied with electricity, air, gas, fresh and salt water. Water tables, aquaria, still, autoclave, ovens, hoods, etc., and commonly used laboratory equipment, glassware and chemicals are available. In addition, the Laboratory has a microtome, vacuum oven, centrifuges, microscopes, pH meters, water baths, automatic gas-flow Beta counting system, one-inch NaI well-type scintillation system, sediment analysis equipment, furnaces, colorimeters, balances, recording

gear for various climatic factors, portable salinometers, tape recorder, etc.

There is a new T-shaped 125-foot long dock, with 50 feet parallel to the channel. The water is 10' deep, MLW. The dock is equipped with fresh water, electricity, and tide gauge, and has a float for small boats.

The Laboratory has a 30-foot dragger-type vessel equipped with depth recorder, bathythermograph and winch, winch for hydrographic and biological collecting, assorted nets and trawls, Petterson and Van Veen graps, Emery bottom sampler, Clarke-Bumpus plankton net, other plankton nets, Nansen bottles, seines, and gill nets. There are four skiffs and four outboard motors.

The Life Science Building on the main campus, Storrs was completed in 1960, and provides excellent laboratory and dark-room facilities. Recirculating salt water systems enable marine organisms to be maintained over extended periods. Microscopes and special equipment may be transferred to Noank as needed. The Noank building is well equipped for maintenance and development of research apparatus and maintenance gear. Its library has a constantly expanding collection of books in the fields under study, and receives about 50 journals. There is also a large collection of reprints, museum bulletins, microfilm reader, etc. No publication is available as yet, but collected reprints are distributed.

The activities may be summarized as follows.

Radiation Biology. Accumulation of nuclides in marine organisms; monitoring organisms for indications of radioactivity in the environment; effect of nuclides on organisms, especially on stages in the life cycle; development of analytical radiochemical techniques applicable to marine organisms; determination of movements of nuclides in the marine environment; and correlation of hydrographic and radiobiological data.

Marine Ecology. Vertebrate and invertebrate census; food chains, especially invertebrates; effect of salt concentration on animal distribution; life cycles of marine organisms; estuaries and marshes as spawn-

ing and nursery grounds; and growth and development of benthic communities.

Bacteriology. Methods of enumeration of marine bacteria; structure and function of obligate marine bacteria; cycles of nitrogen and phosphorus in estuaries; role of coliform bacteria in the economy of estuaries.

Coastal Oceanography and Climatology. Influence of transient weather conditions on the physical properties of sea water in tidal estuaries, including temperature, turbidity, salinity and motions; effect of surface water temperature on the number, intensity and trajectories of coastal summer storms. Developing a program to determine the part played by specific atmospheric elements on the variability of particular sea water properties toward the fuller understanding of how and why physical-chemical changes occur in shallow sea water.

Physiology. Receptors in joints of marine arthropods; excretion of salts by marine organisms; carbon dioxide fixation in tissues of marine organisms; and the use of

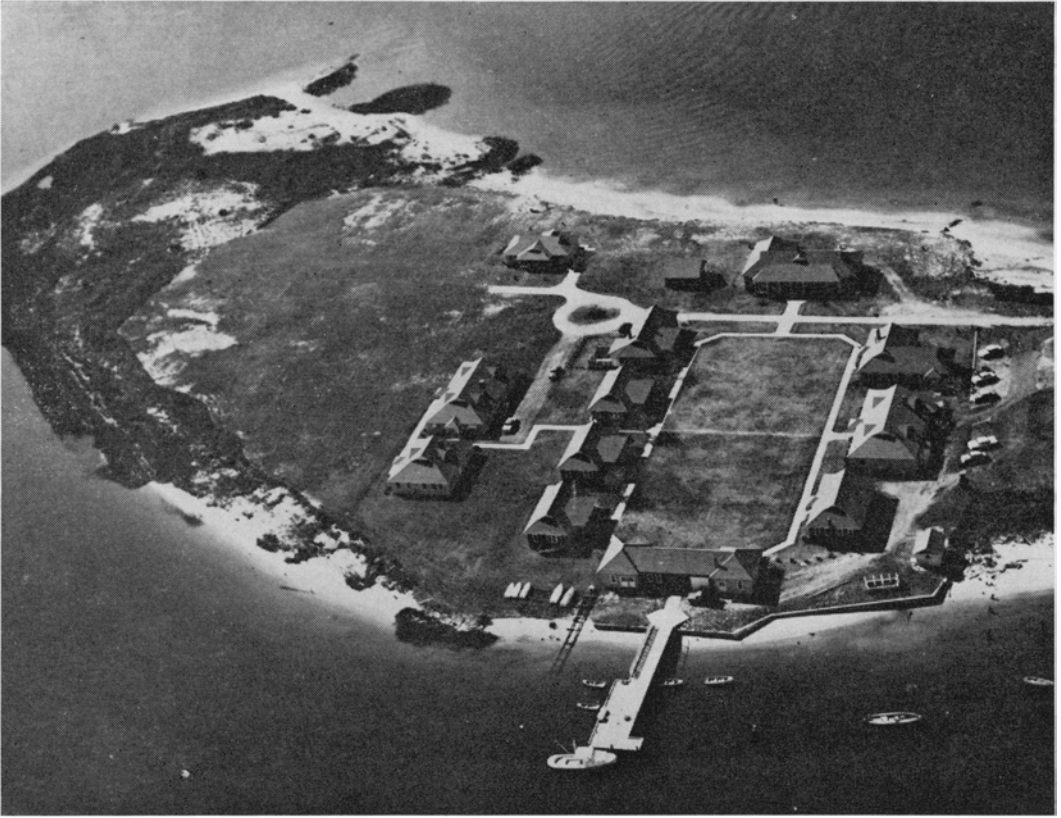
radioisotopes to follow the metabolic processes.

Phycology. Effect of environmental conditions on the structure of marine algae; distribution of marine algae along the Connecticut coast; development of herbarium of marine algae for teaching and research; and isolation and experimentation of marine unicellular algae to compare with non-marine algae.

Education. During the past ten years, the University has conferred four Ph.D and 14 M.S. degrees based on marine research. Currently, there are seven Ph.D. and 11 M.S. candidates. This program will be expanded materially as soon as increased laboratory space and housing facilities can be made available.

The University will provide for basic maintenance and salaries of basic personnel as well as limited amounts for laboratory equipment and supplies. Most of the funds for research staff and equipment come from outside agencies.

Address: Marine Research Laboratory, University of Connecticut, Noank, Connecticut.



Aerial view of Duke University Marine Laboratory

DUKE UNIVERSITY MARINE LABORATORY

C. G. BOOKHOUT, DIRECTOR
AND

F. JOHN VERNBERG, ASSISTANT DIRECTOR FOR RESEARCH

The Duke University Marine Laboratory, which is located on Piver's Island across the Newport River from the historic town of Beaufort, North Carolina, was established in 1938 chiefly through the efforts of the late A. S. Pearse. Investigators from the Johns Hopkins University maintained a field station at Beaufort near the end of the last century, and in 1902 the United States Bureau of Fisheries established a laboratory at the north end of Piver's Island. As a result of investigations covering almost 75 years, the area is biologically well-known. Throughout the years the Laboratory has maintained a bal-

ance between a teaching and a research program. The Laboratory facilities are not only available to all departments of Duke University, but the program at the Laboratory also serves the needs of students and investigators regionally and nationally. Seventy-five per cent of the student body and forty per cent of the research personnel come from colleges and universities other than Duke University.

Administration of the Laboratory is by the Director, C. G. Bookhout, the Assistant Director for Research, F. J. Vernberg, the Oceanographic Program Director, R. J. Menzies, and by an Executive Committee.

The Committee is an advisory and policy-making body consisting of nine members: the administrators of the Laboratory, the chairmen of the Botany and Zoology Departments and two other staff members elected annually from each of the two departments.

The staff of the Laboratory consists of a director, three faculty members in residence throughout the year, two post-doctoral research associates, five graduate students, twelve research assistants, two secretaries, a stockroom man, and three maintenance men. The staff members hold academic appointments in the appropriate university departments and direct student research for the M.A. and Ph.D. degrees.

Beaufort is approximately midway between Woods Hole, Massachusetts, and Miami, Florida. Cape Hatteras, which is 75 miles away, marks the northern boundary of the distributional range of many southern species and the southern boundary of many northern plants and animals. The edge of the Gulf Stream system is about 35 miles offshore, and between it and the shore are occasional reefs. The Laboratory is strategically located for biological research because of the richness of its flora and fauna, and the ease with which one can reach a variety of habitats. One can collect throughout the year in the extensive sounds, bays, and estuaries and, on calm days, in the open ocean which is only $1\frac{1}{2}$ miles from the Laboratory. Creeks, mud flats, sand beaches, dune, marshes, peat bogs, cypress swamps, bird islands and rookeries, and coastal forests can be reached quickly. The salinity of the water of Beaufort Harbor is ordinarily similar to that of the ocean, and the moderate climate of the region provides for a long breeding season of such commonly-used research material as *Fundulus*, sea urchins, sand dollars, *Chaetopterus*, *Sabellaria*, *Nereis*, oysters, clams, hydroids, etc. The inshore area is populated mainly by subtropical species, but some boreal and tropical forms are also found. Tropical plants and animals characteristic of the West Indies can be collected 10 to 20 miles

off shore. A checklist of the invertebrate animals of the Beaufort area is available at a minimal cost. In addition there are published monographs on various marine plant and animal groups found in the region.

The Beaufort area is well-known for its moderate climate during the year. Air temperatures range from a mean of 9°C in the winter to a mean of 27°C during the summer. The average water temperature during August is 27° while this value during January is 7°C.

At present the physical plant consists of fifteen buildings: four dormitories, a dining hall, two residences, a boathouse, a classroom-laboratory building and four air-conditioned research laboratories with approximately 10,000 square feet of floor space. A new oceanographic building will be added in 1963. The laboratory buildings are equipped with running sea-water from a hard rubber and plastic line system. Equipment is available for photomicrography, histological studies, and experimental investigations. In addition to commonly used laboratory equipment, the following are available: refrigerated centrifuge with multispeed attachments, Beckman DU spectrophotometer, balances, pH meters, hoods, and constant temperature equipment. A 27-foot boat, row boats, outboard motors and collecting gear are also available for study of inshore habitats, while trawling and dredging is done from a 39-foot power boat. In the summer of 1964, a 118-foot vessel, well-equipped for all kinds of biological oceanography, will be available through a grant from the National Science Foundation. The grant will support a cooperative program for training and research in various phases of biological oceanography. The chief area to be studied will be from the shore through the Gulf Stream to the deep water beyond the edge of the continental shelf and from the Virginia Capes southward to Florida. In addition to three unheated dormitories, a 13-room air-conditioned and heated dormitory has been recently completed. Housing for families can be ob-

tained in Beaufort and Morehead City, one and two miles away respectively. There are 3,000 volumes and journals in the library, as well as 6,500 reprints. Books and journals not at the Laboratory can usually be obtained within 48 hours from the excellent library on the main Duke campus.

All courses offered at the Laboratory are intended for graduate students and seniors. Marine Ecology, Physiological Ecology and Marine Invertebrate Zoology are offered every summer, whereas Marine Mycology and Marine Algae are given in alternate summers. At present, oceanography is offered every third year, but with increased emphasis in Biological Oceanography at the Laboratory, course work can be expected more often. In addition to the graduate courses, a National Science Foundation sponsored Institute in Marine Biology is offered for college teachers.

To date most of the research programs at the Laboratory have been concerned with flora and fauna of estuaries, salt marshes, and inshore shallow waters. Projects of the permanent resident staff are as follows: rearing crustaceans and other invertebrates under various combinations of environmental factors; physiological adaptation of parasites; physiological ecology

of marine animals with special emphasis on physiological characteristics of latitudinally separated populations; and, with the recent appointment of a biological oceanographer, studies are planned on deep sea organisms. Staff members and graduate students from the Durham campus are engaged in research in the following general areas: ecology, physiology, mycology and algae, systematic parasitology, embryology, and invertebrate zoology.

Funds are available through a grant from the National Science Foundation for the support of pre- and post-doctoral investigators. The post-doctoral awards are available for twelve weeks' research in Marine Biology. This work may be carried out at any time during the calendar year.

Piver's Island is 150 yards across a channel from the historic town of Beaufort. From U. S. Highway 70 the island is readily accessible by a traffic bridge. The closest permanent commercial airport is in New Bern, 40 miles away. Bus service is available to the area. Arrangements for research facilities should be made with the Assistant Director for Research, Duke University Marine Laboratory, Beaufort, N. C. prior to arrival.

OCEANOGRAPHIC INSTITUTE, FLORIDA STATE UNIVERSITY

ALBERT COLLIER, DIRECTOR

The Oceanographic Institute was established in 1949 in the newly organized Florida State University which had formerly been Florida State College for Women. At first the Oceanographic Institute was in the School of Arts and Sciences; for the past several years it has been in the Graduate School of Florida State University. The Alligator Harbor Marine Laboratory is a field unit of the Oceanographic Institute and serves all departments of Florida State University having

need of its facilities. The Oceanographic Institute was established to train students on the graduate level in the several phases of the marine sciences, and to be a focal point for basic marine science research. The staff of the Oceanographic Institute consists of the director, four senior faculty appointees, and a supporting staff including administrative assistant, secretary, maintenance personnel, technicians, and graduate assistants.

Although the Oceanographic Institute

functions as a permanent and full-time agency of F.S.U., the Alligator Harbor laboratory has served principally as a summer teaching installation. However, research, field trips, and collecting, conducted on a year-round basis, use the facilities and a full maintenance staff is housed on the grounds and keeps the facilities in readiness at all times.

The location is in a coastal area on the Northwest coast of Florida, characterized by rolling and forested seafront interspersed with small embayments. Alligator Harbor has no river discharge, and since rainfall usually does not exceed evaporation, the salinity variations follow those of the nearby Gulf of Mexico (28 to 35⁰/₀₀). The water is relatively shallow, and the bottom material is composed of various portions of sand and mud with sand predominating. There are no rock formations except a few limestone outcroppings in the adjacent Gulf of Mexico.

The fauna in Alligator Harbor and the adjacent Gulf is quite varied. The bottlenose dolphin *Tursops truncatus* is usually seen feeding and playing in the harbor waters as well as outside in the Gulf. The fauna includes the loggerhead turtle, *Caretta caretta*; the diamond-backed terrapin, *Malaclemys terrapin macrospilota*; the lancelet, *Branchiostoma cariboeum*. Most fish in the harbor leave for deeper, more stable water during the colder months. During the warmer months, the mullet, *Mugil cephalus*, the spot, *Leiostomus xanthurus* and many other species abound. Several species of sharks and rays are usually abundant during the warmer months. The arthropods include *Limulus polyphemus* as well as many species of Crustacea; among the latter are the commercial species of shrimps and crabs. There is a large variety of mollusks, including *Octopus vulgaris*, and the oyster *Crassostrea virginica* forms extensive intertidal reefs in the harbor. Other phyla are well represented; of the echinoderms, sea

urchins, *Lytechinus variegatus* and *Arbacia punctulata* should be mentioned. Over forty species of sponges have been found in the harbor and the adjacent Gulf of Mexico area. An annotated checklist has been duplicated for the fauna (and flora) of the region. It is presently being revised to include many new species which have been identified since the last edition in 1956. An incomplete collection of animals has been accumulated, but is not maintained in formal museum fashion.

Present investigations are in the fields of neurophysiology, taxonomy, mariculture, diatom and dinoflagellate nutrition, and embryology.

The laboratory building is 30' × 100' and contains a student laboratory with a capacity of about 15 students, five individual research areas, and a storage room. Electricity, fresh water, air conditioning and heating, running sea-water, small boats, pier, and harbor are available. In addition to the laboratory building there are two residence buildings, a small dormitory (with a limited kitchen), a repair shop, and storage sheds. A series of ponds with controlled tidal flow have been built for experimental studies on shellfish populations.

Visiting investigators can be accommodated by arrangement, but no funds are available for that purpose.

Reprints of many papers published by past and present staff members are available, but no formal laboratory publication or "collected reprints" have been produced.

Location. Alligator Harbor is located 43 miles south of Tallahassee and is best reached by auto from that city if approached from the north. From the east or west, it can most easily be reached from U. S. 98. The postal address for the Oceanographic Institute is: Oceanographic Institute, Florida State University, Tallahassee, Florida, U. S. A.



Fort Johnson Marine Biological Laboratory

FORT JOHNSON MARINE BIOLOGICAL LABORATORY COLLEGE OF CHARLESTON

N. A. CHAMBERLAIN, DIRECTOR

The Fort Johnson Marine Biological Laboratory was founded by the College of Charleston, a private liberal arts college, in 1955. The laboratory and accompanying facilities occupy a portion of the former Quarantine Station for the Port of Charleston located on a forty acre peninsula near the entrance to Charleston harbor, and were obtained from the Federal Government under a twenty year Quit-Claim deed. The laboratory was planned originally for undergraduate instruction in marine biology and research in marine microbiology, but the research interests of the laboratory now include developmental and ecological studies of larval invertebrates and the development, ecology, and distribution of marine fishes.

The permanent staff consists of three biologists and three maintenance personnel. Technical assistants are drawn from the College of Charleston through a student research participation program.

Teaching and research facilities are op-

erated throughout the year. Existing facilities include residences, workshops, warehouses, docking facilities, a dormitory, and a hospital building. One-half of the hospital building has been completely reconditioned and converted into air-conditioned research facilities consisting of three laboratory rooms, three offices, an instrument room, a tiled sterile transfer room, a glassware kitchen, and storage rooms. A lecture room and a student laboratory are used for teaching. Housing has recently been completed for six visiting investigators and fifteen students.

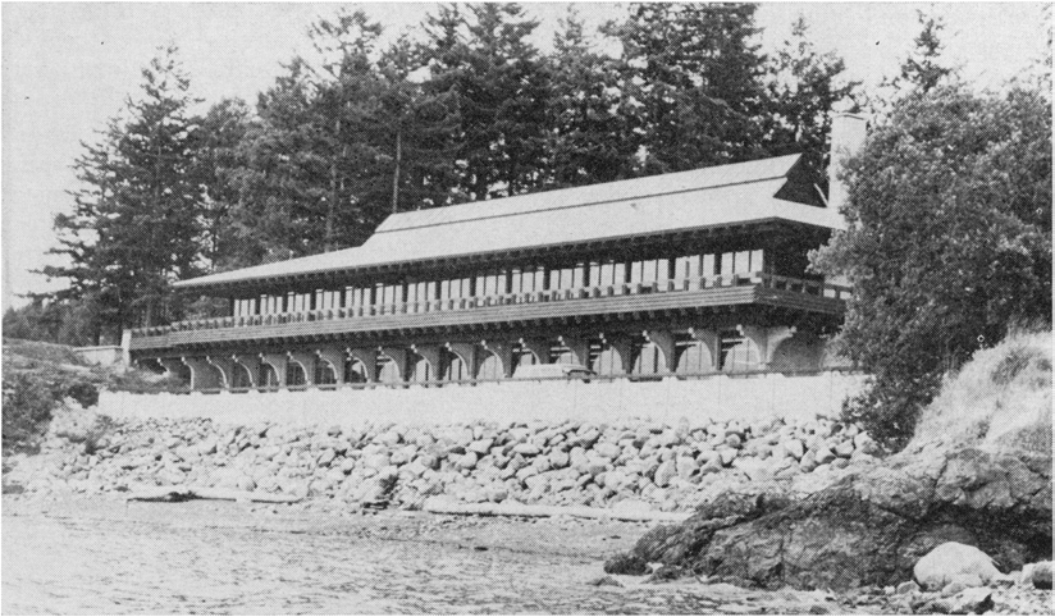
The biological sciences libraries of the Medical College of South Carolina and the Charleston Museum are available in Charleston.

Surrounding the laboratory grounds are estuarine intertidal oyster bars, mud flats, sand flats, and *Spartina* marsh. The open ocean and the beaches of sea islands are two miles away. The extensive exposed rock jetties on each side of the mouth of Charleston harbor provide an unusual

local rocky habitat.

The laboratory is located ten miles by good roads from Charleston, South Carolina. Charleston may be reached by air-

line, train, bus, or highway. Mailing address: Director, Fort Johnson Marine Biological Laboratory, R.F.D. No. 1, Charleston, South Carolina.



New Research Laboratory, Friday Harbor Laboratories, University of Washington

FRIDAY HARBOR LABORATORIES, UNIVERSITY OF WASHINGTON

ROBERT L. FERNALD, DIRECTOR

The Friday Harbor Laboratories, the field laboratories for the study of the marine sciences at the University of Washington, are located on the eastern shores of San Juan Island near the town of Friday Harbor. San Juan Island is one of the largest of the 172 islands of the San Juan Archipelago located near the eastern end of the Straits of Juan de Fuca, approximately 80 miles from the main campus of the University in Seattle. The Laboratories may be reached from Seattle by car or bus and a ferry from Anacortes, Washington. This trip requires about four hours, while a scheduled or chartered flight takes 45 minutes.

This general location for the marine station was selected in 1903 after careful

study of the region by Professors Trevor Kincaid and H. R. Foster. The choice was determined on the basis of the favorable characteristics of these inshore waters. The region is remarkably rich in marine flora and fauna. The diversity of species and abundance of individuals of both plants and animals were important considerations. Within relatively short distance are sea waters varying from oceanic to those highly diluted by streams but free of industrial pollution, with depths of over 200 fathoms, bottoms varying from rock to mud, and water movements ranging from those of quiet bays and lagoons to those of swift tidal channels. A twelve foot tide may expose a wide beach of diverse character—rock, gravel, sand, or mud. The many

diverse ecological situations accommodate an abundance of forms for ecological, developmental, experimental, morphological, and systematic work.

In common with the rest of the Pacific Northwest and Puget Sound Basin, the climate is mild; freezing temperatures and snow are rare in winter and the summers are cool and pleasant. The sea water temperature varies throughout the year by about six degrees C. The annual rainfall in the Friday Harbor area is under 25 inches.

In the summer of 1904 Professor Kincaid was joined by Professor T. C. Frye in organizing an instructional program in marine biology, and the Puget Sound Biological Station was founded. The activity was temporarily housed in a fish cannery until 1910, when the original laboratory was constructed on a four acre plot to the south of the town of Friday Harbor. The Station early outgrew its limited grounds, and in 1921 President Warren G. Harding ceded to the University of Washington the 484 acres of a military preserve across the bay for the development of a marine laboratory. This is the present site of the Friday Harbor Laboratories. This area and all the marine waters of the San Juan Archipelago was declared a marine biological and game preserve by the State of Washington, and in 1923 placed, for conservation purposes, under the jurisdiction of the director of the laboratory.

Construction on the new site was begun in 1923, and the first laboratories were occupied in the summer of 1924. The six hollow tile laboratory buildings of approximately 1,500 square feet each, built in this period and designed mainly for summer occupancy, housed the research and teaching activities of the station until recently. In June of 1962 a modern research laboratory, funded largely by a grant from the National Science Foundation, was completed. Two buildings (120' \times 42' and 44' \times 34') of two stories each, designed for year round use, in addition to providing research space for a number of investigators, house the library, photo-

graphic darkrooms, special holding tanks and aquaria, cold room, microtechnique room, conference and reading room, stockroom, academic shop, radio-isotope room, and rooms for synoptic collections and special equipment. An effort is being made to equip the laboratories to meet the basic and diverse needs for research in the various marine sciences.

The several laboratories are now provided with an abundant flow of sea water of exceptional quality and free from metallic contamination. Three separate systems are used; the lines of two are of Pyrex glass, the third of polyethylene. The continuous flow systems are maintained by electrically-driven hard-rubber centrifugal pumps to small glass-lined tanks placed to provide a constant head of pressure for gravity flow to the various aquaria and sea water tables in the laboratories. These sea water systems are one of the important assets of the Laboratories, and make Friday Harbor a uniquely favorable place for developmental and experimental investigations.

The library, admirably housed in the new research laboratory, contains over 8,000 volumes of standard references and research journals. A number of valuable monographs and expedition reports are included in the listing. A librarian is in attendance during the summer, and cooperation with the libraries on the Seattle campus assures ready availability of books and reference journals from the campus system.

No collecting service is operated by the Laboratories. However, a 55-foot power boat, the *M. V. Hydah*, is under charter to the Laboratories and is available to investigators and classes for dredging, net hauls, plankton towing, current measurements, and water sampling. The successful utilization of this boat is in no small measure dependent upon the skill and fund of information of its skipper, Captain Cleave Vandersluys, who has been associated with the operation since 1947. Smaller boats, skiffs and outboard motors provide transport to nearby islands and

beaches for shallow water work and shore collecting. An official tidal station is operated in cooperation with the U. S. Coast and Geodetic Survey. Aside from the director, the permanent staff is limited to non-academic personnel—a secretary and a maintenance staff of four.

From 1904 on the scientific program has been conceived as serving a two-fold purpose: the training of students, and providing an opportunity for independent research in the marine sciences. From that early period to the present the major emphasis and activity has been in the areas of marine biology. However, aspects of chemical and physical oceanography as well as oceanographic meteorology have been a part of the program for many years.

Currently the instructional program is designed to provide training for graduate students although an occasional highly qualified undergraduate may be admitted. Traditionally, instruction is offered in two five-week sessions during the summer. In an effort to accommodate more of the qualified graduate students seeking training at the marine station, and to utilize more fully the facilities of the laboratories, a program of courses is being offered during Spring Quarter of 1963. The formal courses offered are developed in close cooperation with and sponsorship by the following departments from the University: Botany (Algology, Algal Physiology and Marine Mycology), Atmospheric Sciences (Sea-air Transfer Processes), Fisheries (Biology of Marine Fishes), Oceanography (Phytoplankton and Zooplankton Ecology), and Zoology (Intermediate and Advanced Invertebrate Zoology, Invertebrate Embryology and Physiology).

There is on the permanent staff of the University a corps of approximately fifteen faculty members who have continuing programs of research at the Laboratories and provide continuity and stability to the instructional program. The contribution of this group to the Laboratories goes beyond the participation in formal instruction in the summer program. They and their graduate students at the University have

established a significant link between activities of the Seattle campus and the Laboratories, and are making increased use of the facilities of the Laboratories with each year.

It has been the policy of the Laboratories to appoint over one-half of the instructional staff from institutions other than the University of Washington. It has thus been possible to enrich the program of instruction immensely by inviting distinguished marine scientists from other universities in this country and abroad to participate in the training of selected graduate students. The program has benefited inestimably from this policy.

In regard to the selection of students to participate in the summer program, the policy of the Laboratories emphasizes the importance of "academic excellence." Students from all sections of the country have been welcomed. However, all are screened carefully and impartially on the basis of academic qualifications, recommendation of major professors, and appropriateness of the training to the overall educational program of the applicant. Financial assistance has been available to qualified graduate students under a grant from the National Science Foundation.

The administration of the Friday Harbor Laboratories attempts to encourage the fullest and most diverse use of the facilities for marine research by independent investigators. Research is not programmed in the sense of emphasis of restricted areas—the acceptance of investigators rests on the appropriateness of the investigation to a marine facility, the quality of the proposal, and the availability of appropriate space. Excessive demands upon the biological resources of the region are not encouraged or tolerated. Utilization of the facilities of the laboratories for research throughout the year is encouraged, and a limited amount of financial assistance for research activities has been available.

The Puget Sound Biological Station sponsored a publication series, *Publications of the Puget Sound Biological Station*, from 1915 through 1931. Since that

time no publication series has been sponsored by the Laboratories. In recent years two important international symposia have been held at Friday Harbor. The first was held in September 1957; the proceedings were published by the University of Washington Press in 1959—*Marine Boring and Fouling Organisms*, edited by Dixy Lee Ray. The second in May 1960 emphasized recent developments in neurophysiology, and the proceedings were published in 1961 by Pergamon Press — *Nervous Inhibition*, edited by Ernst Florey.

The Friday Harbor Laboratories are administered as an independent unit under the Dean of the Graduate School of the University of Washington. An advisory committee appointed by the Dean advises the director in matters of policy. This committee is representative of the departments of the University involved in the academic program of the Laboratories. In addition a facilities committee represent-

ing various administrative and maintenance units is appointed to advise the director on non-academic matters.

Since their establishment in 1904, the Friday Harbor Laboratories have been supported in large measure from funds allocated from the regular budget of the University of Washington. Consistent with the policies of a state university, tuition fees for the instructional program, charges to visiting investigators, as well as living costs have been kept minimal. It may be anticipated that these attitudes will be maintained, and that every effort will be made to extend the activities of the Laboratories with special emphasis placed on an expansion of the use of these facilities during other than the summer months.

Summer mailing address: Friday Harbor Laboratories, University of Washington, Friday Harbor, Washington.

Winter mailing address: Friday Harbor Laboratories, University of Washington, Seattle 5, Washington.



The Gulf Coast Research Laboratory

THE GULF COAST RESEARCH LABORATORY

GORDON GUNTER, DIRECTOR

In 1936 Dr. R. L. Caylor brought students on field trips to the coast from Delta State College, Cleveland, Mississippi. The tradition grew, and in the summers of 1947 and 1948 courses in marine biology were taught at Magnolia State Park by the Mississippi Academy of Sciences. In 1949 the Legislature established the Laboratory under the Board of Trustees of the Institutions of Higher Learning, which controls all public colleges of Mississippi. Forty acres of land on Davis Bay were purchased and surplus property buildings were moved to the site.

The Laboratory teaches the marine sciences for the public colleges of the State (the University of Mississippi, Mississippi State University, the University of Southern Mississippi, and Delta State College), and the private institutions (Belhaven Col-

lege, Millsaps College, and William Carey College). Five out-of-state institutions are affiliated with the Laboratory by special contract. They list the courses, register their students, and pay a fee depending upon the number of students. Louisiana State University furnishes one instructor and contributes a nominal sum for support. The other out-of-state institutions are: Louisiana Northwestern State College, Louisiana Polytechnic Institute, Louisiana Northeastern State College, and Missouri Northwestern State College.

The courses are advanced and require considerable prerequisites. Courses given are: Physical Marine Geology, Chemical Marine Geology, Problems in Geology, Introduction to Marine Botany, Introduction to Marine Zoology, Marine Invertebrate Zoology, Marine Vertebrate Zoology and

Ichthyology, and Problems in Zoology. During the 1962 session seventy-one students were registered.

Two staff members teach. Additionally, summer teachers come from Hamline University, Louisiana State University, Millsaps College, the University of Alabama, the University of Southern Mississippi, and Vanderbilt University. Classes are held only in the summer, but a student may work on a master's or a doctor's thesis during the whole year. A Summer Institute for selected high school students and teachers is given at the Laboratory by Louisiana State University; it is supported by the National Science Foundation.

During the 1961-62 college year 46 college field-trip groups in geology and biology from Kansas, Tennessee, Alabama, Arkansas, and Louisiana made trips by boat into the Gulf of Mexico. Quarters and boat trips are provided free. Living and working quarters are furnished free to professional visitors and workers.

A research staff of seven people and a non-technical staff of six people, three of them half-time workers, remain at the Laboratory all the year round. The technical staff consists of one geologist, one physical oceanographer, and five biologists.

With support from the Office of Naval Research, the physical oceanographer has been studying distribution of water of the Mississippi River and current patterns in the Gulf. The influx of tropical animals into the northeastern Gulf has been explained on the basis of current and wind patterns, and it has been shown that about 25% of Mississippi River water goes eastward, while the remainder goes westward.

The geologist has been concerned with various problems of sedimentation, such as the movements of the sand spits — these lash about over a period of a few weeks, depending upon the forces of the winds, currents, and tides.

One staff biologist is a member of the Mississippi Marine Conservation Commission, and spends full time with the oyster reefs and shrimp populations. The reefs

are shelled, seeded, and sometimes transplanted; and the shrimp and oyster seasons are regulated by the Commission. During the fiscal years 1959-60 and 60-61 Mississippi oyster production was the largest ever.

Two biologists have been concerned with racial studies of the menhaden, which supports the largest fishery in the Gulf and which yielded one billion pounds in 1961. The life history, the species catch of the fishery, the gonadal cycle of the menhaden, and the geographic distribution of the three Gulf species have been studied. A bibliography and a review of menhaden biology have been published. This work was supported by the U. S. Fish and Wildlife Service.

One biologist conducted a two year quantitative faunistic study of the waters of Grand Isle, Louisiana. Several species new to the northern Gulf, some new to the Gulf, and one new species of fish were discovered.

Another biologist has been concerned with fish which survive extreme injuries. Descriptions of the fishes with developmental abnormalities, many of which grow and survive as virtual monstrosities have been compiled. There is a bibliography of 750 papers on the subject, and specimens, photographs, and records are being collected from all available sources.

A taxonomic revision of the naked, broad soles has been carried out through a grant from the Society of the Sigma Xi.

With the help of oil company geologists, who made corings and bottom sediment studies of Mississippi Sound and the adjacent Gulf, a study of the distribution of amphioxus was made. It was estimated that several hundred million or possibly even a few billion amphioxus live in the Sound.

During the summer, ten to fifteen investigators are given small grants through support from the National Science Foundation. Others with their own grants are given a place to work. During the past four summers biochemists from the University of Mississippi School of Medicine

have worked at Ocean Springs on fishes' blood.

The Laboratory has established its own journal, *Gulf Research Reports*, and three issues have been printed. There is a small but rapidly growing library with emphasis upon the reprint collection.

The Laboratory also has a museum into which most of the common animals of the northern Gulf of Mexico have already been accessioned. Examples of all animals and plants of the whole Gulf will be acquired eventually.

BUILDINGS AND EQUIPMENT

The property consists of forty acres of woodland on which a large summer home and two small buildings were present when it was acquired. Three wooden buildings, surplus property from Armed Services, were moved onto the land in 1951. One of these is the caretaker's cottage. One was made into a kitchen and dining hall, and another was made into a marine laboratory. The same building now houses the museum and a modernized midsection is used as a teaching laboratory. It also contains a darkroom and one office.

The summer home contains offices for the oceanographer and geologist, one class-

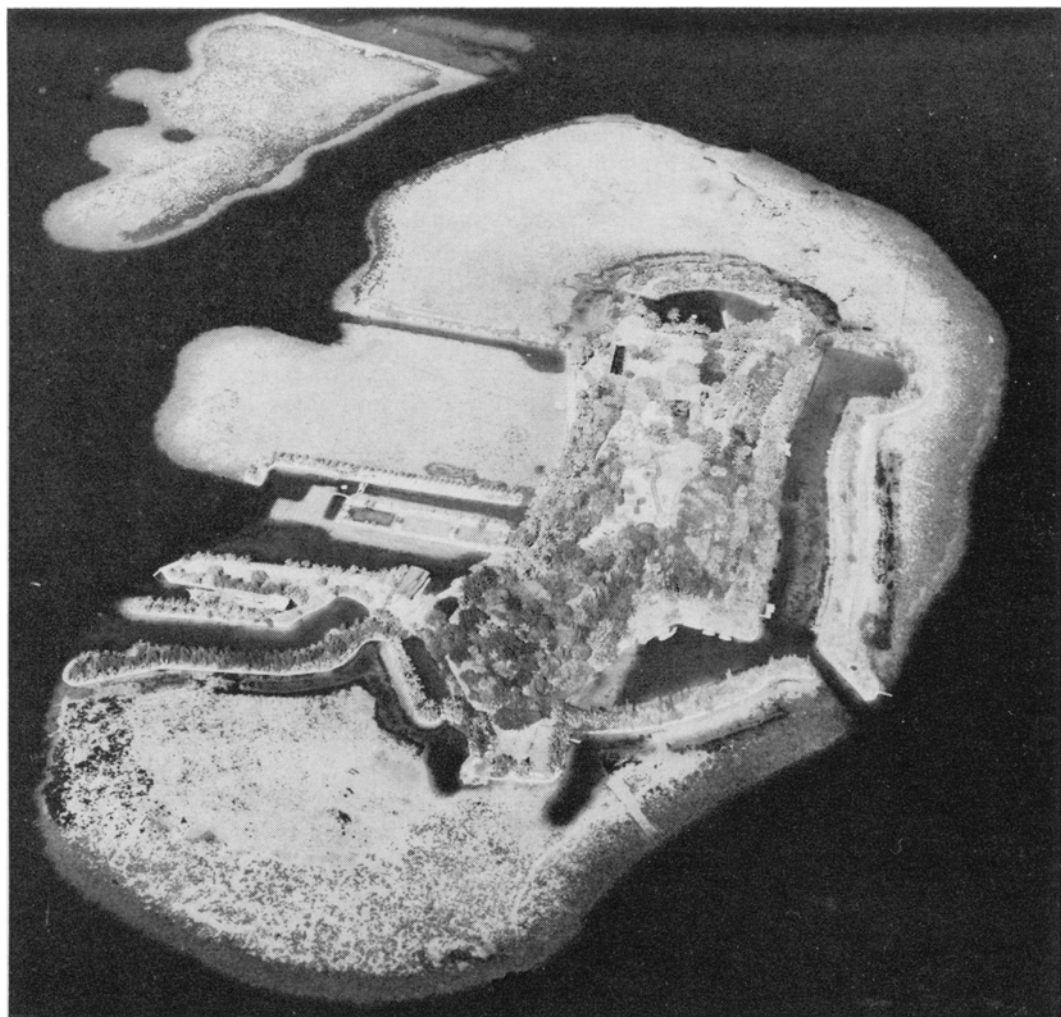
room, and men's dormitories. Two other dormitories, one for men and one for women, will house 20 people each. One of the small wooden buildings is used as a shop and storeroom, the other as a chemistry laboratory. A brick research building, constructed in 1952, contains six work tables and four water tables with running seawater, and the administrative offices. A brick teaching laboratory, completed in 1956, consists of two large rooms which contain eight water tables and eighteen work tables, and a smaller botany laboratory with four work tables.

In summer the Laboratory has been over-crowded. The 1962 Session of the Mississippi Legislature voted a bond issue for a \$400,000 research building to be erected within two years.

The Laboratory has a 38-foot steel, diesel-powered trawler. A 65-foot T-boat, recently acquired through the Surplus Property Agency, is being renovated at a cost of approximately \$120,000.

From 1955 to the end of the fiscal year 1961, Laboratory support was about half from outside contracts and half from the State of Mississippi. The budget has quadrupled since 1955.

Address: Gulf Coast Research Laboratory, Ocean Springs, Mississippi.



Hawaii Marine Laboratory

HAWAII MARINE LABORATORY, UNIVERSITY OF HAWAII

ALBERT H. BANNER, DIRECTOR

The official founding of the Hawaii Marine Laboratory by the University of Hawaii was in 1951, but the Laboratory was a direct outgrowth of the University's Waikiki Laboratory (Cooke Memorial Laboratory) which was put into use in 1921. The Laboratory now has two sites: one at Waikiki, in Honolulu; and one at Coconut Island, in Kaneohe Bay. Originally, the Laboratory was a branch of the Department of Zoology, but after 1951, it broadened its base, supporting the research of

all marine sciences; however, the emphasis is still upon marine zoology. Administratively, the Laboratory is a separate department under the Director of Research of the University, with a separate budget administered by the Director of the Laboratory.

While the Laboratory has no permanent scientific staff and offers no courses, its facilities may be used by any faculty member or graduate student for marine research and as a base for field trips in any marine

science. The actual staff of the Marine Laboratory consists only of the half-time director and the civil service maintenance personnel. However, the facilities were used at least in part by 20 University staff members and 40 graduate students during the academic year of 1960-61, and during that period six senior and junior staff members, not otherwise connected with the University, were employed on staff research projects while 26 visiting investigators also worked at the Laboratory.

The main branch of the Hawaii Marine Laboratory is located on Coconut Island, in Kaneohe Bay, Oahu, in the center of the most flourishing coral reef community of the Hawaiian Islands. Near the Laboratory are several types of coral reefs, coral-sand flats, mud flats, mangrove swamps, deeper channels, and deep mud-bottomed bays; within 20 minutes from the Laboratory lies the open Pacific Ocean, dropping rapidly off into water several miles deep. The marine fauna of the Hawaiian Islands, while not as rich as some of the more tropical — and inaccessible — Pacific Islands, is an example of the great Indo-West-Pacific fauna, and contains representatives of most of the groups of this fauna. The best introduction to the shallow-water fauna of the Hawaiian Islands is C. H. Edmonson's *Reef and Shore Fauna of Hawaii* (Bishop Museum Special Publ. 22, \$6.00).

The research carried on at the Hawaii Marine Laboratory is diverse, and varies from year to year. Almost all of it centers on the biology of reef and inshore animals; systematics, embryology, ecology, behavior, and physiology of both invertebrates and fishes are currently being studied. Current research programs with national-agency support include studies on toxicity of marine fishes, ecological succession on submarine lava flows, investigation of trophic levels by means of isotopic tracers, studies in marine parasitology, etc.

In the Waikiki Laboratory there are two teaching laboratories and four individual research rooms; at Coconut Island the main laboratory building burned to the

ground in December, 1961, and at present working space is extremely limited. However, two new laboratory buildings are planned for Coconut Island, and these will contain an estimated ten to twelve thousand square feet of laboratory space; the first building of two thousand square feet will be completed in the spring of 1963, the second, in mid-1964. There will be no space for visitors until both laboratories are completed. In the new facilities, space and equipment will be available for most types of marine biological work. Laboratories in both locations have a running seawater system; at Coconut Island there are also large tidal ponds for studies on larger fish. The Laboratory at Coconut Island maintains a 46-foot research vessel, two 22-foot personnel boats, and a number of outboard-powered skiffs for research purposes.

Living accommodations are usually obtained by visitors either in Honolulu or in the shore-side community of Kaneohe; the Laboratory has three small apartments on Coconut Island which are rented at a nominal fee to graduate students and to visiting investigators without families.

The Laboratory has no funds to support visitors, and for visitors there is a charge of \$25 per person per month to cover laboratory space and transportation to the island.

The Hawaii Marine Laboratory issues annually its collected reprints and the University publishes *Pacific Science*, a quarterly devoted in part to marine sciences in the Pacific basin. Both are available on exchange.

The Laboratory maintains a small reference collection of local marine animals; however, the Laboratory and the University have a cooperative agreement with the Bernice P. Bishop Museum, which has larger and more extensive collections.

The Waikiki Laboratory is on Waikiki Beach, about three miles from the University Campus; Coconut Island is 15 miles from the campus, and workers from the campus may ride to the dock in Laboratory vehicles and be transported to the

Laboratory by water taxis in scheduled trips. The laboratories are operative the year around. Mail may be addressed to

Director, Hawaii Marine Laboratory, University of Hawaii, Honolulu 14, Hawaii.

Contribution No. 191, Hawaii Marine Laboratory



The Hopkins Marine Station of Stanford University, Pacific Grove, California, and a portion of the adjacent shoreline protected by state law as a marine life refuge and study area. The buildings shown include the Jacques Loeb Laboratory (center), the Marinostat (right), and the pump house and storage tank for seawater (left).

THE HOPKINS MARINE STATION OF STANFORD UNIVERSITY

DONALD P. ABBOTT, ASSISTANT DIRECTOR

The Hopkins Marine Station is the oldest marine laboratory on the U. S. Pacific Coast. Founded in 1892 and originally housed in frame buildings, the laboratory moved to its present site in 1917. The station occupies a rocky promontory on the southern shore of Monterey Bay, and holds title to about 11 acres of land on and around the point. The area is fenced, and both shoreline and waters 1,000 feet to sea are protected by law as a marine life refuge and study area.

The marine station is open the year round. Administratively, it operates under its own director as a division of Stanford University, and is financed partly through endowment income from the Timothy Hopkins Trust. Academically, it operates as a branch of the Department of Biological Sciences of the University, and all

staff members hold academic appointments in the Department. The orientation of the work is primarily biological rather than oceanographic. The activities of the laboratory include teaching, research, and graduate training in several areas of marine biology.

The areas of interest of the present scientific staff are as follows: physiology of algae, ichthyology, biological oceanography, microbiology, physiology of marine invertebrates, marine invertebrate zoology, comparative biochemistry and immunology of marine organisms, marine algae. Additional staff members are appointed to aid with summer teaching. A technical staff of eight includes an administrative assistant, secretaries, boat operator, and maintenance and custodial personnel.

Present facilities ashore include three

main buildings housing rooms for research and teaching. These buildings are equipped with running seawater, conducted in lead or plastic piping. The Alexander Agassiz Laboratory, a three-story concrete structure built in 1917 and renovated in 1960, provides space and equipment for teaching and research on the biology and ecology of marine invertebrates, fishes, and algae. The two-story concrete Jacques Loeb Laboratory, constructed in 1928 with funds from the Rockefeller Foundation provides rooms and other facilities for experimental work on the physiology and biochemistry of marine animals, plants, and microorganisms, and houses the station's sizeable specialized library. A third main building, the Marinostat, constructed in 1962 with funds from the National Science Foundation, contains special facilities for controlled environment studies in both large and small laboratory work rooms. Special features include six darkrooms and a refrigerated seawater system, permitting organisms to be raised under different regimes of temperature and illumination. Future plans call for the control of additional variables. Other structures include a marine greenhouse, a shop, pumphouses, sea water storage tanks, and outdoor concrete pools for larger marine organisms.

Most of the present work of the station involves studies on shallow water and shore organisms. Skiffs are available for work offshore, and two diesel powered vessels are available for work in deeper water. The *Tage*, a 40.5-ft. launch equipped with winch and 1,000 meters of 1/4-inch cable, is used for tow-netting, trawling, and dredging in Monterey Bay. A larger vessel, the 135-ft. diesel-powered schooner *Te Vega*, capable of much longer cruises, contains laboratories for research and graduate training in biological oceanography. During 1963-64 this ship will participate in the International Indian Ocean Expedition.

The shore and waters in the immediate vicinity of the laboratory provide a rich variety of marine life for study and investigation. Representatives of most of the

invertebrate phyla are within easy reach, among which the sponges, hydroids, sea anemones, bryozoans, polychaetes, molluscs, crustaceans, echinoderms, and tunicates are particularly conspicuous and abundant. The commoner shore forms are listed in *Intertidal Invertebrates of the Central California Coast* by Light, Smith, Pitelka, Abbott, and Weesner (Univ. Calif. Press). The echinoderms *Strongylocentrotus*, *Dendraster*, and *Patiria*, and the echiuroid *Urechis* provide useful materials for the experimental embryologist. More than 50 species of fishes may be taken by dipnet along the shore, and many others are available farther out. Bathypelagic organisms are obtained by midwater trawl in the Monterey Submarine Canyon, which provides depths of more than a mile within 7 miles of the station. The algal flora is rich and varied, and includes not only the larger brown kelps but also a host of smaller forms listed in *Marine Algae of the Monterey Peninsula* by G. M. Smith (Stanford Univ. Press). Approximately 80% of the algal species reported between Puget Sound and southern California occur in the area. Identified specimens of most species may be consulted in the G. M. Smith Herbarium at the station. The habitats represented in the station area include granite reefs and outcroppings, protected channels and tidepools, sandy beaches, and offshore kelp beds, while within a radius of a few miles one may visit intertidal mud flats, brackish estuaries, brine pools, and protected harbor floats and pilings. Ponds, brooks and rivers are also accessible.

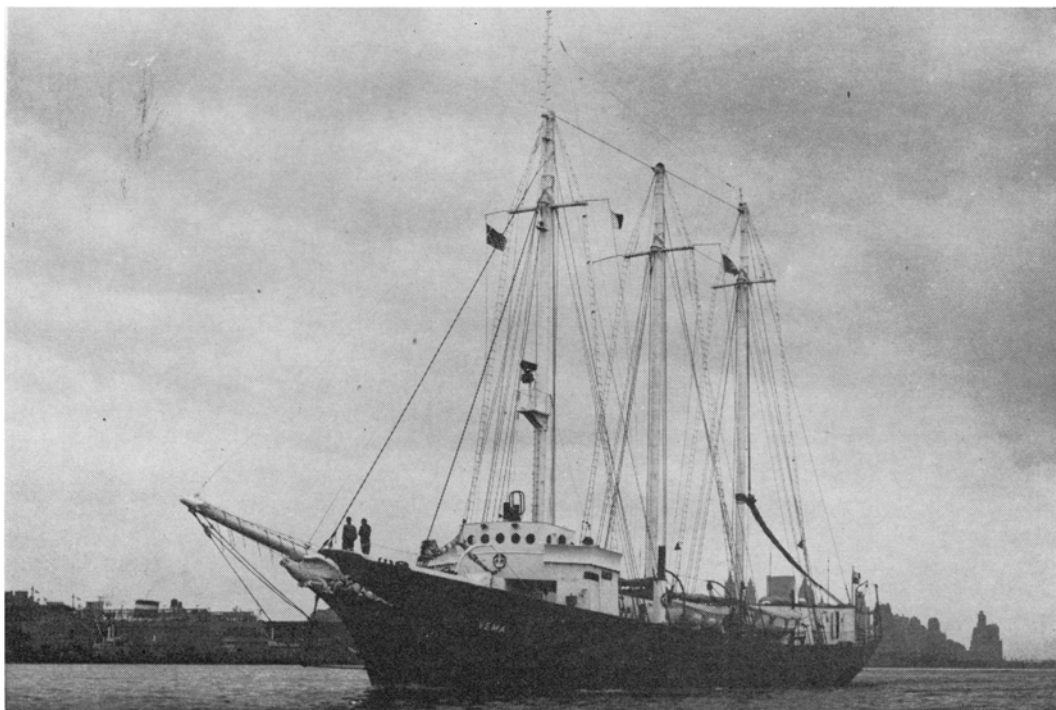
During the 10-week summer session the station offers courses in the following fields: natural history of marine animals, marine algae, marine invertebrates, embryology, ecological physiology, ichthyology, physiology of algae, and comparative biochemistry of marine organisms. Except for the offering in natural history, courses are designed primarily for graduate students in the biological sciences, but qualified teachers and undergraduates are also accepted. During the summer when nearly 100 students and staff are in residence at

the station, space for visiting investigators is very limited. During the remainder of the year, the resident staff and some 15-20 graduate students carry on their research. Visiting investigators are therefore encouraged to come during the fall, winter, and spring seasons. Funds for the support of visiting workers are not generally available from the station.

An information bulletin describing the facilities and program in greater detail is available on request. The laboratory does not publish a journal of its own, nor does it issue sets of collected reprints. Requests

for reprints of published work done at the station should be directed to the investigator concerned.

The laboratory is easily reached by Greyhound bus (to Pacific Grove) or by plane (to Monterey Airport). The station does not provide housing for students or investigators, but rooms, apartments, and motel facilities are available the year around within a few minutes walking distance of the laboratory. All communications relating to the use of space and facilities at the laboratory should be addressed to The Director, Lawrence R. Blinks, Hopkins Marine Station, Pacific Grove, California.



The *Vema*, one of the ships of the Lamont Geological Observatory

LAMONT GEOLOGICAL OBSERVATORY OF COLUMBIA UNIVERSITY

PAUL R. BURKHOLDER, CHAIRMAN, BIOLOGY PROGRAM

The biology program of Lamont Geological Observatory was initiated several years ago with intensive studies of marine plankton, especially the skeleton-bearing

organisms which serve to illuminate problems in sedimentation, climatology, and various biological processes connected with geologic development. This biology pro-

gram has since been expanded in scope, as well as in its research facilities. General marine productivity and ecology of the sea are being studied, with particular emphasis on the nutrition and metabolism of small plants and animals. A large and well-equipped building has been constructed for biological research and graduate instruction. In addition to continuing studies of cores and skeleton-bearing organisms, there are programs concerned with new drugs from the sea, and studies of life under extreme conditions of environment, such as low temperature and great pressure.

Lamont Geological Observatory, located in a rural community, is governed by an administrative board, and from its inception has been affiliated with Columbia University. In addition to well-equipped laboratories, the biology programs have available unusual collecting facilities on Lamont's ocean-going ships, *Vema* and *Conrad*, and several smaller vessels located in New York and Bermuda. Programs of investigation currently include problems in radiobiology, biochemistry, taxonomy, ecology, and exobiology. Because certain organisms of the plankton and coral reefs possess strong antibiotic and other unusual chemical properties, research on them may result in new discoveries of significance in ecology and medicine.

The biology staff includes some 25 persons, of which seven with the Ph.D. degree have responsibility for carrying on research projects. Various forms of technical assistance, maintenance, and bookkeeping are provided by the institution, as well as the facilities and services of an excellent machine shop.

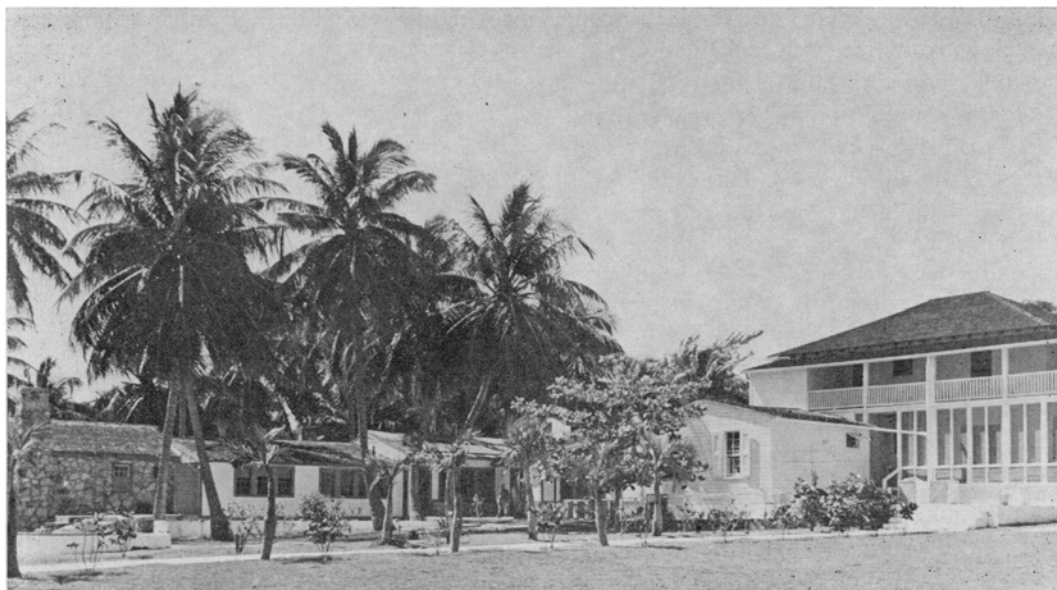
The Lamont campus is located along the Hudson River, and its ships dock in nearby Piermont for brief periods between

world cruises. Through various cooperative arrangements with other institutions, studies are carried on in tropical laboratories, as well as at stations in polar regions. As a result of world-wide excursions, numerous collections of microorganisms, plankton, and bottom animals are brought back for study. Special reference collections of core materials, foraminifera, living bacteria, and plankton organisms are available at Lamont, and specimens of larger animals are kept in the collections of the American Museum of Natural History in New York City.

Visiting scientists of established reputation, as well as promising young investigators, are welcomed to the Lamont laboratories and taken aboard ship for cooperative studies in marine biology and oceanography. Excellent facilities for pure culture work, biochemistry, and growth of all kinds of small marine plants and animals are provided in modern laboratories. Local working collections of books and journals, as well as the libraries of Columbia University are available to the staff.

Graduate students interested in the life sciences and cognate fields, who may wish to do research at Lamont, may enroll in the Department of Zoology, Cognate Fields Program of the Department of Geology, etc., of Columbia University. Excellent opportunities exist in the areas of Geochemistry, Geophysics, Submarine Geology, Oceanography, and Planetary Sciences for persons attracted to interdisciplinary research.

The Lamont Geological Observatory may be reached by bus or automobile from New York City, going north on route 9W along the west side of the Hudson River about fifteen miles above the George Washington Bridge. The mailing address all year round is Torrey Cliff, Palisades, New York. The Director is Maurice Ewing.



Laboratory and Residence at Lerner Marine Laboratory, Bimini, Bahamas

THE LERNER MARINE LABORATORY, THE AMERICAN MUSEUM OF NATURAL HISTORY

ROBERT F. MATHEWSON, RESIDENT DIRECTOR

The Lerner Marine Laboratory, a field station of The American Museum of Natural History, is situated in The Bahamas, on the island of Bimini, some 50 miles due east of Miami, Florida. This ideal locality was chosen by the laboratory's founder, Dr. Michael Lerner. He recognized that the large (three square mile) shallow-water lagoon enclosed by extensive mangrove swamp which borders the eastern coast of the island, the deep waters of the Florida Strait which abut the western shore, and the vast expanse of water over the Bahama Bank beyond the lagoon, would yield an abundance of diverse marine flora and fauna for study.

The Laboratory has grown from one small limestone building and a typically-porched Bahamian home, which are still being used as administrative office and investigators' residence, respectively, to the outstanding marine laboratory in the Bahamas area. Three residence buildings, machine shop, carpentry shop, library

building, laundry building, commissary, power plant, and a laboratory building, which can comfortably accommodate at any time more than 18 visiting investigators, are the present structures which facilitate the work of visiting investigators.

The laboratory is equipped with six concrete tanks of approximately 250-gallon capacity with continuously running sea-water, a 15-foot circular concrete tank with a capacity of approximately 1,000 gallons, six 50-gallon aquaria, twenty 25-gallon aquaria, and fifty 2-gallon aquaria. All tanks are housed under a roofed aquaria shed and are individually supplied with filtered sea-water. A recently installed system constructed of stainless steel and PVC plastic pipe insures adequate pressure and volume for all projects.

In addition to the aquaria, ocean pens are available for the study and maintenance of large marine animals. Three 50-by 80-foot pens, with access areas from dockside catwalks, floating rafts, or graded

banks have been constructed of greenheart piling and stainless steel hurricane fencing. Study has been and is being carried on with cetaceans in these enclosures. Two large 60- × 30-foot shark pens with overhead observation platform, holding pens, and an overhead electric hoist and accessory gear, have basically similar construction. These are available to visiting investigators working with large elasmobranchs. Four similar pens are also available to maintain large marine teleosts for study. Individual laboratory rooms are equipped with water tables and running sea-water.

Basic laboratory materials, such as acids, preservatives, etc., in reasonable amounts, are provided by the laboratory. All other chemicals and materials are available at cost. Centrifuges (clinical and refrigerated), pH meters, cold rooms, freezer (-70°C), cryostat (-40°C), spectrophotometer (Beckman DB), fluorometer (Farand), microtomes, oscilloscopes, amplifiers, distillation apparatus, autoclaves, are all available on a part-time basis. Where specific instrumentation is necessary for projected periods, it is required that the visitor bring these tools. Logistics are not a problem, as both airplane and surface craft visit the island daily. Large freight is carried in or out once a week.

At present, a checklist of the flora and fauna of the area is being compiled from the five volumes of Collected Reprints of work carried on in this laboratory. Requests for these will be answered as soon as the lists are completed.

The great diversity of marine flora and fauna that is found in abundance in this area permits a wide variety of study. Physical and biological oceanography have been carried on at this Laboratory for many years.

While visiting investigators are encouraged to do their own collecting, assistance is often available by the staff collector, or local help can be procured at a reasonable rate. A large fleet of floating craft is available for all studies. Six skiffs powered by outboard motors; one flat shallow-draft barge, outboard powered; one flat shallow-draft barge, air powered (now under construction) for working in mangrove swamp and shallow water lagoon; one 26-foot sea-going launch, inboard powered; two 40-foot buoy boats, diesel powered—one equipped with laboratory and living space for four scientists, one equipped with large sea well, winch, boom, etc., for large fish collecting; as well as one 24-foot fishing boat which daily is crewed by two men who collect fish for general laboratory purposes.

The Director is Robert F. Mathewson; the Liaison Officer, Anne H. Schiehl (Miami, Florida Office—1211 duPont Building). The administrative and service staff totals about twenty.

A schedule of rates for use of laboratory facilities will be made available upon application.

Mailing address: Lerner Marine Laboratory, 1211 duPont Building, Miami 32, Florida.

INSTITUTE OF MARINE SCIENCE OF THE UNIVERSITY OF MIAMI

ROBERT L. BEUTEL, ADMINISTRATIVE ASSISTANT TO THE DIRECTOR

The Institute of Marine Science of the University of Miami embraces The Marine Laboratory, The Department of Marine Science (of the Graduate School), and the Gulf and Caribbean Fisheries Institute.

The Institute was established to provide, for the tropical Atlantic, the functions of the various temperate-zone marine research institutions—an oceanographic institute, a fisheries station, and a marine biological laboratory—with facilities for visiting investigators and students from other universities.

Its location, at Miami, although geographically approximately 26° North, is actually within the zoogeographical region of the West Indies. Because of this ideal location, the Institute was established in 1943 as a division of the University. In the absence of any other marine tropical stations on the continent, it has developed a program which includes a full graduate academic curriculum in the geophysical, geochemical, biological, physical, and meteorological sciences, as well as a year round research program.

For administrative and academic purposes, the Institute now includes three research divisions—Physical Sciences, Biological Sciences, and Fisheries Sciences—and the academic Department of Marine Sciences for graduate studies. In practice this does not interfere with interdisciplinary communication. Senior scientists and investigators may recruit both assistants and consultants from more than one division for their research projects, and students are encouraged to study in breadth as well as in depth. Total staff now numbers approximately 214.

The Laboratory is situated within ready reach of a wide variety of habitats belonging to the West Indian Faunal region. Sand beaches, mud and turtle-grass flats, mangroves, coral rock shores, and living



Institute of Marine Science, University of Miami

reefs are accessible by automobile or boat. The Gulf Stream is within sight of the Laboratory. Small boats are on hand for collecting trips to shallow-water localities, and facilities are provided for trawling and dredging. Two seagoing vessels are equipped for offshore work. Two laboratory buildings contain running sea-water aquaria for maintaining animals. No comprehensive checklist of the marine fauna is available as such, but the *Bulletin of Marine Science of the Gulf and Caribbean*, (11:552-649) includes a checklist of flora and fauna of the estuarine waters. Most local forms of marine fauna can be readily identified by consultation with staff members and by reference to the Laboratory Museum.

Staff research in zoology includes a broad selection of topics, including coral reef ecology, plankton, behavior, biochemistry, physiology, microbiology, development, and systematics. Specialties of the research staff include the Octocorallia,

Polychaeta, Chaetognatha, Stomatopoda, Copepoda, Anomura, Ophiuroidea, Asteroidea, Gastropoda, and Cephalopoda. Extensive research is carried out on the economically important shrimp, spiny lobster, and fishes. Deep sea research is carried out over a wide area.

The Institute comprises three permanent buildings of 36,476 square feet (gross), a temporary wooden building of 4,000 square feet, a workshop of 3,902 square feet and a refrigerated storage structure.

A full range of modern equipment and instrumentation ranging from mass spectrometers to X-ray photography is provided for research in all branches of marine science. Arrangements can also be made for the use of the facilities of the School of Engineering, the School of Medicine and the College of Arts and Sciences, including animal colony maintenance and electron microscopes.

Other facilities at the Institute include instrument maintenance, electronics design and construction, carpentry, painting, glass-blowing, printing and reproducing and a well-equipped photo-laboratory.

Living accommodations at a modest rate are available for visiting investigators and students in dormitories both on the In-

stitute grounds and at the Main Campus of the University. Hotel and motel accommodations are also available within a short distance of the Laboratory. Funds are available for the support of visiting investigators.

The Institute sponsors a publication entitled the *Bulletin of Marine Science of the Gulf and Caribbean*, printed quarterly and available at a cost of \$2.00 per copy or \$7.50 per volume of four copies.

The Laboratory maintains a museum with reference specimens of the West Indian fauna and flora, as well as research collections of groups under active study by staff specialists. Specimens for demonstration and teaching purposes are separately maintained.

Exchange arrangements are made on an individual basis, and the Laboratory is desirous of increasing the scope of its reference collection of the West Indian marine biota.

The Institute of Marine Science of the University of Miami is located at 1 Rickenbacker Causeway, Miami 49, Florida, convenient to air, rail, bus, and steamship transportation, and in immediate proximity to U. S. Highway #1, south of Miami. The Director is Dr. F. G. Walton Smith.

THE MOUNT DESERT ISLAND BIOLOGICAL LABORATORY

ALVIN F. RIECK, DIRECTOR

The Laboratory was founded by John S. Kingsley in 1898 as a summer school of biology for the undergraduates of Tufts College. From the beginning at South Harpswell, Maine, some investigations were carried on in addition to the teaching activities. The teaching activities were discontinued after a few years, and the laboratory has been a research institution ever since. A non-profit corporation was formed by the investigators in 1913, and Tufts College transferred title of the property to this newly formed corporation, The Harpswell Laboratory.

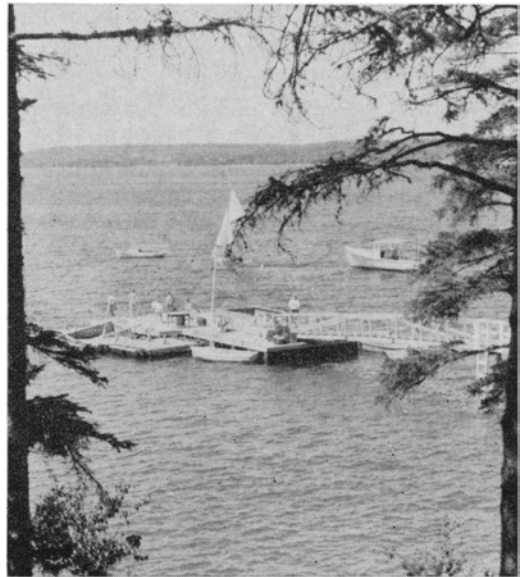
The Laboratory was moved to its present location at Salisbury Cove, Maine, in 1922, and in 1923 the name was changed from The Harpswell Laboratory to The Mount Desert Island Biological Laboratory. The land on which the Laboratory now stands was a gift from the Wild Gardens of Acadia, an organization instrumental in the establishment of Acadia National Park. Some classes were taught at the new location, but they were discontinued just prior to World War II.

Presently, this private laboratory furnishes research facilities and logistic support for investigators from various institutions who come to work on problems of their own choosing. Priority for research space is given to those investigations for which the local fauna is particularly suited.

The Laboratory is governed by a Board of Trustees. These trustees elect an Executive Committee that is responsible for transacting the business of the Corporation. The Director is the executive officer of the Corporation and supervises the general operation of the Laboratory's facilities.

RESEARCH ACTIVITIES

Research activities are usually limited to the summer months—June 15-September 15. About 33-35 senior investigators are in



A view from a laboratory window of the dock and live car facility at high tide

residence each summer. These investigators bring about 75 students, technicians, or research associates to work in their assigned laboratories.

Twenty-seven research rooms are available, varying in size from small cubicles for one person to large rooms adequate for four-five people. Each laboratory has fresh and salt water, electricity, and gas. Special equipment available for use by all investigators is as follows: spectrophotometers, centrifuges, deep freezes, refrigerators, refrigerated centrifuge, flame photometer, balances, and Warburg apparatus (investigators use their own glassware).

Modest collecting equipment is available for general use. A lobster boat takes investigators and assistants to places for collecting.

A partial checklist is being compiled. In general, animals available are restricted to the cold water forms of the North Atlantic. Tides at the Laboratory average 10.5 feet, providing good opportunities for studying intertidal forms. Large live cars

in the sea and small laboratory aquaria are available for keeping forms after they are collected.

The Laboratory owns 17 cottages which are usually reserved for investigators with young children. A use charge of about \$350.00 per season plus utilities is made for each cottage. Housing for single people and couples without children may be obtained in the vicinity of the laboratory. The Laboratory operates a dining hall for the single investigators and students.

Renal physiology has been historically the predominant theme of investigations at the laboratory's present location. However, recently the group working in developmental biology has increased in size. A few investigators are also working in marine microbiology. Presently, investigations are being made of transport across gill membranes, ammonia excretion through gills, transport across gastric epithelium, rectal gland secretions, bile pigments, respiratory physiology of diving mammals, cerebrospinal fluid production, and carbonic anhydrase activity in special organs of the skate. Developmental biology studies include mechanical analyses of cytokinesis, early differentiation, dynamics of karyokinesis, regeneration, special inhibi-

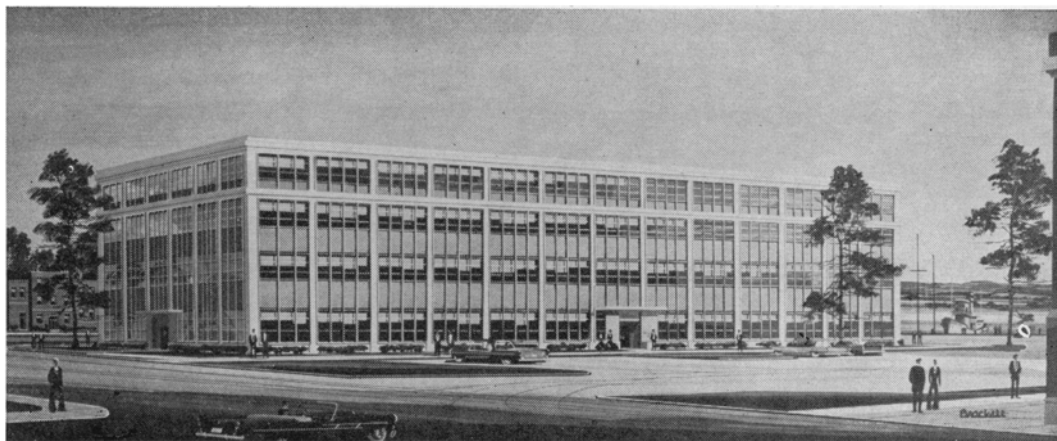
tors to early differentiation and immunological studies of regenerating grafts. Some studies are being made of the ultrastructure of secretory cells.

The laboratory publishes *The Bulletin of The Mount Desert Island Biological Laboratory* at three year intervals. It includes general information about the Laboratory, lists of personnel who worked each year, and short abstracts of research projects pursued each summer. It is not a scientific publication, but the medium of publishing information about the Laboratory.

The Laboratory is located on Mt. Desert Island near Bar Harbor, Maine. Bus service to Bar Harbor is available from Boston. The nearest convenient air service is to Bangor, Maine about 40 miles from the Laboratory and limousine service is available directly to Bar Harbor.

The Laboratory has a modest assistance fund for young investigators. This is usually not adequate for both laboratory costs plus living expenses during a research season.

For specific information regarding facilities, please write The Director, Mt. Desert Island Biological Laboratory, Salisbury Cove, Maine.



National Oceanographic Data Center (Architect's Remodeling Plan)

NATIONAL OCEANOGRAPHIC DATA CENTER

ANTHONY R. PICCIOLO AND WILLIAM L. MOLO

The National Oceanographic Data Center (NODC) is of interest to the American zoologist for three principal reasons: (1) NODC is planning and developing the storage and retrieval of marine biological information, in quantitative and qualitative form; (2) NODC has extensive files of physical oceanographic data which describe the marine environment in which the marine species exist; (3) the services of NODC are available to the scientific community and to the public.

For over one hundred years the United States has been acquiring and compiling oceanographic data. Many scientists have recognized the need for a central oceanographic data repository where data could be made available to all who needed them.

Based on a 1959 report of an Oceanographic Working Group, the Interagency Committee on Oceanography (ICO) recommended to the Federal Council for Science and Technology that the National Oceanographic Data Center be established, and that it be sponsored, financed, and its policies determined jointly by the Navy, the U. S. Coast and Geodetic Survey, the Weather Bureau, the Bureau of Commercial Fisheries, the National Science Foundation, and the Atomic Energy Commis-

sion. These recommendations were approved unanimously by the Federal Council on 28 June 1960.

NODC was established as an administrative component of the Hydrographic Office (now U. S. Naval Oceanographic Office) on 1 November 1960 and the Interagency Agreement was signed by the Secretaries of Commerce, Navy, and Interior, the Director of the National Science Foundation, and the Chairman of the Atomic Energy Commission on 23 December 1960. The oceanographic data holdings of the U. S. Hydrographic Office, consisting of more than 20,000,000 machine punched cards, data logs, reports, and other forms were transferred to the NODC.

NODC is managed in accordance with policies and procedures determined by an Interagency Advisory Board. This Board consists of representatives from each of the supporting agencies plus two representatives selected by the National Academy of Sciences, and is probably one of the best informed groups on the Nation's oceanographic activities.

The NODC Charter describes the areas of responsibility and functions of the Center. Primarily, the NODC is a central repository for the Nation's oceanographic

data. Part of its mission is: to receive, compile, process, and preserve oceanographic data for rapid retrieval; establish procedures for insuring that the accuracy and general quality of the incorporated data meet the criteria established by the Advisory Board, and to prepare data summaries, tabulations, and atlases showing annual, seasonal, or monthly oceanographic conditions.

NODC was established to function as a service activity for the Nation's scientific community and supplying their marine environmental data and information requirements. Data are available for public use free of charge at NODC, or copies of the data may be obtained at cost.

The staff of NODC as of December 1962 included 40 professional oceanographers (including specialists in physical, biological, geological areas) and about 40 other personnel.

The major program at NODC of interest to zoologists is the development of a holding-recall system for marine biological data. At present, the marine biological program of NODC includes two distinct classes of data: digital data which are collected and measured by sufficiently standardized or comparable techniques to allow recording and mechanical processing by punched cards and magnetic tapes; and data, both digital and descriptive, which cannot at the present time be recorded and processed by mechanical methods.

Standard punch card formats are being developed to process biological data which are amenable to machine processing. These include observations on primary productivity, plant pigments, phyto- and zooplankton, benthos, radiobiology, etc. In order to handle the second broad class of biological data, i.e., data not amenable to punch card techniques, a mechanized information storage and retrieval system is under development. Present plans call for retaining the original data reports as a microfilm record.

The biological activities of the NODC are closely coordinated with those of the Aquatic Sciences Information Group at

the University of Rhode Island, the information activities of the Bureau of Commercial Fisheries, the Defense Documentation Center, the Smithsonian Institution Science Information Exchange, the AIBS Biological Communications Project, and the American Geographical Society. The NODC maintains liaison with governmental, university, and private organizations which engage in any aspect of marine biological research.

A closer cooperation will undoubtedly develop between the NODC and the institutions concerned when the biological program becomes fully operational. Exchange of data and ideas on processing biological data are encouraged and have been found beneficial to NODC; the NODC expects to serve the data needs of the entire biological community.

The location of NODC within the District of Columbia is convenient to the many hotels, libraries, numerous governmental and private organizations, and several excellent universities in the Washington, D. C. area, as well as to the resources and collections of the U. S. National Museum. A National Aquarium is planned for the Washington, D. C. area in the near future. The Library of Congress, the American Institute of Biological Sciences, the Bureau of Commercial Fisheries, the American University, Georgetown University, the George Washington University, and the University of Maryland are among the many institutions in the nearby area of possible interest to marine biologist researchers. A complete description of the Federal Government's information services, which includes many agencies in the Washington area, is given in the publication, "Specialized Information Services in the United States," prepared by the National Science Foundation in November 1962.

Study rooms are available at NODC free of charge to the visiting scientist. Advance notification is requested to reserve a study room and it is advisable to indicate, in advance, the type of data and geographic areas of coverage required for study. Re-

productions of existing data or machine listings or tabulations can be prepared at cost. Arrangements can be made to maintain a fund or working account at NODC from which work costs could be extracted. Reproductions are generally by photostat, Ozalid, or Xerox process.

The NODC's Automatic Data Processing (ADP) facilities include both Electric Accounting Machine (EAM) equipment and a high speed computer system. The EAM equipment is located physically at NODC and consists of card punching machines, a card verifier, a sorter, a collator, a tabulator, and a card reproducing machine. The NODC is therefore well equipped for performing "in house" the non-computational phases of machine data processing. All computational work is done using a high speed IBM 1401/7070 computer system, which is currently housed at the U. S. Naval Oceanographic Office. The present NODC computer programs have been written for this system; however, the NODC expects to maintain a machine program library for use on oceanographic data.

The NODC publishes a General Series, a Catalog Series, and a Manual Series. Those available as of 1 January 1963 are:

Publication G-2, *Oceanographic Vessels of the World*.

Publication C-1, *Reference Sources for Oceanographic Station Data* (Provisional).

Publication M-1, *Conversion Tables, for Use by the International Indian Ocean Expedition*.

Publication M-2, *Processing Physical and Chemical Data from Oceanographic Stations*.

The following publications are currently in work:

Publication G-1, *Introduction to the National Oceanographic Data Center*.

Publication C-4, *Catalog of Oceanographic Data, Indian Ocean*.

Publication C-5, *Catalog of Oceanographic Data, North Pacific Ocean*.

The following publications were issued originally under another series but are now out of print:

Publication C-2, *Catalog of BT Data,*

World Wide. (Appeared originally as SP 12, Part II a.)

Publication C-3, *Catalog of Oceanographic Data, North Atlantic Ocean*. (Appeared originally as SP-12, Pt. II b, *Inventory of Oceanographic Data, North Atlantic Ocean*.)

Under its charter, the NODC is responsible for "acquiring by exchange, gift or purchase oceanographic data of scientific value from domestic or foreign sources." The NODC now has working exchange arrangements with 27 foreign nations, the International Council for the Exploration of the Sea, and the International Indian Ocean Expedition.

Data may be exchanged with the NODC in two ways: (1) For contemporary data, the NODC will process contributed data, preferably coded on NODC forms according to NODC procedures, and provide final listings and/or duplicate punch cards in exchange for the data. Bathythermograph slides will be processed by NODC standard procedures and copies of the final BT prints will be provided to the contributor. Basic NODC data forms (log sheets) and instructions are available on request. (2) For historical data or information (publications, reports, atlases, etc.) the NODC will exchange original or reproduced material in exchange for information of like kind.

Participants in exchange arrangements may delineate specific areas for which they require information. The NODC, on the other hand, has no geographic limits and will accept data or information from all oceans, seas, or estuaries.

NODC extends an invitation to all nations and to all institutions, corporations and individuals, both within and outside the United States, to exchange oceanographic data and information of all types with us, and we welcome the opportunity to be of service.

The mailing address for NODC is as follows: National Oceanographic Data Center, Washington 25, D. C.

The Center is located in Southeast Washington near the Anacostia River. The Director is W. C. Jacobs.



Institute of Fisheries Research—Laboratories and offices in T-shaped building, upper left center. Shop, net loft and dormitories in the near two-story wing of building in center. Research vessel tied to pier.

INSTITUTE OF FISHERIES RESEARCH OF THE UNIVERSITY OF NORTH CAROLINA

A. F. CHESTNUT, DIRECTOR

A four-year grant from the Knapp Foundation, Inc., with matching funds from the State, made possible the Institute of Fisheries Research. The grant from the Knapp Foundation was "a tribute to Joseph P. Knapp's life-long interest in the betterment of mankind." On September 29, 1947, the Board of Trustees established the Institute as a branch of the University of North Carolina. Professor Robert E. Coker was appointed as director. Later, Mr. William A. Ellison served as director from 1949 to 1955.

The basic purpose of the Institute is to conduct research directed toward a better understanding of the complex problems of marine science. Four interrelated research activities were envisioned: biological, oceanographic, economic, and educational.

Biological and oceanographic studies have been in progress. Educational activities have been limited to lectures and guidance in the graduate program. Special courses and direction of graduate studies in marine biology may be offered by the Institute staff upon approval by the Administrative Board of the Graduate School.

The Institute is governed through established administrative channels of the University. Local administrative details are delegated to the director and senior staff. An Executive Committee of seven members appointed by the President of the University determines basic policies.

Through an agreement between the University and Department of Conservation and Development, the Institute functions as a scientific agency in an advisory capa-

city on problems relating to marine and estuarine resources.

Six senior scientists, a boat captain, mate-engineer, two maintenance men, and a secretary comprise the permanent staff. Temporary research aides, usually students, are employed during summer months. Other temporary research assistants or technicians assist in research programs supported by funds from granting agencies.

Each senior scientist is responsible for the initiation and development of specific research programs. Current research includes: life history, ecological studies, and taxonomy of crustaceans, fishes and mollusks; oceanographic and primary productivity studies of North Carolina sounds and estuaries; and laboratory studies on the influence of environmental factors upon meristic structures in developing fishes.

A variety of fauna and flora is found in the immediate coastal and estuarine areas. Wharf piling, stone jetties, sand and mud flats, ocean beaches, sand dunes, oyster reefs, and marshes provide habitat for crawling, burrowing, and sessile forms. The open sea, sounds, rivers, canals, and creeks abound in pelagic biota.

The laboratories, offices, and library are housed in a one-story, frame building of approximately 7,700 square feet. The building contains standard biological equipment, a continuous flowing salt-water system, cold room, histology laboratory,

photographic dark room, culture room, air-conditioned laboratories, a small lecture room, and research collections of fish, decapod crustaceans, and mollusks. A research library contains about 400 volumes, 120 current periodicals, and over 10,000 reprints and separates relating to marine biology. In a nearby building, a two-story wing of about 12,000 square feet contains a shop with power tools, a net loft and dormitory space for about 20 men. A 47-foot, diesel-powered research vessel with sleeping accommodations for four is equipped with a hydraulic power winch for trawling and dredging. Four skiffs and runabouts, 15 to 20 feet in length, powered by outboard motors are used for shallow-water collecting.

Facilities for visiting investigators are limited in space and some modest sleeping quarters are available.

The research collections contain 3,646 catalogued series of fishes, 1,556 series of decapod crustaceans and 1,086 mollusks. These are available for research purposes and for loan to individuals.

The Institute is located five miles west of Beaufort Inlet on the north shore of Bogue Sound, within the city limits of Morehead City, N. C. The nearest airport is at New Bern, N. C. about 30 miles distant, although a summer schedule of flights is continued to the Morehead City-Beaufort Airport. The Institute, located on U. S. Highway 70, is readily accessible by bus or auto.

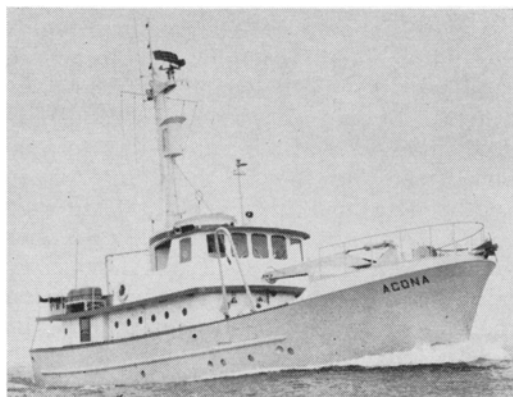
DEPARTMENT OF OCEANOGRAPHY, OREGON STATE UNIVERSITY

JUNE G. PATTULLO AND JAMES E. MCCAULEY

The Department of Oceanography at Oregon State University was established in 1959 to undertake research and to offer graduate training in all aspects of oceanography. The Pacific Ocean off Oregon has been inadequately explored due to its distance from laboratories with seagoing vessels.

Oregon State University has a large and vigorous School of Science as well as all the other facilities normally found in a modern university; the current enrollment slightly exceeds 10,000 students. The Department is located on the campus in Corvallis, Oregon. Access to the ocean is through the town of Newport; travelling from campus to the open sea is less than two hours. All these factors influenced the Oregon State Board of Higher Education and the Office of Naval Research to select this location. The latter provided most of the funds for initial staffing, supply of equipment, and support of research in the new department. Current research support, in addition to continued generous funds from the Office of Naval Research, is provided by the National Science Foundation, the Atomic Energy Commission, and the Air Force Office of Scientific Research. Teaching costs, including teaching faculty salaries, come from the State of Oregon through the Board of Higher Education.

The basic research tool for an oceanographer is a ship. The Department operates the *R/V Acona*, specially designed for oceanographic research work. The *Acona*, built in Portland, Oregon, with funds provided by the Office of Naval Research, is the first vessel constructed in the United States for oceanographic work in nearly thirty years. Special features include an auxiliary bow engine, for maneuverability at very low speeds; a deep-sea crane and winch with 18,000 feet of wire rope, for handling equipment weighing up to a ton; an underwater port and lights for observ-



The *Acona*, an 80 foot oceanographic vessel operated by Oregon State University

ing marine life under the ship; and precision depth-determining and navigational equipment. The ship was commissioned in May 1961. In the first year and a half of operation it has cruised more than 15,000 miles and has been at sea about 50% of the time.

Research projects under way include studies of currents, water masses, and oceanographic fronts; detailed mapping of the topography and sediments of the bottom; chemistry and radiochemistry of sea water and of marine organisms; gravity and seismic work to determine the structures beneath the sea floor; and inventory and ecological studies of flora and fauna obtained from the ocean waters and the sea floor at various trophic levels. Specialists are studying bacteria, phytoplankton, zooplankton, nekton, and benthic organisms.

The departmental staff includes 31 research workers and technicians, eight office and supporting personnel, and the crew of seven on the *Acona*. In addition, twenty-four of the thirty-two graduate majors assist in research projects one-third time, and four other students are supported on fellowships from the U. S. Public Health Service or the U. S. Fish and Wildlife

Service. The research and teaching staff includes sixteen professors representing a wide variety of fields.

The present area of study is the ocean to a distance of 165 miles off the Oregon coast. The ocean off Oregon is a highly interesting and complex environment. Offshore, the North Pacific Drift flows toward the coast, and, when still several hundred miles from the coast, divides to send one stream flowing north along Alaska, another stream south along the California coast. To the northwest lies the cold, low-salinity water of the Gulf of Alaska, containing subarctic fauna. To the southwest the water is warmer and saltier, and the populations differ from those in the Gulf. Oregon is an area of mixing between these two.

Along the coast the surface currents follow the winds, moving principally from north to south in summer and south to north in winter. The summer flow is often accompanied by intense upwelling of cold water along the coast and coastal water temperatures drop to as low as 6° or 7°C. Deep currents (1,000 meters and below) along the coast are believed to be from the south because the water at these depths is relatively warm and salty.

Surface salinity fluctuates widely. During summer upwelling, the salinity of the water along the coast may be 34⁰/₀₀, while offshore the southward-flowing discharge from the Columbia River reduces it to less than 30⁰/₀₀. During winter the flow northward along the coast is of water of about 32⁰/₀₀, but local rainfall often reduces nearshore values to below 30⁰/₀₀.

The biological studies are designed to complement each other and to be part of a broad study of the ocean. An intense study of phytoplankton composition, physiology, primary production, and grazing set the groundwork for studies at higher trophic levels. Zooplankton are collected regularly at hydrographic stations, using a Clarke-Bumpus net. Sampling for macroplankton by meter-net tows has begun.

In addition, there is under way a study of the dynamics of zooplankton population

in Yaquina Bay, Oregon, where a good correlation exists between the changes that occur in the plankton species and changes in the physical and chemical properties of the waters of the bay. Weekly samples have been collected for more than three years and patterns are beginning to be clearly discernible.

Nektonic studies and ichthyofaunal studies have been proceeding for more than 18 months, and a familiarity with the fauna has been gained. Midwater fish species have been taken with an Isaacs-Kidd midwater trawl, and benthic fishes with an otter trawl. The composition of the nektonic fauna and the migrational habits of the component members are being studied.

Benthic research includes a study of the species composition of the fauna of the bottom of the ocean, and an inventory of the forms that are present. Benthic communities are being defined, and the dynamics of the populations are being studied. Otter trawl and anchor dredge collections have been made to depths of more than 2200 meters.

Radioactivity studies are being made of both benthic and nektonic organisms. Indications to date are that organisms on the second trophic level, i.e., those feeding on algae, concentrate radioactive isotopes more readily than those on higher trophic levels.

Collections to date are almost entirely research collections. At the present time we are inventorying marine animals in all categories with the aim of preparing checklists in the future. Publication of results is through existing journals, and collected reprints are not available at this time.

The Department is presently housed in the new Physics-Chemistry building on campus, and has full laboratory facilities, except that there is no provision for maintaining living animals in the laboratories.

Funds have been granted by the National Science Foundation and by the Oregon State Board of Higher Education for construction on campus of a four-floor, 29,000-square foot oceanography building, which should be completed by mid 1964.

Work will also be begun soon on a marine sciences laboratory at Newport, on Yaquina Bay. The city of Newport has leased approximately 50 acres of bay front land, just inside the harbor entrance, to the State Board of Higher Education. The Area Redevelopment Administration has granted funds of over \$950,000 for construction. The building will contain almost 34,000 square feet of floor space and will be supplied with running sea water for use in research in oceanography, fish-

eries and water resources. It will also house a marine museum, a public aquarium, and an auditorium.

Present work is conducted on a full-time basis, and no special summer programs either in research or training are undertaken. Whenever space permits, visiting investigators are welcomed both in the laboratories and on board the *Acona*. The staff would welcome inquiries from interested scientists.

Address is Corvallis, Oregon.



Aerial view of immediate environment of Institute of Oceanography and Marine Biology, Oyster Bay, New York

THE INSTITUTE OF OCEANOGRAPHY AND MARINE BIOLOGY, OYSTER BAY, NEW YORK

WALTER E. TOLLES, DIRECTOR

The Institute of Oceanography and Marine Biology was established in 1959. Its objectives are to establish and carry out programs of pure and applied research in the area named, and to provide facilities for training, instruction and marine exploration.

The accompanying photograph shows the immediate environment of the Institute. Long Island Sound is to the north at

the top of the photograph, Oyster Bay and estuaries are westward, and Cold Spring Harbor is to the east. Thus, an extremely wide range of physical habitat is available for study and instruction.

The principal interests of the laboratory lie in the areas of a) The study of underwater ecological communities; b) The study of marine fluorescence; c) Electrophysiology of fish and shellfish; d) The

development of quantitative methods for behavioral experiments; e) The development of instrumentation, principally optical and electrical, for physical oceanography.

At this time, the orientation of most of the interests of the laboratory is toward physical methods of quantitation of biological experiments. With growth and progress, the addition of interests and competence in the chemical aspects of this field is expected.

The laboratory itself is in temporary

quarters. It possesses adequate space and facilities for the present level of activity, but does not have facilities for visiting investigators at this time. It is well equipped for work in all types of microscopy (except interference) and for projects requiring electronic, electrical, mechanical, and hydraulic facilities. Small craft, diving equipment, and underwater photographic equipment are at hand for underwater investigations. Portable generators allow experiments requiring substantial power to be carried out on the water or at remote locations.

INSTITUTE OF MARINE BIOLOGY, UNIVERSITY OF PUERTO RICO

JOHN E. RANDALL, DIRECTOR

The Institute of Marine Biology of the University of Puerto Rico was established on February 8, 1954. The main office and laboratory building is on the campus of the College of Agriculture and Mechanic Arts in Mayaguez at the western end of Puerto Rico. The field station is located on Magueyes Island, La Parguera, 22 miles southeast of Mayaguez. The island is about 18 acres in area and is separated from the shore by a narrow channel. The existing laboratory is small, the main room measuring 22 by 35 feet, but is well equipped. A 40 by 100-foot laboratory building is under construction. There is also a maintenance building and a dormitory with kitchen and eight rooms. The Institute has a 65-foot research vessel, the *Carite*, the 28-foot *Pelicano* and several skiffs.

La Parguera is in the dry southwest part of Puerto Rico. Because of the small amount of rainfall and the absence of rivers in the region, the sea is usually clear. The location of the field station is particularly advantageous in that it is close to many different marine environments. Numerous well-developed coral reefs occur up to six miles offshore. The shore and a



Laboratory Building, Institute of Marine Biology, University of Puerto Rico, Mayaguez, Puerto Rico
La Parguera, Puerto Rico

number of small islets are lined with luxuriant mangroves. Dense beds of turtle grass (*Thalassia*) abound. Two miles to the east lies unique Bahía Fosforescente (Phosphorescent Bay), famed for luminescence produced by dinoflagellates. A few miles to the westward is Cabo Rojo; here bold rocky coast alternates with sandy beaches. Salt flats in this region harbor dense populations of brine shrimp (*Artemia*). La Par-

guera is primarily a fishing village, and Puerto Real to the north of Cabo Rojo is one of the two major fishing centers on the island. Deep water (up to 500 fathoms or more) may be found within five to seven miles of the laboratory.

A six weeks course in marine ecology is taught in English at the field station in summer, beginning about mid July. The course is designed for both students of the University of Puerto Rico and for visiting students. It is an undergraduate course, but graduate credit may be given.

Beginning in August, 1963 a curriculum will be offered at the University of Puerto Rico leading to a master's degree in biology. A student may major in marine biology. Some required courses are taught in Spanish, some in English.

Current programs of research of the Institute include systematics and ecology of marine algae of the Caribbean, coral reef ecology, systematics of marine copepods and productivity of inshore and offshore waters of Puerto Rico, biology of the West Indian topshell, biology and classification of West Indian fishes, classification of West Indian opisthobranchs and other mollusks.

Senior staff members include L. Almodóvar (algology), G. Bane (fishery biology), P. Glynn (ecology), J. G. Gonzalez (biological oceanography), M. Diaz Piferer (algology), J. Randall (ichthyology), and G. Warmke (malacology).

The Institute hopes to add staff members in the future in the fields of microbiology, invertebrate taxonomy, and biochemistry. An exploratory fishing program for pelagic fishes is in operation.

A series of guidebooks on marine organisms of the West Indies is planned. *Caribbean Seashells* by Warmke and Abbott is completed. One on fishes is in preparation (J. Randall), as is one on corals (Almy and Carrión).

A book on tropical marine ecology entitled "Comunidades Naturales" by visiting investigator Ramón Margalef has just been printed as a special publication of the Institute of Marine Biology. It is available from the Institute at nominal cost.

The Institute distributes bound volumes of its collected reprints on an exchange basis for comparable literature from other marine stations. It would welcome an increase in such exchange.



Sandy Hook Marine Laboratory

THE SANDY HOOK MARINE LABORATORY, BUREAU OF SPORT FISHERIES AND WILDLIFE

L. A. WALFORD, LABORATORY DIRECTOR

The central laboratory building is a converted 50-bed hospital which was given to us by the U. S. Army. The building is well located and extraordinarily adaptable to the requirements of marine research. It is sufficiently commodious to provide offices, library, laboratories, study collections, aquaria and shop, and to accommodate not only the resident staff but also a considerable number of visiting biologists and graduate students. Ample docking facilities are available at nearby piers.

The laboratory is on the shore of Sandy Hook Bay, into which several rivers empty, and is little more than one-half mile from the open Atlantic Ocean. Thus it is within easy reach of a remarkable variety of ecological situations — oceanic, coastal, bay, estuarine. It is near principal transportation facilities and several universities that are engaged in oceanographic studies. Finally, Sandy Hook is near the center of one of the greatest concentrations of sport fishing in the world, and one which draws from species of boreal, transitional, and tropical life zones.

Just two years ago the first of our staff arrived here. During the first year, substantial progress was made in the extensive job of renovating the laboratory building to adapt it to its new function. Accomplishments of particular importance were the installation of a sea water system for laboratory experimental work and a microbiology laboratory and micro-organism culture facility. This is only the beginning stage of an extensive long-term development program.

The central laboratory plant now consists of a three-story main building and annex with floor space of 27,000 square feet. There are also three smaller adjacent buildings in use, and in addition a building housing six large sea-water tanks which have a total capacity of over 400,000 gallons. The development of this unique facility is awaiting acquisition of funds for restoration and modification; it is expected to be ready in 1964.

The laboratory is the central marine research facility of the U. S. Bureau of Sport Fisheries and Wildlife. It is operated un-

der a congressional act, Public Law 86-359, passed in 1959 which directs the Secretary of Interior to: ". . . undertake a comprehensive continuing study of the migratory marine fish of interest to recreational fishermen of the United States, including species inhabiting the offshore waters of the United States and species which migrate through and spend part of their lives in the inshore waters of the United States. The study shall include, but not be limited to research on migrations, identity of stocks, growth rates, mortality rates, variations in survival, environmental influences, both natural and artificial, including pollution, and effects of fishing on the species, for the purpose of development of wise conservation policies and constructive management activities."

This charter is a landmark in the history of Federal work relating to conservation of marine fish resources on three counts: First, it is a response to the growing concern of the general public throughout the nation in preserving the recreational values of the sea fish resources and their environments. Second, the Congress, in providing for research to this end, has recognized the necessity of continuity—of taking the long view. Third, it emphasizes that the research program must be comprehensive.

The Charter is as remarkable for what it does not say as for what it does say. It does not specify any local problems; it does not designate any species of fish for special attention; it does not prescribe any technique of conservation; nor does it limit the program to any particular line of research. The law does open the way for seeking fundamental principles; it directs that the program be national in scope and that it include all species of concern to people who fish in the sea for recreation.

Experimental aquarium. Sea water of salinity 23‰, temperature 54°F, pH 7.7, and 6.0 ppm oxygen, located at a depth of 57 feet, approximately 50 feet from the bay is pumped under pressure to the laboratory at 23 gallons per minute utilizing a submersible pump and PVC plastic pipe.

These characters have remained constant despite wide fluctuations in temperature and salinity of bay water. The experimental aquarium is furnished with equipment that is commonly used in fish rearing activities. Total capacity of all aquaria in the main tank room is 5,200 gallons, including a 3,500-gallon concrete holding tank and two 250-gallon aquaria. In a separate building we have six large concrete tanks with total capacity exceeding 500,000 gallons. These tanks will be remodeled and should be available for research in early 1964.

At present, large numbers of actively-feeding mullet, killifish, and silversides are maintained. Other species of fishes which have adapted well to aquarium life for at least one month include blackfish, eels, winter flounder, blowfish, pipefish, white perch, northern kingfish, toadfish, anchovies, goosefish, and sticklebacks. Great difficulty was experienced with maintaining adult striped bass, fluke, porgies, and blue fish, but this problem will be solved with time.

Microbiology. The microbiological laboratory consists of three large, well appointed rooms at ground level. A media preparation room is stocked with all reagents commonly used to culture planktonic organisms. There are chemical-resistant tables and benches, sinks, cabinets, etc. A good stock of pipettes, flasks, test-tubes, graduated cylinders, beakers, clinical centrifuges (2), colorimeter, various balances, hotplates, pH meter, vacuum system, and precision thermometers is available.

The service room houses a large steam autoclave suitable for mass-culture work and equipped with automatic controls. Distilled water of unusually high purity is supplied by a Loughborough Glass Still. An automatic pipette washer and baskets are available, also two large sinks, bacteriological incubators and a 600°C muffle-furnace (for baking pyrogens from glass-ware surfaces).

A constant temperature room for growing cultures is equipped with banks of

40-watt cool, white, fluorescent lights arranged in three tiers of nine lamps each. These are discontinuously variable in intensity, and are connected to an automatic timer for variation in diurnal cycle if desired. A shelf 3' \times 10' fronts each tier and will support thousands of test-tubes or hundreds of mass culture flasks. The room is maintained at 20°C. Space and a special table are reserved for a research microscope and its equipment, routine microscopy remaining in the preparation room. Temperature is checked constantly by automatic recording devices. Cabinets for "dark-growth" of heterotrophic microorganisms and light-labile organisms (fish eggs) are installed. Space is reserved for two recirculating marine aquaria, each containing six 5-gallon tanks and filtering apparatus. A cabinet for sterile inoculation of cultures, equipped with visible and ultraviolet sources of light and gas vacuum jets has been built.

Radiation laboratory. In the basement, a suite of six rooms is easily modifiable for radiation equipment and laboratories. These rooms are in close proximity to the experimental aquarium and microbiological laboratories. One room formerly housed an X-ray unit and can be reconverted to this purpose. Modification of another room to a chemistry laboratory is completed as described below. Office space is available for tabulation and analysis of data on the first and third floors of the main building.

Chemistry laboratory. A small laboratory for general chemical analysis is outfitted with minimal standard equipment and instruments. Standard reagents and glassware are stocked.

Other laboratory facilities. Most facil-

ities described are presently fully utilized. A number of small unequipped work rooms are available for individual researchers. Arrangements can be made to provide working space for visitors who can provide their own equipment and instruments.

A large tiled area, with table space, sinks, and disposal unit, is available for preserving, sorting field specimens, making gross dissections of large fishes, and so forth.

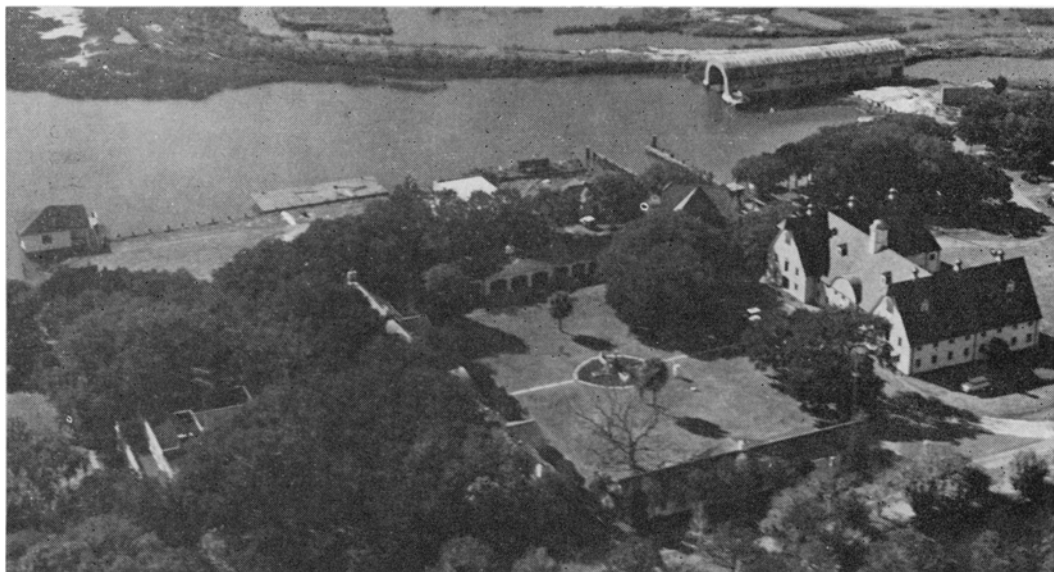
As a U. S. Fish and Wildlife Facility, the laboratory's major publishing medium is the Fish and Wildlife Research Report series. Other Fish and Wildlife Service publications are utilized, as are outside sources. We are most interested in arranging an exchange of any U. S. Fish and Wildlife Service publications for publications of other laboratories and agencies.

The laboratory has a small but growing library with a full-time librarian, and is developing on a broad plan to encompass all fields of marine science.

The American Littoral Society, an amateur group with national headquarters at this laboratory, publishes the *Underwater Naturalist*.

A central reference collection of both vertebrates and invertebrates is being developed as time permits. We are engaged in exchange of materials with other laboratories in many parts of the world. Many local animals are represented in quantity, but collecting additional specimens is a simple matter because of our strategic location.

The laboratory is located in New Jersey on the Sandy Hook Peninsula on the Fort Hancock reservation. Mailing address is P.O. Box 428, Highlands, New Jersey.



Sapelo Island laboratory and associated quadrangle buildings

SAPELO ISLAND RESEARCH FOUNDATION, THE UNIVERSITY OF GEORGIA MARINE INSTITUTE

GEORGE H. LAUFF

The Sapelo Island Research Foundation was established in 1949 as a private, charitable, and non-profit organization through the generosity of Mr. Richard J. Reynolds. It was originally incorporated as the Georgia Agricultural and Forestry Research Foundation, but the charter was amended in 1959 to rename the organization in light of the activities it supported. It was envisaged as promoting basic research in agriculture, forestry, and allied fields, and made the essentially unmolested environs of one of the major barrier islands of coastal Georgia available as a natural laboratory.

Affiliation with the University of Georgia resulted from an invitation extended to the University by the Foundation to propose a program which might utilize certain resources of the island. In 1953, financial assistance was provided to support the establishment of the Marine Biology Laboratory, later reorganized as the University of Georgia Marine Institute, with the pri-

mary objective of pursuing basic research on biological productivity in the coastal waters and marshes of the Sapelo Island region.

Development of research quarters was initiated early in 1954. Ample space for laboratories and related services was immediately available in buildings adjacent to a boat basin, while additional facilities for the comfort and work of the staff complement were also provided. The basic plan of the laboratory and related buildings on the "quadrangle" offered excellent potential for future development. Within the past nine years, increase in staff and expansion of the research program have permitted efficient utilization of approximately one-half of the potential laboratory space.

The Sapelo Island Research Foundation is administered by an elected Board of Trustees; the research programs it supports are the responsibility of the Research Coordinator, assisted by the counsel of an in-

vited panel of prominent scientists. The Foundation provides major financial and facilities support for the operation of the University of Georgia Marine Institute, organized under the Office of General Research of the Graduate School. The Institute is administered by its Director, working in close cooperation with the Research Coordinator and a Scientific Advisory Board appointed from the University staff.

The staff complement of the laboratory consists of six resident senior scientists, while two others have half-time teaching appointments with academic departments on the University of Georgia campus. They are supported by six technical and research assistants, and two secretaries. There is a maintenance and labor crew of ten.

Major research emphasis of the Sapelo Island laboratory is related to the nature of the local habitats, the interests of the resident staff and visiting investigators, and the facilities being developed. Current biological research centers on aspects of productivity of the salt marsh, estuarine, and inshore communities, and includes biogeochemical cycles of essential elements, animal-substrate relationships, and halophyte physiology. Geological interests include the entire barrier island system, but particularly aspects of sedimentology and geochemistry. Visiting scientists have active programs in biochemistry of luminescence, marine microbiology, elasmobranch physiology, and ecology of fishes. Doctoral students from several universities are pursuing research in production ecology, ichthyology, paleontology, and geology. In addition, a broad spectrum project in systematics of the regional biota has been inaugurated, and the development of a botanical garden-arboretum is in progress.

The laboratory provides access to a diversity of aquatic and terrestrial habitats. The island is approximately ten miles long and four miles wide, and has over five miles of ocean front with associated sandy and silty beaches and dune developments. The continental shelf is broad and extends offshore fifty or more miles. Several miles of salt marsh-estuary-

tidal creek systems separate the island from the mainland. Sounds and shallow bays lie along the coast to the north and south. Aquatic environments on the island also include several fresh-water ponds, as well as cypress and gum-bay swamps. Terrestrial habitats include old field environments and extensive areas of pine-palmetto and pine-hardwood stands, some of which are essentially virgin in character. Blackbeard Island, a national wildlife refuge, borders Sapelo on the northeast.

The biota of the area is poorly known at the present time, and no faunal checklist is available. Important species readily obtainable include the following: Anthozoa, *Renilla reniformis*; Crustacea, *Uca pugnax*, *U. pugiliator*, *U. minax*; Gastropoda, *Littorina irrorata*; Pelecypoda, *Modiolous demissus*; Asteroidea, *Luidia clathrata*. The terrestrial fauna is, for the most part, typical of the semi-tropical environment. The vascular plants are being catalogued and a preliminary checklist has been prepared.

Excellent facilities exist for both laboratory and field studies. The physical plant is largely air-conditioned and includes modern offices, laboratories, radioisotope and chromatographic facilities, as well as a running sea-water system. All research laboratories are well equipped, major additions having been made within the last three years. The library includes more than eighty current journals, as well as basic reference materials; the holdings and services of the University of Georgia libraries are available on request. Field work facilities include a sixty-five foot diesel research vessel equipped with a hydraulic hydrographic winch, a heavy duty winch, an ELAC fathometer, Loran, and RDF equipment. Numerous small craft, as well as standard biological and geological collection equipment are available. A motor pool is maintained for land transportation.

Living accommodations are excellent and include fifteen housing units, most of which are newly constructed or renovated and have three or four bedrooms. Dorm-

itory space for eighteen is available. A fresh-water swimming pool, tennis court, and other outdoor recreation facilities are readily accessible.

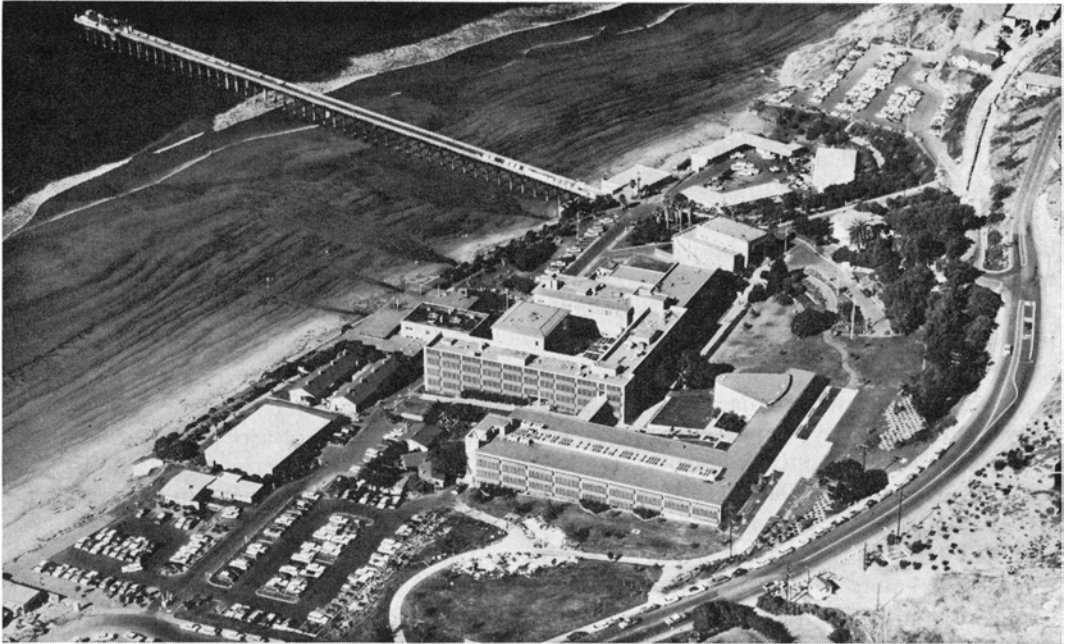
Increase in resident scientific staff has largely eliminated seasonal fluctuations in the size of the research group, with the exception of summer assistants. Limited accommodations for visiting investigators and graduate research are available. Requests for research space and financial support are considered in relation to the overall research program. No formal academic training is now offered, although field excursions of class groups are encouraged.

The University of Georgia Marine Institute has distributed two volumes of Collected Reprints to date; the Sapelo Island Research Foundation will initiate a miscellaneous publication series in the near future. Requests for establishing exchange agreements are solicited.

During recent years, the laboratory has accumulated an extensive collection of bio-

logical materials from the Sapelo Island area. Collection activities are now being intensified and extended to enhance the research museum and limited teaching collections that have been established. Exchange arrangements with other laboratories on the southeastern Atlantic seaboard would be welcomed.

Sapelo Island is a private island accessible only by boat or plane. It is located approximately forty-five miles south of Savannah, Georgia, and ninety miles north of Jacksonville, Florida. Commercial air lines also serve Brunswick, Georgia, where air charter service to Sapelo is readily available. The Sapelo Plantation Dock on the mainland is located just off Highway 99, approximately nine miles northeast of Darien, Georgia. Notice in writing should be given prior to any proposed visit. Inquiries concerning accommodations, facilities, and related matters should be directed to the Research Coordinator, Sapelo Island Research Foundation, Sapelo Island, Georgia.



Aerial view of Scripps Institution, February, 1963 (Photo by United Aerial Survey)

SCRIPPS INSTITUTION OF OCEANOGRAPHY, UNIVERSITY OF CALIFORNIA

CARL L. HUBBS, PROFESSOR OF BIOLOGY

The oceanographic branch of the University of California has earned a worldwide reputation as a major, year-round center for research and graduate training in marine sciences, including various phases of zoology. It is in La Jolla, on the "lower campus" of its outgrowth, the newly developing University of California, San Diego. There is a substantial segment at the Navy Electronics Laboratory, about 14 miles distant. In many respects, the sea is the Institution's chief laboratory.

Closely associated, geographically and in research, are other units of the University, particularly the Institute of Marine Resources, the Institute of Geophysics and Planetary Physics, and the new School of Science and Engineering (including a Department of Biology, specializing in biochemical genetics); also, two biological laboratories of the U. S. Bureau of Commercial Fisheries and the Inter-American

Tropical Tuna Commission. Close relations are maintained with the Navy Electronics Laboratory, with the expanding research activities of the San Diego Zoological Gardens, the San Diego Natural History Museum, and other scientific institutions, especially those engaged in the California Cooperative Oceanic Fisheries investigations.

History and scope. The antecedent of Scripps was a field investigation of coastal animals inaugurated in 1892 by William Emerson Ritter, head of Zoology at the University of California. On transfer to San Diego in 1903 this enterprise became the function of the Marine Biological Association of San Diego, a private organization locally supported, notably by Ellen Browning Scripps and E. W. Scripps. In 1912 this activity was integrated into the University, as the Scripps Institution for Biological Research. In 1925, after the

functions of the station had expanded under Dr. Ritter, and for two years under Thomas Wayland Vaughan, to cover other marine sciences, its name was changed to Scripps Institution of Oceanography. Growth continued under Dr. Vaughan and accelerated, from 1936 to 1948, under the distinguished Norwegian oceanographer Harald U. Sverdrup. This acceleration was due largely to the realization, during and after World War II, that proficiency in oceanography is essential to national security.

As the importance of oceanography has become increasingly appreciated, the institute's scope and activity have expanded under Carl Eckart (1948-1951) and Roger Revelle (1951-). From 1946 to 1962 the Scripps faculty increased from 12 to 25; the total personnel from 50 to approximately 800 (including 110 ranking from Assistant Professor or Assistant Research Scientist upward); the State support from \$64,000 to \$1,500,000; the total financial support, including research contracts and grants, from \$150,000 to \$7,900,000, gross square footage of permanent buildings from 42,854 to 220,788 (including space temporarily occupied by the School of Science and Engineering, but excluding extensive quarters at the Naval Electronics Laboratory); the research ships from one schooner to a fleet of 8 ocean-going vessels ranging in length from 65 to 180 feet and in gross tonnage from 99 to 2,079.

Marine biology at Scripps was markedly advanced during the 1950's by a million-dollar grant from the Rockefeller Foundation.

Instruction and research. The instructional departments, exclusively graduate, are Oceanography (including biological oceanography, ecology, fisheries, and other phases of environmental biology) and Marine Biology. There is, as yet, no special summer curriculum, except for undergraduate and advanced high-school trainees.

Research units are: Oceanic Research Division, Earth Sciences Division (associated with the Department of Earth Sciences of the School of Science and Engi-

neering), Marine Biology Division, Marine Physical Laboratory, Visibility Laboratory, Marine Life Research Group, and Applied Oceanography Group. Organized Research Programs are: Marine Life Research, Scripps Tuna Oceanography Research (STOR), and Indian Ocean Investigation.

Administration. Scripps Institution is administered by a Director, responsible to the University President through the Chancellor of the San Diego Campus.

Major zoological research programs. Numerous zoological topics are included among the research activities of staff and students. Various aspects of comparative animal physiology are being emphasized. Other investigations pertain to animal pigments, role of particulate matter in the nutrition of marine animals, productivity and grazing, accumulation of trace elements, vision, bioluminescence, population dynamics, and ecological analyses. Systematic, life-history, zoogeographical, and oceanographic researches are being conducted on various groups, including Radiolaria, Foraminifera, Chaetognatha, Copepoda, Euphausiidae, other Crustacea, and pelagic molluscs and tunicates. A special topic is comparative cardiology, with particular attention to the aneural heartbeat of cyclostomes. Many staff members of Scripps and associated laboratories work on the systematics, distribution, life-history, population dynamics, and economics of fishes, with some attention to other marine vertebrates. Paleoecological researches deal with prehistoric man as well as with other animals and their changing environments. Plant physiology and microbiology are strong cognate fields.

Publications. Publications include: *Bulletin of the Scripps Institution of Oceanography*, issued irregularly by the University Press; annually collected reprints from journals (*Contributions from the Scripps Institution of Oceanography*); *Oceanic Observations of the Pacific*; *Data Report* (in SIO Reference series); a descriptive brochure on the Institution, course announcements, etc. Exchanges are maintained.

Habitats and faunas. San Diego lies in the warm-temperate zone of the rich North Pacific fauna, within easy reach of the cool-temperate fauna (even richer, especially intertidally) in central California, and of tropical forms in the Gulf of California (the cooperating San Diego Society of Natural History maintains a field station on the Gulf). Among marine mammals gray whales (*Eschrichtius gibbosus*) migrate alongshore annually and breed in Baja California lagoons; other cetaceans occur; and elephant seals (*Mirounga angustirostris*), California sealions (*Zalophus californianus*), and other pinnipeds are common on adjacent islands. The marine bird fauna is rich. Sea turtles (Cheloniidae) abound within reach to the south. The rich shore-fish fauna includes numerous ovoviviparous and viviparous teleosts, notably many species of *Sebastes* and the unique Embiotocidae. A blind goby (*Typhlogobius californiensis*) is intertidal. Several hagfishes (Myxiniidae) are readily collected. Among shoreline invertebrates, sea urchins, sand dollars, and other echinoderms abound, along with a good representation of other phyla.

The faunal resources at Scripps Institution are particularly rich in the bathypelagic area, which can be reached in two hours and is widely available to the fleet.

No inclusive local faunal list has been published. There are lists of the local birds, reptiles, fishes, and algae, and the region is covered in monographs of various pelagic invertebrates.

General facilities. The outstanding facility is the Scripps fleet of eight ocean-going vessels plus locally operating smaller craft. Two vessels are equipped to dredge to the greatest depths. A revolutionary craft, the FLIP (Floating Instrument Platform), which when shifted into stable, vertical position draws 300 feet, was recently launched. Two ships, one for physiological research, are on the drawing boards. A radio station (WWD) provides daily contact with the fleet, which is operated and maintained by our own Marine Facilities, with headquarters provided by

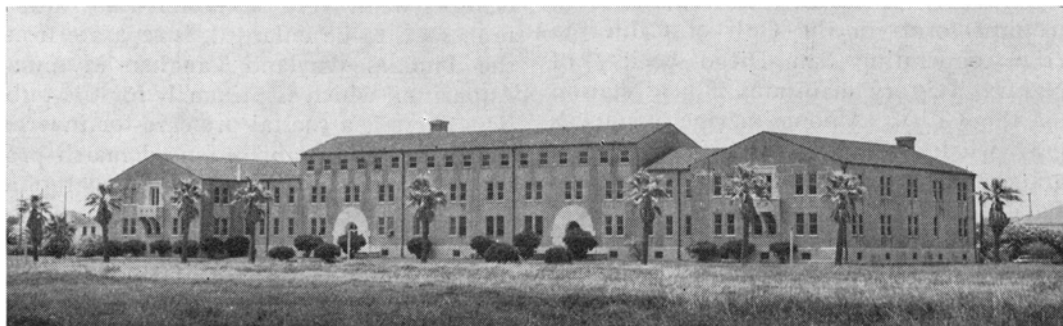
the Navy in San Diego Bay. The 1000-foot pier at the La Jolla campus provides for instrumentation, for launching small craft, and as the source of the ample salt-water system. The Experimental Aquarium, soon to be enlarged, is separate from the Thomas Wayland Vaughan Museum-Aquarium, which is primarily for the public. There is a coastal preserve for invertebrates and algae, and a fenced marsh preserve in Mission Bay. The Oceanographic Data Archives include, for example, more than 300,000 processed bathythermograph records. The Scripps Library, especially rich in oceanographic material, is expanding in basic and cognate fields, and is being supplemented by the rapidly enlarging general library of the San Diego campus. Extensive research and teaching collections encompass marine vertebrates, with emphasis on bathypelagic and Pacific Coast fishes; invertebrates, predominantly bathypelagic; marine-geological samples, including refrigerated bottom cores; and sea-water samples from various depths. Specimens are exchanged with other institutions. Well-equipped shops include research and development functions. A modern, general-purpose, multi-computer system serves Scripps. A radiocarbon laboratory, mass spectrometers, electron microscopes, and various other laboratory facilities are in service. A large pool with towing equipment and a new building for research in comparative physiology have been funded for Scripps and the Brain Research Institute by the National Science Foundation.

Visitor facilities. Many visiting scientists conduct research in the Institution, either independently or in collaboration with the staff. They are accommodated during the summer as well as other seasons, but there is as yet no regular summer session. Opportunities for visiting workers are expanding as other units of the University, by moving to the upper campus, release space for Scripps Institution. Funds are occasionally provided for visiting scientists. Housing facilities, except for married students, are very limited on the campus, but

are obtainable in adjacent communities. Meals are available on the campus.

Location and address. The Institution

is in La Jolla (about two miles north of the village center, within the northern city limits of San Diego).



A & M Marine Laboratory, Fort Crockett, Texas as viewed from the Gulf of Mexico

DEPARTMENT OF OCEANOGRAPHY AND METEOROLOGY A & M COLLEGE OF TEXAS

DALE F. LEIPPER, HEAD OF THE DEPARTMENT

The Department of Oceanography and Meteorology was established by the Agricultural and Mechanical College of Texas in 1949. Full curricula leading to the M.S. and Ph.D. degrees are available in the various oceanographic disciplines — biological, chemical, geological, meteorological, and physical. B.S., M.S., and Ph.D. degrees are offered in meteorology.

In 1954, the Department established the Galveston Marine Laboratory in Galveston, Texas. In 1958, the laboratory was moved to its present location at Fort Crockett, and in early 1962 the name was changed to the A & M Marine Laboratory. Administration of the facility remains with the Department of Oceanography and Meteorology.

The laboratory is located in old Fort Crockett at Avenue U and Sias Street. The front of the building faces the Gulf of Mexico which is about 300 yards distant. The building, constructed in 1937, is a modern steel and masonry structure, 100% fireproof. It is approximately 340 feet long, 50 feet wide in the center section and three stories high, containing approximately 65,000 square feet of usable space.

Present plans call for the west wing to be devoted entirely to research and the east wing to be used for teaching purposes. Beginning in 1963, the recently organized Texas Maritime Academy will occupy the east wing.

Research space is supplied with laboratory benches and water tables. Each laboratory has individual air conditioning which can be adjusted over a reasonable temperature range. There are six special purpose areas: darkroom, "hot lab," radiation-counting laboratory, histology laboratory, hazardous material laboratory and low-temperature light room for algal cultures. In addition there is a large laboratory (30' \times 60') designed for the culture of marine organisms. The air conditioning system in this laboratory is designed to maintain $70 \pm 2^\circ\text{F}$. There are six rooms designed to accommodate individual investigators. The basement houses a wood-working shop, pipe shop, electric shop, machine shop, refrigeration machinery, air compressors, etc.

Objectives of the A & M Marine Laboratory are: (1) To conceive and execute researches contributing to the understand-

ing of the dynamic processes of and the interactions between the living and the non-living elements of the oceanic environment; and (2) To utilize the facilities

of the laboratory and its research programs to extend the teaching potential of the Department of Oceanography and Meteorology.



Virginia Institute of Marine Science

VIRGINIA INSTITUTE OF MARINE SCIENCE

WILLIAM J. HARGIS, JR., DIRECTOR

The present Virginia Institute of Marine Science evolved from the Virginia Fisheries Laboratory, founded in 1940 as part of the College of William and Mary and the research agency for the Virginia Commission of Fisheries. The Institute's original purpose was to undertake research useful in the management of the seafood and sport fishing industries. At the same time it offered an undergraduate and graduate program in marine science through the Department of Biology of the College of William and Mary, and gave general information to the public.

The demand for marine research by industrial, business, and recreational interests, as well as by the fishing industries and the government, and the need for basic information about the marine environ-

ment led the 1962 General Assembly to restate the functions of the laboratory and to rename the laboratory the Virginia Institute of Marine Science. Academic activities were also re-authorized.

The Institute is governed by a Board of Administration consisting of eight citizens of the state appointed by the Governor, and the Commissioner of Fisheries (ex officio). Its major support is by appropriation from the General Fund of the Commonwealth. Some phases of research are supported by grants and contracts from federal, state, and private agencies.

The Virginia Institute of Marine Science is charged with the duties of conducting biological, chemical, geological, and physical studies of the marine environment; of investigating problems of the com-

mercial and sport fishing industries; of seeking information for use, development, and conservation of all marine resources, including fisheries; and more broadly, of engaging in research in all marine sciences. Furthermore, it is specifically charged with maintaining a teaching program in Oceanography through affiliation with institutions of higher learning within the state. Under such an affiliation the Institute and the College of William and Mary operate the School of Marine Science. Present offerings extend to the masters level, a Ph.D. program is planned for the near future.

The present staff consists of a Director, named by the Board of Administration, 5 Senior Marine Scientists, 12 Associate Marine Scientists, 8 Assistant Marine Scientists, 7 Research Assistants, 22 Research Technicians, secretaries, an auxiliary summer staff of five visiting professors, a full-time librarian, 8 administrative workers, 9 maintenance personnel, and 5 employees for operating vessels. A large number of Research Aides are employed in summer. Eighteen graduate students are in residence at the Institute, twelve of whom hold half-time assistantships. Sixteen of the major research people are members of the Faculty of the School of Marine Science. Associate membership in the Institute is held by scientists from other departments of William and Mary and the University of Virginia.

The laboratories at Gloucester Point are located thirty-five miles below fresh water in the York River and thirty-three miles from the ocean, thus a wide variety of aquatic environments is provided. The permanent branch station at Wachapreague on the eastern shore of Virginia offers ready access to salt marshes, lagoons, barrier beaches, and open waters of the Atlantic coast.

From these laboratories it is possible to study a large endemic flora and fauna in waters having a wide range of salinities. Regular cruises are made from the fresh waters of the upper York River to the edge of the continental shelf off the Virginia coast. Check lists of animals of this area

are available without cost to interested investigators.

Research areas in zoology are as follows:

1. Bio-deposition by filter-feeding organisms.
2. Ecological survey of benthos in estuarine waters.
3. Productivity of benthic communities.
4. Study of the toxicity of industrial wastes on marine organisms.
5. Artificial enrichment of the marine environment.
6. Studies of the effects of thermal discharges on benthic communities.
7. Survey and study of life histories and ecology of Crustacea of Chesapeake Bay and the continental shelf.
8. Studies of ichthyoplankton of the continental shelf.
9. Studies of morphology and development of the embryos of marine fishes.
10. Studies of culture techniques for laboratory rearing of marine fishes.
11. Ecology of marine fishes.
12. Epidemiology of diseases of mollusks.
13. Biology of molluscan parasites.
14. Selection and breeding of bivalve populations with desirable characteristics.
15. Development of techniques for laboratory culture of bivalves.
16. Ecology, taxonomy, and biology of mollusks.
17. Etiological studies of diseases and populations of marine organisms.
18. Bacteriological studies.
19. Ecological and taxonomic survey of the plankton of the lower Chesapeake Bay, the continental shelf and the York River.
20. Energy relationships in plankton and basic productivity of the Chesapeake area.
21. Systematics, host-specificity and zoogeography of monogenetic and digenetic trematodes.
22. Embryological, biological and physiological studies of *Urosalpinx cinerea* and other marine gastropods.
23. Study of the development of enzyme systems in invertebrate embryos.

An outline of research programs now in

progress is available upon request.

Four buildings of masonry construction and a fifth located at Wachapreague contain several special laboratories, lecture rooms, offices, and a constant-temperature room. A well-equipped general shop is available. In addition to such regular collecting gear as trawl, meter plankton nets, and bottom grabs, the laboratory owns special laboratory equipment required for the research being undertaken.

There are well-equipped analytical chemistry and radio-biology laboratories. Several laboratories are furnished with running sea-water and compressed air for maintaining marine organisms in aquaria. Special research equipment can be made to specifications.

The Institute owns a number of small boats equipped with outboard motors, as well as a 27-foot inboard launch for light field work. The 55-foot research vessel *Pathfinder*, designed and built especially for marine research, is active in the Bay and over the continental shelf. *RV Langley*, a converted passenger ferry, serves as a large shallow water floating laboratory. Research stations are occupied all the way from fresh waters through the Bay to the Gulf Stream some 100 miles off our coast.

The Virginia Institute of Marine Science provides living quarters for most of its students. Housing for others is not yet available; however, the administration assists visiting investigators and summer students to find adequate accommodations in the nearby community.

The laboratory extends a special invitation to scientists wishing to carry on independent research. Arrangements for

work space must be made well in advance. The laboratory has funds available for several visiting investigators, and offers stipends to college teachers through a Research Participation for College Teachers Program financed by the National Science Foundation. We also offer an Undergraduate Research Participation Program sponsored by the National Science Foundation.

The Institute operates on a year-round basis, and in addition to research conducts a graduate program. Courses at the graduate level are described in the catalogue of the College of William and Mary, Williamsburg, Virginia.

A limited number of reprints and special reports of scientific investigations are available for distribution. Specific requests should be directed to Miss Evelyn Wells, Librarian, Virginia Institute of Marine Science, Gloucester Point, Virginia. Contribution series and special scientific reports are exchanged with other laboratories.

The Institute has a small museum displaying local marine animals, and open to the public daily. There is also a collection of marine invertebrates and fishes, as well as extensive parasite collections accessible to interested scientists.

The Virginia Institute of Marine Science is located at Gloucester Point, Virginia, across the York River from Yorktown on U. S. route 17. Connections may be had by bus from Washington, Baltimore, Norfolk, and Richmond. Address all communications: Director, Virginia Institute of Marine Science, Gloucester Point, Virginia.



Fisheries Research Institute field station at Porcupine Island, Iliamna Lake, Alaska

FISHERIES RESEARCH INSTITUTE OF THE COLLEGE OF FISHERIES OF THE UNIVERSITY OF WASHINGTON

WILLIAM F. ROYCE, DIRECTOR

The Fisheries Research Institute of the University of Washington was founded in 1947 to study the salmon fisheries of Alaska. Until 1955 the Institute was financed by the Alaskan salmon industry. Since then support has come from other outside sources through contracts and grants, and today the latter sources provide the major part of the Institute funds. At the same time its research has broadened into other areas and other species of fisheries interest. Effective with the next biennium, the regular University appropriation is expected to finance part of the research faculty of the Institute.

Originally under the Graduate School of the University, the Institute was made a part of the College of Fisheries in June 1958. Since then much emphasis has been placed on training graduate students in fisheries science while carrying out its regular research programs.

The Institute has a total staff of some 60 members, consisting of a research faculty of 10 people ranging from research instructor to research professor, a research

staff of 37 people from fisheries aide to fisheries biologist III, and an administrative staff of 13 people comprising secretaries, key punch operators, and typists.

The research programs of the Institute today cover a variety of subjects. Some of the major research areas are: the determination of optimum escapement level for individual lake systems for red salmon; environmental studies of pink salmon to determine mortality factors; artificial spawning channels for pink salmon; tagging of salmon on the high seas to study the migratory habits and to determine the continental origin of salmon on the high seas; guiding salmonoid fishes by light; shellfish toxicity; oyster pathology; and blood parasites of salmon. In addition, in conjunction with the Departments of Economics and Law, the Institute is investigating the legal, economic, and biological aspects of Puget Sound salmon fisheries.

The Institute is located on the University of Washington campus, Seattle, Washington. It has an easy access to both fresh water and salt water environments. Sev-

eral field stations are maintained in Alaska (see photograph). All stations can accommodate visiting investigators, although the Institute does not have funds to support them.

The results of the Institute's research are reported from time to time in the form of circulars; finished reports are published in outside scientific journals or in a new series of *Publications in Fisheries of the University of Washington*. Reprints of these publications are available for distribution and exchange. In addition, the College of Fisheries publishes an annual report entitled, *Research in Fisheries*, which has been issued in March every year since 1959.

This publication presents progress reports of research results.

The College has also just published its first volume of *Publications in Fisheries, New Series* in the form of a book entitled *Studies of Alaska Red Salmon*, which is for sale at the University of Washington Press.

Within easy reach of all major transportation means, the Institute is about 20 miles from the Seattle-Tacoma International Airport, 5 miles from a train terminal, and 4 miles from a bus depot. The mailing address of the Institute is as follows: Fisheries Research Institute, University of Washington, Seattle 5, Washington.

MARINE BIOLOGICAL LABORATORY, WOODS HOLE, MASSACHUSETTS

(Shown in frontispiece)

PHILIP B. ARMSTRONG, DIRECTOR

The Marine Biological Laboratory was founded in 1888 to provide a place where biologists could carry on research during the summer months on marine forms, and where students could study these forms at first-hand and receive training in scientific investigation. The Laboratory derived directly from the Annisquam Laboratory on the north side of Cape Ann. This was established in 1881 by the Women's Educational Association of Boston and run in cooperation with the Boston Society of Natural History. In 1886 it became obvious that a more stable, independent, and permanent marine laboratory should be established devoted to both research and instruction. Funds were raised and Woods Hole was picked as a site for the new laboratory which opened its doors to investigators and students in July 1888.

The Laboratory was located at Woods Hole on Cape Cod because of the unusual abundance of marine fauna and flora, due to the influence of the Gulf Stream from the south and the Labrador Current from the north combined with a highly varied

coast line. There are numerous capes and bays, sand and mud flats, open water and protected inlets, each having a characteristic population. It was for this reason that, previous to the founding of the Marine Biological Laboratory, the U. S. Fish and Wildlife Service erected its first station at Woods Hole. With the establishment of the Woods Hole Oceanographic Institution in 1930, the biological interests of the area were further broadened.

The Laboratory is unique in its organization. The government of the institution is by professional biologists who are drawn from all over the country, thus assuring a national scope for the Laboratory and complete freedom in its policies and operations from overriding institutional control. The Corporation of the Marine Biological Laboratory has 500 members who elect a Board of Trustees, the governing body of the Laboratory.

The Laboratory has traditionally oper-

For a history of the laboratories at Woods Hole see: Lillie, F. R. 1944 *The Woods Hole Marine Biological Laboratory*, Univ. Chicago Press.

ated as a summer research and educational institution attracting investigators and students from all over the United States and from foreign countries. The results of the aggregation of a large number of scientists in the various fields of biology is most salutary. The free interchange of ideas, the informal discussions, and the lectures and seminars develop a ferment of ideas and a widening of the scientific vistas of the participants. All of this, in combination with active research and the possibilities of observing and mastering new techniques, results in a most rewarding scientific experience for all involved. By fostering and stimulating the scientific advancement of its investigators as well as its students, the Laboratory does more to advance science than serving only as a place for research. When the summer is ended and the investigators return to their home institutions, these effects go with them and are widely disseminated throughout the country.

Subject to this primary purpose of bringing together scientists from all over the world for research, teaching, and discussions, it is the policy of the Laboratory to foster to the maximum extent the use of its research facilities during the balance of the year. Therefore, scientists are encouraged to take advantage of the Laboratory and its services during the fall, winter, and spring months. Scientists on sabbatical leave or on special projects which will extend through the winter, including those supported by foundations or corporations, can thus be accommodated. Where Laboratory space is assigned on a year-round basis, long-term commitments will be avoided so that the assignment of space can be periodically reviewed to ensure that the best advantage is being taken of the research space available.

There are eight summer training programs in operation at the Laboratory: invertebrate zoology, experimental embryology, general physiology, marine ecology, marine botany, neuromuscular physiology, fertilization and gamete physiology, and comparative physiology. The training

staffs are drawn widely from this country and from abroad. These programs are designed not only to develop the student's basic information but also to bring to his attention some of the pressing problems in various disciplines and the techniques for solving these problems. Also the trainees carry out research projects under the direction of staff members as a part of the program. Fellowship support is available for selected trainees in these programs.

In 1962 a year-round program in systematics and ecology was instituted to extend the systematic knowledge and the basic information of the ecology of marine organisms of the Cape Cod region through a continuous long range program of research, as well as to provide training in systematics and ecology through research assistantships, associateships, and postdoctoral fellowships. The staff will also advise visiting investigators at the laboratory on the biota of the region and its availability and adaptability for various research problems. This program is under the direction of Dr. Melbourne R. Carriker, and is supported by grants from the Ford Foundation, the National Science Foundation and the National Institutes of Health.

During the summer months, lectures on topics of current biological interest are given by outstanding scientists. Included are the Friday Evening Lecture Series, the Forbes Lectures sponsored by the Grass Foundation honoring Dr. Alexander Forbes, and a lecture by the Senior Lalor Fellow. An informal seminar is held each week, and at the end of the summer there are general meetings at which investigators present progress reports on their current research. These meetings, and the lectures given in connection with the courses of instruction, are open to all members of the Laboratory.

The *Biological Bulletin*, now in its 123rd volume, is published bi-monthly by the Laboratory. It publishes papers on a wide variety of subjects of biological interest, and abstracts of the Tuesday evening seminars, the papers presented at the General Meetings, and the Lalor Fellowship re-

ports. Standards of acceptance of manuscripts for publication are set by the Editorial Board.

The George M. Gray Museum is being developed by the Systematics-Ecology Program to contain as complete a collection as possible of the local marine fauna and flora, and so arranged as to facilitate its use for scientific purposes by students and investigators. In the Museum will also be kept records of the seasonal occurrence and geographical distribution of the various Woods Hole organisms, together with such other information concerning local conditions as is likely to be scientifically useful to persons working at the Laboratory.

The two main research buildings are four-story fire-proof structures with approximately 140 laboratories which are designed for the maximum flexibility in providing the facilities for various types of research activities. Also included in these buildings are photographic and experimental dark rooms, temperature-controlled rooms, dry rooms, apparatus and chemical supply rooms, a machine shop, the library, and administrative and business offices. There is also an auditorium seating 545, and a lecture room accommodating 150. The training programs are carried out in the original wooden buildings of the Laboratory which were designed for this purpose. Also they provide the laboratory facilities for the training program instructors. There are service buildings for the Biological Supply Department and a carpenter shop.

Housing for investigators, instructors, students, and research assistants is available in apartment houses, several dormitories, and cottages. Also the Laboratory operates a dining hall which will seat 400. A clubhouse on the waterfront provides

for social and cultural activities.

The success of the Laboratory depends in a large measure on the effective operation of its service departments. The biological collecting and supply department has a permanent crew of experienced collectors, and operates several power boats, trucks, and skiffs, all with the necessary collecting gear and the equipment to transport the living marine forms to the Laboratory in good condition. It also operates a fish weir in Buzzards Bay, and has the necessary tanks to maintain animals at the Laboratory. During the non-summer months the Supply Department collects and ships living animals on order to investigators at their home institutions.

The scientific services include apparatus and chemical supplies, glass-blowing, machine shop, carpentry, plumbing, and a special apparatus laboratory with technical supervisory service. In this laboratory are included a Spinco ultracentrifuge, Spinco preparative centrifuge, Perkins Elmer Tiselius electrophoresis apparatus, and refrigerated centrifuges. Also the laboratory has electron microscopes with supervisory service.

The radiobiological laboratories are operated under the supervision of an experienced radiation physicist. There are ten service laboratories which include counting rooms with various types of counting equipment; high level, low level, and carbon-tritium laboratories; preparation and waste storage rooms; and a radiation laboratory with a cesium-135 irradiator which provides up to 5,000 r/min.

Application blanks for research space, library readers desks, and housing, as well as the *Annual Announcement* can be obtained by writing to the Marine Biological Laboratory, Woods Hole, Massachusetts.

WOODS HOLE OCEANOGRAPHIC INSTITUTION

(Shown in frontispiece)

MARY SEARS

The Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, was incorporated on 6 January 1930, under the Statutes of the Commonwealth of Massachusetts "to prosecute the study of oceanography in all its branches; to maintain a laboratory or laboratories, together with boats and equipment and a school for instruction in oceanography and allied subjects." A grant of \$3,000,000 from the Rockefeller Foundation provided for the original building, ships, and endowment, and the land was purchased with funds from the Carnegie Corporation. An independent, non-profit research institution, it is today largely dependent on contracts and grants from governmental agencies for its financial support.

The Members of the Corporation and the Board of Trustees meet once a year. In the interim, the Executive Committee of the Board of Trustees meets every four to six weeks with the President and Director, Dr. Paul M. Fye, for consultation and major policy decisions.

There are 75 scientists with Trustee appointments and about 140 research assistants and technicians in residence throughout the year. There are roughly 420 employees in all categories (including business and administrative personnel, engineers, machinists, ship crews, etc.).

Woods Hole has a protected deep-water harbor, which seldom freezes over, and affords shelter for sea-going ships. It is within convenient cruising radius of the Gulf Stream, the Sargasso Sea, the Labrador Current, and Grand Banks.

There are two brick laboratory buildings built in 1931 and 1954, facing Great Harbor. A third building diagonally across the street overlooking the Eel Pond, primarily for biology and chemistry, was opened in the summer of 1963. Among its

special features are 20 controlled temperature rooms; eight environmental rooms that can be set at temperatures between 0-60°F; deep-freeze rooms, for the storage of specimens frozen at sea; a room for storing and dissecting large (200-300 lbs.) marine animals; an isotope storage vault and laboratories for radioactive experimentation; and a large aquarium room with running sea water, at controlled temperatures.

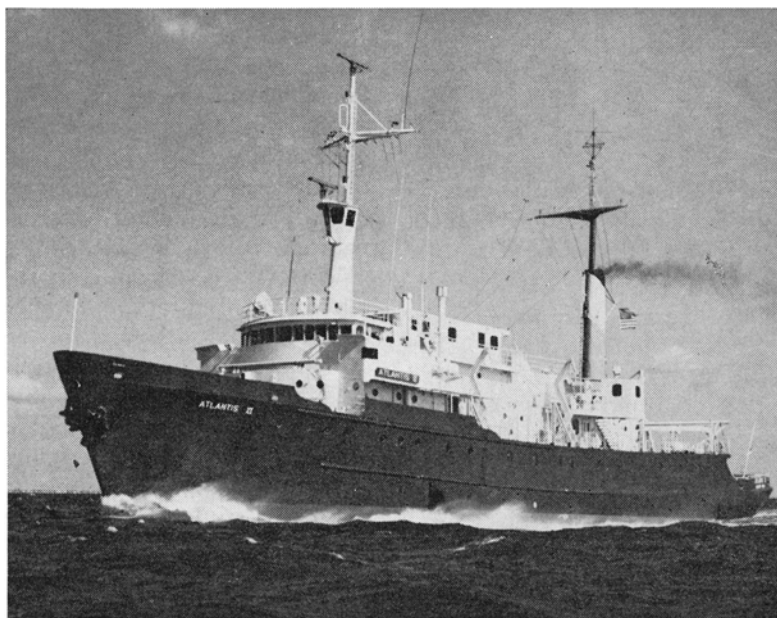
Housed in these three buildings or in a number of small temporary wooden ones on the four Institution-owned lots on the main village street, are such adjuncts as a paraffin-lined concrete tank for salt water of 12,500 gallons capacity, a salt water pump, a tide gauge, a carpentry shop, an instrument shop, electronic laboratories, machine shops, a computer, a buoy laboratory, plastics shop, and a hangar for the Helio-Courier seaplane. In addition there is a complete drafting, photographic, and multilithing service for the preparation and reproduction of charts and reports.

On a nearby tract of 20 acres, high above Little Harbor, there is a large, prefabricated warehouse (presently providing laboratory space); a wooden homestead used principally for the business offices, but with several guest rooms for short-term visitors; and the Director's house. Other wooden buildings here provide seasonal (5) or year-round (4) apartments, a men's summer dormitory, and space for the course in Geophysical Fluid Dynamics. An adjacent swamp has been filled in to provide offstreet parking.

There are many advantages, particularly for a zoologist, in the close proximity to the Marine Biological Laboratory and the Biological Laboratory of the Bureau of Commercial Fisheries. These include many cooperative endeavors in prob-

lems of mutual interest, the opportunity for consultation and discussion of problems with resident biologists and visitors, an unusually rich offering of lectures of

ably." The *Crawford*, a converted 125-foot Coast Guard cutter and the *Chain*, a former 213-foot Navy salvage ship are also equipped for work on the high seas. The



RV *Atlantis II*

wide variety by distinguished investigators and visitors, superb library facilities, and the use of the MBL mess by summer visitors to the institution.

The *Atlantis II*, the second Institution vessel to be built specifically for oceanographic research, was completed early in 1963, and will make her first major cruise to the Indian Ocean in 1963. She has "twin propellers powered by a uniflow reciprocating steam engine. Her principal specifications are: overall length, 210 feet; waterline length, 195 feet; beam, 44 feet; draft, 16 feet; displacement, 2100 tons; cruising speed, 12 knots; range 8000 miles. She has accommodations for a crew of 28 and a scientific party of 25. Among her special features are anti-roll tanks and bilge keels for increased stability, a bow propulsion unit for maneuverability and an underwater observation chamber in the bow. There are four fixed laboratories and deck space for portable laboratory units which can be used interchange-

Gosnold, a 99-foot ex-cargo vessel, with portable laboratory units on deck is outfitted for work on the continental shelf, chiefly in biology and geology. The *Asterias*, a 40-foot dragger, is equipped for inshore and estuarine work. A small submarine capable of submerging to 6000 feet is scheduled for delivery in August 1963. The *Cap'n Bill*, a local fishing vessel, is chartered from time to time, primarily for ichthyological work.

The ketch *Atlantis* will become the summer training ship to provide field experience for three summer courses offered for the first time in 1963.

The vessels are manned by professional seamen, who assist with the handling of oceanographic gear. Radar, Loran, sonic depth sounders are standard equipment. Ordinarily, the work on each cruise centers about one particular program, so that the gear for that work is installed just before putting out to sea and removed immediately after docking on return to

Woods Hole. To save time and money, equipment for the next trip can be installed in portable laboratories on the dock and readied for sea before the vessel reaches port.

An R4D airplane, soon to be replaced by a 4 engine R5D, is adapted chiefly for meteorological work and for geological mapping of coastal areas. The Helio-Courier can be fitted with floats and is useful in local studies, especially since it can be safely flown slowly enough to track whales or other large organisms at sea.

The Institution has ship facilities to reach almost any marine habitat, particularly in the western North Atlantic. Recent zoological programs have centered about the following topics:

Indicator species.

Structure and significance of Cephalocarida.

Zooplankton physiology and productivity.

Pelagic larvae of intertidal gastropods.

Intertidal fauna of Barnstable Harbor.

Light in the sea (including bioluminescence).

Deep benthos between Bermuda and Woods Hole.

Borers infesting wood at 3000 meters.

Sound production by marine animals.

Sound scattering by marine organisms.

Fish behavior, distribution, taxonomy and life histories.

Reworking of sediments by molluscs.

Ecology of edible molluscs.

Environmental cetology.

Coral banks on the Blake Plateau.

Priapulids from the North Atlantic.

Contributions of scientists at the Institution are published in regular scientific journals, and reprints are bound in an annual volume of *Collected Reprints*. This is distributed to about 1000 libraries throughout the world. Nearly 1200 contributions are included in the twenty-eight volumes issued to date.

Visitors are welcomed at the Institution, but due to limitations of space, ship-time, and financial support for research, each case must be considered individually.

In the summer of 1963 about 15 fellowships for juniors, seniors, and graduate students will be awarded for work under the supervision of a senior staff member; fifty-three students with a B.A. or a B.S. degree are enrolled in four courses in the geological and physical sciences; and about 100 students are employed on research projects.

Assistance is provided in locating rented quarters in Woods Hole or Falmouth. The Institution has only limited living accommodations for visiting investigators and students. Arrangements for housing should be made well in advance, as modest apartments are difficult to locate.

Address, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts.

FRESH-WATER LABORATORIES

CANAL ZONE BIOLOGICAL AREA (BARRO COLORADO ISLAND), SMITHSONIAN INSTITUTION

MARTIN H. MOYNIHAN

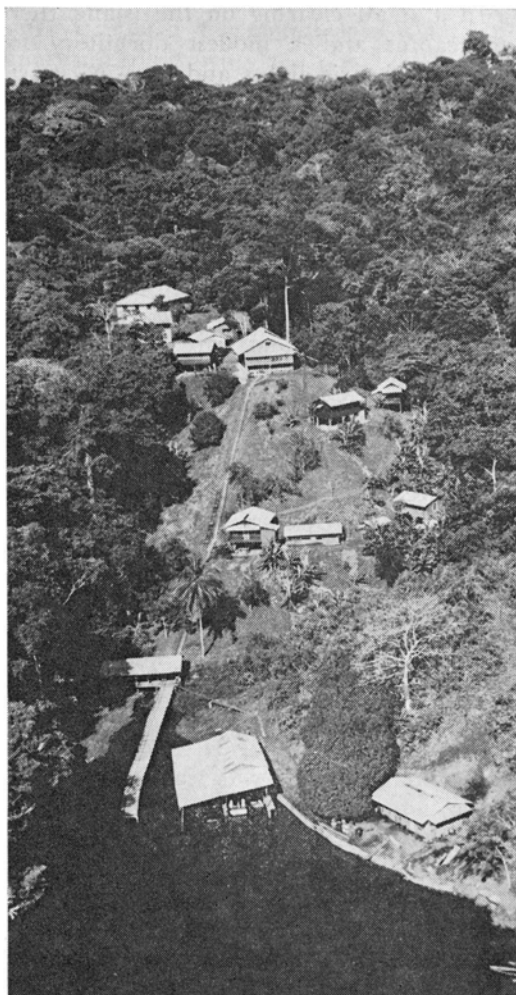
When Gatun Lake was created in the course of constructing the Panama Canal, the area flooded included a large hill, the top of which projected above the water level to form jungle-covered Barro Colorado Island—3 miles wide, 3.5 miles long, and almost 4,000 acres in extent. The

island is reached by a 20-minute launch ride from Frijoles, near the center of the Isthmus, accessible by trains which cross the 48 miles from the Atlantic to the Pacific in 80 minutes. The island's irregular shore line, approachable in many places by dugout boat only, is approxi-

mately 25 miles long. Cleared well-marked trails on the island extend an equal distance. Except for about 15 acres of man-made clearings, the island is forested. Approximately half the forest (typical "monsoon" or "seasonal humid tropical") is in mature state, the remainder being second growth from 30 to 50 years of age. The dry season usually lasts about 4 months (January through April) during which time rainfall may be less than 2 inches a month. Then rains usually increase until they reach a peak in November. Although the average annual rainfall is in the neighborhood of 105 inches, rain seldom falls continuously for more than a few hours. Temperatures are nearly always in the high 70's or low 80's, with little daily or seasonal variation. Humidity is high but variable. The known vertebrate fauna on Barro Colorado Island includes over 310 species of birds, 65 species of mammals, 22 lizards, 37 snakes, 5 turtles, 2 crocodiles, 15 toads, 16 frogs, 2 salamanders, a caecilian, and 22 fishes. Spiders, insects, and other arthropods are present in great variety. Land crabs and mollusks are common.

In 1923 Governor Jay Morrow of the Canal Zone set aside this island as a wildlife preserve under the administration of the National Research Council. Since July 16, 1946, as the Canal Zone Biological Area, the island has been a bureau of the Smithsonian Institution. Under the aegis of the Institution, and in accordance with the Act of July 16, 1946, the Canal Zone Biological Area has as its purpose that of "setting aside such an area . . . to preserve and conserve its natural features, including existing flora and fauna, in as nearly a natural condition as possible, thus providing a place where duly qualified students can make observations and scientific investigations for increase of knowledge."

During the past year research conducted in the Biological Area covered every branch of the tropical natural sciences except anthropology. Since 1957 over 300 scientists, representing a dozen nations,



Aerial view of Canal Zone Biological Area (photo furnished by the Smithsonian Institution)

have availed themselves of the bureau's facilities. Their studies have covered such diversified projects as: interspecific relations of formicariids in mixed species flocks; the behavior of sphingid and saturniid moths; primate population and social organization; ptiliid beetles; microscopy of insect blood; nonmarine mollusks; leaf-mining beetles; temperature and humidity gradients within the forest; tropical diseases with particular reference to the opulinid protozoa of anurans; apical meristems of tropical woody plants; stratigraphic relations of fossiliferous beds of early Tertiary age.

In a small clearing on the island there are cabins and a modest dormitory for lodging, electric lights and fans, a central dining room, showers, and other conveniences. Although many investigations require no laboratory other than a roof, there is a laboratory building for indoor work. This building contains a 3,000-volume biological library, herbarium, animal specimen collections, laboratory supplies, darkroom, dry storage rooms, and ample working space. Glassware, preservatives, photographic chemicals, and other supplies may be purchased from the stockroom. Limited equipment may be borrowed and small supplies of wood, wire, glassware, and other materials are available for improvising equipment. Tents and camping equipment are available for those who wish to camp out in the jungle.

Scientists accredited by the Smithsonian Institution to the Canal Zone Biological Area may also conduct investigations on the mainland in an area recently made

available to the Institution for scientific research. Ecologically this area is in sharp contrast to the island, thus affording an opportunity to carry on studies of an entirely different nature. Although investigations which require extensive collecting or modification of natural conditions may not be suitable for Barro Colorado Island, it may be convenient for scientists to use the laboratory and living facilities there as headquarters while working nearby in easily accessible areas which include true rain forest, dry scrub, arid savannah, extensive marshes, and several different types of sub-tropical montane forest.

It is necessary to charge visiting scientists a reasonable fee for board, lodging, and use of the laboratory and available equipment. Further information on this and on the facilities available in the Canal Zone Biological Area may be obtained by addressing inquiries to the Secretary, Smithsonian Institution, Washington 25, D. C.

THE INDIANA UNIVERSITY BIOLOGICAL STATION

SHELBY D. GERKING, DIRECTOR

The Indiana University Biological Station is an arm of the Zoology Department. It was established in 1894 by the Board of Trustees as the first station of its kind to be located on a freshwater lake in the United States. The original location was on Lake Wawasee near Syracuse, Indiana; it was moved in 1899 to the present site at Winona Lake, Kosciusko County. Dr. Carl Eigenmann, eminent ichthyologist and evolutionist, was the first director. His purpose in establishing the station was to study variation in animal species. He felt this could be done competently in the more or less isolated lakes, where differences in environments should produce marked morphological variations in animal populations of the same species. Thorough studies of intraspecific variation of darters and minnows by W. J. Moenk-

haus and J. H. Voris were among the first in this fertile field of study.

Gradually the original character of the research changed. More interest developed in the physical and chemical characteristics of water as well as the plants and animals which lived there. Limnology thus became the second line of research initiated by Eigenmann at the turn of the century when that science was in its infancy. Basic research conducted at the Station through the years has played an important part in developing the sciences of limnology and fishery biology. The Station is best known for research on lake chemistry, bottom fauna, sedimentation, and fish populations. Dr. Will Scott (1920-1937), Dr. W. E. Ricker (1939-1950), and Dr. David G. Frey (1950-1959), successive directors of the Station during the years indi-

cated, were responsible for the basic investigations in lake ecology.

During the early years, undergraduate and graduate courses in botany, bacteriology, and zoology were taught, but from about 1903 only the last was offered. Embryology, comparative anatomy, elementary zoology, and limnology attracted more than 100 students each summer. The teaching function declined during the depression years and was discontinued in 1938.

Research, however, has been prosecuted vigorously throughout the years to the present. Increasing consideration is being given to the prospect of reestablishing a program of course work at a field station, and of expanding the research program. This desire has been hindered by the fact that the Winona Lake property is not suitable for these expanded activities.

A search for a new location for the Station began as ideas about the future of summer courses and research interests were being crystallized. Northern Indiana again was a favored area because (1) the glacial lake district offers a greater variety of environments than any other area of the state, (2) it is reasonably close to the base of instruction at Bloomington, and (3) we wished to take advantage of the fund of knowledge acquired over the years about the lakes and their surroundings. The result of this search was the purchase by the University of approximately 20 acres of wooded shoreline on Crooked Lake, seven miles north of Columbia City. The desirability of increasing this holding is obvious, and prospects for doing so are under review at the present time. Construction of buildings will begin in 1963, and our operations will shift from Winona Lake to Crooked Lake next summer.

A research building and boathouse will be built with the aid of a grant from the National Science Foundation. The research building is designed for the examination and storage of specimens as they are brought in from the field, and for experimental work in physiological ecology. Facilities in the 60' \times 40', two-story building include a complete chemical laboratory

equipped with analytical instruments designed primarily for aquatic research. An aquarium room with both standing and running water will be used for experimental work on fish, insects, and other aquatic invertebrates. These facilities, plus two temperature-controlled rooms, will allow experimental work to be performed soon after the organisms are brought into the laboratory. Six smaller research laboratories, dark room, space for storing reference collections of animals and plants, fish scale processing room, and an area for sorting bottom organisms are other significant parts of the building. One-third of the floor space, including the chemical laboratory, will be heated for winter research.

Other prospective developments at the Crooked Lake site include a teaching laboratory, dormitory, kitchen-dining-recreation unit, and staff housing. Accommodations are being planned for approximately 100 persons when the teaching program is under way. Courses such as algae, higher aquatic plants, vertebrate ecology, and ecology of aquatic insects will be aimed at upper division undergraduates and graduate students. Only courses designed to take advantage of field work will be offered. Limnology is an obvious choice because of its interdisciplinary character, and because of the long-standing interest in the subject at Indiana University. The teaching program should be in operation by 1965.

Crooked Lake is located in the heart of a belt of lakes extending about 75 miles from the northeast corner of the state in a southwesterly direction. The lake belt was formed by repeated retreats and advances of the Saginaw and Huron-Erie lobes of the Wisconsin glacier. Glacial lakes cross the northern third of the state to the western border, though in the west they are less numerous than in the east. About 1000 lakes dot the landscape, varying in area (largest is Wawasee Lake, 3000 acres), depth (deepest is Tippecanoe Lake, 123 feet), shoreline development, degree of domestic pollution, bottom type, and other

limnological features. Crooked Lake itself is 206 acres with a maximum depth of 108 feet. Oxygen remains in the deep water throughout the summer, an unusual feature among the lakes in the area. This interesting oxygen distribution results in a cold-water fauna living in the deep water along with a fauna characteristic of warm water in the surface layers.

Streams abound in the region. The Tippecanoe River traverses the northern third of the state in a southwesterly direction to join the Wabash River. The Eel, Mississinewa, Salamonie, and numerous tributaries also contribute water to the Wabash. The Great Lakes drainage is represented by the St. Joseph River cutting across the Indiana border from Michigan and flowing westerly to Lake Michigan. The Maumee River once flowed from Lake Erie to the Wabash River during an early glacial stage, but has since reversed its course and drains the northeastern corner of the state to its outlet at Toledo, Ohio. All of the major streams have a warm-water flora and fauna, but some of the smaller tributaries can be classed as marginal trout streams with a biota typical of these waters.

The countryside is undulating as a result of terminal moraines, secondary moraines, eskers, and outwash plains. The soil is mainly sand and gravel, but some "muck-land" has been exposed due to agricultural drainage practices. The soil and configuration of the land are not well adapted for agriculture, and sizable stands of sec-

ond-growth deciduous hardwoods can be used as areas for studying wildlife. Perhaps the most unique feature of the northern Indiana landscape is the shifting sand dunes on the shores of Lake Michigan in the northwestern corner. The "dunes" is a famous site for research in vegetational and faunistic succession. Some prairie land is found several miles to the south in this section of the state. All of the lakes, streams, and terrestrial habitats are within easy driving range from Crooked Lake.

The regional fauna is reported chiefly in volumes of the *Indiana Academy of Sciences* and *Investigations of Indiana Lakes and Streams*, a journal published at irregular intervals by the University.

The present research programs are particularly directed toward the productivity of lakes at various trophic levels. Several types of comparisons have been made between nearly barren marl lakes and advanced eutrophic lakes. Recent studies include: factors responsible for metalimnetic oxygen maxima; lake history as seen in changing species associations of cladoceran and dipteran microfossils in the sediments; competition and survival among species of midge larvae; seasonal growth of bluegill sunfish; studies of water beetles; primary productivity; and aquatic fungi.

Visiting investigators will be most welcome when our research facilities are completed. Arrangements can be made by contacting the Director at the Department of Zoology, Indiana University, Bloomington.

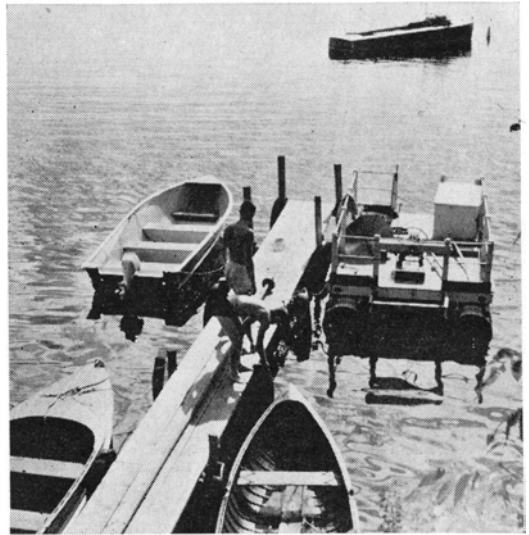
THE IOWA LAKESIDE LABORATORY

R. L. KING, DIRECTOR

The Iowa Lakeside Laboratory is located on a tract of about one hundred acres on the west shore of Lake West Okoboji in Dickinson County, Iowa. The region lies east of the Great Plains in the Missouri Valley drainage area, near the boundary between the humid east and the dry west. It is just north of the terminal moraine of the most recent glacial advance, and shows typical knob and kettle topography interspersed with many bodies of water. Lake West Okoboji has sufficient area (3,700 acres) and depth (140 feet) to make it favorable for the study of physical and chemical limnology, as well as investigations of animals and plants typical of deep lakes. There are many other lakes nearby which are less deep, such as Spirit Lake (5,600 acres), East Lake Okoboji (1,800 acres), Silver Lake (1,000 acres), and an exceptional number of smaller bodies of water, including hanging bogs, large sloughs, and a large variety of glacial kettle holes. Some of the latter contain permanent ponds; others have summer dry ponds. The Little Sioux River and tributary brooks are nearby. This aquatic spectrum offers an excellent opportunity for the study of aquatic biota.

Some good stands of tall-grass prairies persist on the flatlands of the region, while elements of short-grass vegetation occur on the knobs; oak woods flourish on protected slopes, particularly at lake margins. The study of bryophytes has been a prominent activity over many years. The area, with its ecological diversity, is remarkably rich in algal species and has been and continues to be a center of research in algology. An adequate herbarium is maintained for studies of local vascular plants and bryophytes; a check collection of diatoms is being started.

Many Great Plains insects have their eastern limits of distribution in the vicinity, and unusual species of ants are found on the knobs and on the prairies which



Assembling 10 meter core sampler. Iowa Lakeside Laboratory.

have remained undisturbed. The birds of the area have received a good deal of study.

Lake Okoboji itself is unique in this geographic position of being a Great Plains extension of the northern lake country. The opportunities for limnological study are many. Actually the biota of the lake and the features of the lake have been neglected when compared with the well known lakes of this country. The crustacea, aquatic insects, mollusks, rotifers, annelids, and many other groups are well represented. The aquatic vegetation is exceedingly rich. The varied biota of all of the hundreds of smaller bodies of water close at hand have been barely touched in terms of systematic study.

The laboratory was established in 1909 by alumni of the State University of Iowa under the leadership of Professor Thomas H. Macbride, and now has become one of the state educational institutions controlled by the Iowa State Board of Regents. General administration of the laboratory

is conducted by the State University of Iowa Extension Division. A scientific Advisory Board with representatives of the three cooperating state schools (Iowa State University, State University of Iowa, State College of Iowa) advises on the educational and scientific policies of the laboratory.

Dormitories for men and for women, several cottages for small families, and shower facilities are in an area adjacent to the dining room. Housing and meals are furnished by the laboratory, since reasonable facilities are not available nearby. These needs are tended to by a resident custodian, staff of cooks, and business manager.

Around a hillside overlooking the lake are five very attractive stone cottage-type laboratories, each with two student and two staff laboratories. These are basically equipped, with optical equipment and materials suitable for the specialty studied. Each is well lighted and cool; each has running, untreated lake water. A large lecture hall is within this grouping; classes which require projection equipment meet here and larger groups meet here for special lectures.

Research facilities in limnology are in a newly built laboratory at the water's edge. This is available for workers in any field where the newer gear and laboratory equipment would be useful. For work on the lake, the laboratory maintains several boats, from small punts to a 26-foot motor launch with winch. Water samplers, Clarke-Bumpus sampler, underwater thermometers, bathythermographs, photometers, etc., are available for class and research use. Laboratory cars are ready for transportation to other sites nearby.

The staff of the laboratory comes from the faculties of the three institutions which join in its operation. The courses offered in the ten-week summer session differ somewhat from year to year, depending on the

specialties of the staff members. For the summer of 1963 the following courses are listed: Field Biology; Aquatic Ecology; Protozoology; Morphology of Algae; Field Mycology; Helminthology; Plant Taxonomy; Plant Ecology; and Independent Study and Research. Three other courses have been offered from time to time: Field Entomology, Biology of the Fresh-water Fishes, and Biology of the Bryophytes.

The ten-week summer session is divided into two periods; each five-week course carries five semester hours of credit. Students register for one course only and meet with that class every day for the entire day. Registration may be made at any of the three state schools. Classes range in maximum size from 6 to 12 students; these small classes have the extreme virtue of close contact between class and instructor.

Over the last several years the number of students working on research toward advanced degrees has increased greatly. Space for a few visiting scientists is available and their presence is welcomed; however, support for visitors is limited. The research done by the staff, students, and visitors has centered almost entirely on field studies which are appropriate for the location and facilities. Active programs have been going on in algology, study of bryophytes, prairie ecology, plant distribution and taxonomy, life history studies of helminthes, protozoology, myrmecology, ecology and behavior of aquatic invertebrates, and basic limnology.

No publication is sponsored by the laboratory; many local studies are published in the *Proceedings of the Iowa Academy of Science*. Over two hundred papers have come from studies done at the laboratory, rather equally distributed between plant and animal subjects.

Milford, Iowa is the mailing address and nearest town. Bus connections are available, and air transportation is within one hour's drive.



View over campus of University of Michigan Biological Station from ridge behind the campus

THE UNIVERSITY OF MICHIGAN BIOLOGICAL STATION

A. H. STOCKARD, DIRECTOR

The Station was founded in 1909, on its present site in the northern tip of the Lower Peninsula of Michigan, near the confluence of the upper three Great Lakes, Michigan, Huron, and Superior. Established by the University of Michigan, for conducting instruction and research in botany and zoology in a field situation, it has followed this purpose throughout its fifty-four years of continuous operation. Originally a unit of the Summer Session, it now is an administrative department of the College of Literature, Science, and the Arts. Its chief administrator is a director, who is aided by an executive committee composed of the dean of the School of Natural Resources and the chairmen of the Departments of Botany and Zoology.

The physical plant consists of a 9,000-acre tract of mostly wild forested land, with a 30-acre campus containing 143 buildings and the service installation neces-

sary for an independent community of about 260 persons. The tract borders on two large inland lakes, Douglas and Burt, and is surrounded by vast areas of State-owned wilderness and abandoned farm and pasture land. The entire region is dotted by numerous glacial lakes and bogs in various stages of evolution, and contains many streams, as well as plains, uplands, moraines, and dunes. Sandy soils predominate, but there is some rich humus, and gravel and clay deposits, sandstone and limestone outcrops add variety. The region is in the transitional zone, between the boreal coniferous forests of Canada and the more southerly hardwood zone.

With its varied topography, immense wilderness areas and interzonal location, the region provides a wide range of natural habits and supports an assemblage of plants and animals that is rich in numbers of both taxa and individuals. Among

the plants are more than 100 families, 400 genera, and 1,000 species of phanerogams; 85 kinds of equisetals, club mosses, ferns and conifers; more than 250 species of mosses and 75 species of liverworts; 175 genera and 600 species of algae, 150 species of lichens, and vast assemblages of higher fungi, slime molds and water molds.

Among animals, the vertebrates include 52 species of mammals, 150 or more of birds, 16 each of reptiles and amphibians, and 75 of fishes. Of the invertebrates, sponges, hydras, turbellarians, nematodes, gastrotrichs, bryozoans, and aquatic annelids are abundant. The mollusks include 76 species of snails, 14 of unionid clams and a large number of sphaeriids. The arthropods include many species of small crustaceans and several of larger crustaceans, centipedes and millipedes; spiders, acarinids, phalangids, and rotifers are common, and insects are plentiful, with 23 orders represented. Protozoans are abundant, including all major groups of both free-living (except strictly marine) and parasitic forms. Helminth parasites, especially the larval stages of trematodes, cestodes, and nematodes, also are abundant.

The Station has fleets of boats and station wagons, making collecting easy anywhere in the region. It also has presses, driers, containers, preservatives, aquaria, and cages, for processing and caring for specimens. Herbarium and museum specimens of most of the species are maintained for instructional purposes, but there is no effort to expand the collections for general taxonomic research purposes.

The 143 buildings, with a total of 73,000 square feet of floor space, include 26 laboratory rooms in 16 buildings, a library, an administration building with community dining room, an assembly hall, 24 other service buildings, and 100 residences. The Station provides all of the usual chemicals, glassware, and other supplies, as well as optical equipment, measuring devices, collecting gear, aquaria, cages, boats, and vehicles for a full program of instruction and research in both field and laboratory aspects of the environmental biology of the region. The library contains more

than 7,000 bound volumes and 20,000 catalogued reprints on biological topics, and others are available through loan services.

Of the 100 residences, about 30 are occupied by faculty and other employees, and the others are for students and investigators, with room for about 35 families. Most are plain one-room houses, equipped, except linens and blankets, for three single persons or a small family. There are five community shower buildings and a laundry. A maximum of about 260 persons can be housed, which is the usual population in summer. The residences are not equipped for the preparation of meals, but all occupants board at the dining room. The University Health Service maintains a branch at the Station, with a physician in residence. Spring and fall work also is encouraged, but the buildings at present are not suitable for winter use. Plans are in progress, however, for providing suitable winter quarters.

Preserving its original aim, the Station pursues a program of instruction and research in biology during an eight-week session from late June to mid-August each year, and it is available for research use at other times also. The instructional program includes 18 to 20 courses in botany and zoology. They cover all of the major taxonomic groups and ecological assemblages and all of the major environmental media of the region. In addition, individual instruction is given to advance students in special fields of endeavor. Both graduate and undergraduate students are admitted to courses, but at least one year of college biology is prerequisite for enrolling. The student enrollment usually totals about 120, 40 undergraduates and 80 graduates. They come from many colleges in Michigan, in other states, and in foreign countries. All courses give University of Michigan credit, with full graduate credit to graduate students. They meet by the day rather than the hour; a two-semester-hour course meets one full day each week, and a four-semester-hour course meets two. Six to eight hours constitutes a full load.

The faculty consists of 16 to 18 profes-

sors who are specialists in the several aspects of the Station's program. Like the students, they are from many sources; about half of them are from The University of Michigan and the remainder are from seven to ten other institutions in the United States and Canada. Chosen for their ability in both teaching and research, their instructional programs are limited to two days per week, leaving the remainder of the week to be devoted to their own research activities and those of their graduate students.

The Station also accepts postdoctoral and professional biologists as independent investigators, on projects that are suited to a field situation. From ten to twenty such persons usually can be accommodated, some with families. Living and working conditions for them are similar to those for faculty and students.

Although considerable effort is devoted to instruction, the Station's research effort

also is productive. The number of topics under investigation by graduate students, faculty, and postdoctoral scientists totals well over 100 each summer, and each year from 25 to 40 papers are published. The number of such papers now exceeds 1,200. The Station does not sponsor a publication, the regular professional journals being outlets for papers emanating from it; nor does it collect reprints for distribution.

Some funds for the support of both students and investigators have been granted to the Station by the National Science Foundation.

The Station lies 6 miles east of Pellston, Michigan, and 3 miles west on Riggsville Road from its interchange with Interstate Highway 75. Buses and planes stop at Pellston. The address June 15 – August 31 is The University of Michigan Biological Station, Pellston, Michigan; otherwise, Ann Arbor, Michigan (Sept. 1 – June 15).

THE LAKE ITASCA FORESTRY AND BIOLOGICAL STATION, UNIVERSITY OF MINNESOTA

WILLIAM H. MARSHALL, DIRECTOR

The Station was established in 1912 to provide field instructional facilities primarily in the forestry area. In 1935 its functions were broadened to include biology, and since that time a Biology Session has been held each year, except for a brief period during World War II. Forestry instruction continues during part of the summer.

The major objective of the Biology Session is to provide opportunities for instruction and research in field biology. The philosophy underlying work at the Station is to exploit the field opportunities in the area by a fundamental approach to the many ecological and taxonomic problems available. During recent years emphasis has been shifting from formal instruction towards independent and guided research, and at present two-thirds of the student body are graduate students.

The Biology Session is a unit of the University of Minnesota Summer Session. It is administered by a Director who relies on an advisory committee representing the major biology departments of the University of Minnesota, and which includes a representative from the University of Wisconsin.

The present staff consists of the Director, eleven professors, three teaching assistants, a secretary, resident manager, and other temporary employees. The teaching staff is selected annually by the Departments of the University directly concerned: Botany, Entomology, Fisheries and Wildlife, Plant Pathology and Botany, and Zoology.

The Station is situated in Itasca State Park, a 50-square mile area which includes many lakes of different types and a unique array of forests. Extensive stands of deciduous trees representing the northern hardwoods and several types of coniferous stands on both upland and bog sites are found in the Park. Forty miles to the west there are considerable areas of very fine



Animal Ecology Laboratory, Lake Itasca Forestry and Biological Station, University of Minnesota

tall grass prairie associations and to the north are the immense stretches of northern bogs around the Red Lakes. Habitats representative of the three major biomes of eastern North America are thus easily accessible.

Check lists of mammals and birds of the area are available. Until the supply is exhausted these can be supplied free of cost.

The session stresses the field approach to ecological and behavior problems. The variety of terrestrial organisms which can be studied is exceedingly rich because of the location of the area in relation to tall grass prairies, hardwood forests, and coniferous habitats on bog and upland. There is no difficulty in finding considerable areas of each habitat rather than relicts. The avifauna is particularly rich. There are a number of forest insects which show striking fluctuations in abundance and the opportunities for studies in population dynamics are outstanding.

Concurrent with this rich ecotone situation is the fact that the area has been heavily glaciated. This set the stage for a large array of shallow and deep lakes, streams and rivers, as well as soil differences that influence the basic productivity in many ways. Aquatic forms show great diversity.

The Station has ten class laboratories in five buildings and in addition buildings with individual laboratories for 25 research workers. Equipment for measuring environment and for doing microscopic work is available. During the Biology Session, quarters for single students are available on the Station and meals are served in the dining hall. At other times of the year some cabin space is available for research workers. Nearby resorts can provide accommodations for families. Limited campground sites with utilities are available on the Station.

There is no laboratory publication. Reprints of articles published may be available from the authors.

Collections of animals at the Station are minimal and are used principally for teaching. Complete collections are available in the Minnesota Museum of Natural History in Minneapolis. The Station maintains a herbarium for plants indigenous to the area.

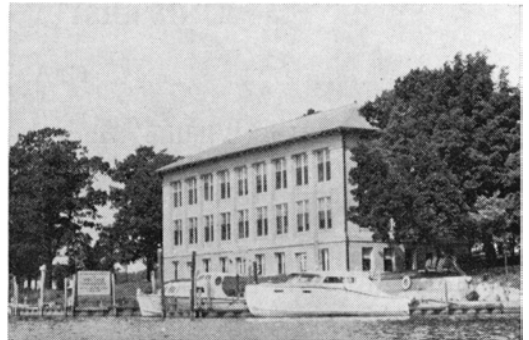
The summer mailing address is Itasca Biology Session, Lake Itasca P. O., Minnesota. During the remainder of the year mail should be addressed to the Director, Itasca Biology Session, 300 Coffey Hall, University of Minnesota, St. Paul 1, Minnesota. The laboratory is 240 miles northwest of Minneapolis and can best be reached by U. S. Highway #71. Bus routes include Itasca Park. The nearest airport is Bemidji, Minnesota, 40 miles distant.

THE BIOLOGICAL STATION OF THE OHIO STATE UNIVERSITY

L. S. PUTNAM, DIRECTOR

The Ohio State University Biological Station, founded in 1896, was first located near Sandusky, Ohio. In the beginning the station was utilized by advanced students and teachers from the university for summer research. In 1900, courses of instruction in botany and zoology were instituted, and the summer teaching program became active. In 1918 the laboratory was moved to Put-in-Bay, Ohio, on South Bass Island; in 1925 it was moved to Gibraltar Island as a permanent location. At this time it also received its present name. The station has always encouraged research and teaching in field biology, but places emphasis on the aquatic habitat of Lake Erie by stressing limnology and fisheries biology. Franz T. Stone Laboratory is operated cooperatively by the Department of Botany, the Department of Zoology, and the Natural Resources Institute of the Ohio State University. The administrative officers are Dr. Charles A. Dambach and Dr. Loren S. Putnam.

The staff of Stone Laboratory consists of eight senior scientists, two assistants, one



The Biological Station of the Ohio State University

secretary, and four technical and maintenance men.

The immediate habitat is Lake Erie, a eutrophic lake which, with its shores, bays, and tributary streams, offers a wide variety of aquatic situations. The islands of Western Lake Erie and access to the Ohio mainland make available many terrestrial areas as well. Most mid-continental plants and animals can be obtained for study and research.

The physical facilities consist of a large

classroom and office building, a research building, three dormitories, refectory, boat house, and shop. Mobile equipment includes three vessels (42 feet, 37 feet, and 25 feet L.O.A.), row boats, and outboards, a 36-passenger bus, a carryall, and a truck. It has a wide variety of collecting equipment, aquaria, and holding cages for specimens. General optical and other types of equipment normally used in taxonomic, behavioral, and physiological studies are kept in stock. Working collections of the local fauna and flora are maintained. The laboratory maintains a small library.

The instructional program is conducted during the summer quarter (June 15 to August 30). Courses are given by the Department of Botany and the Department of Zoology and Entomology of The Ohio State University. These include: limnology, ichthyology, fish ecology, animal physiology, parasitology, aquatic entomology, invertebrate zoology, herpetology, field

zoology, ornithology, field entomology, field botany, algae, mycology, plant physiology, aquatic botany, and field plant ecology. Students range from college upper classmen through graduates. Many of the graduate students engage in thesis research. The program is designed to give training to professional biologists and teachers in the field-related aspects of the science.

While the major research interest of the station continues to be in the areas of limnology and ichthyology, there are also active studies being conducted in ornithology, invertebrate zoology, entomology, and botany. Independent research workers are welcome. Information about arrangements for space and housing can be obtained from Dr. L. S. Putnam at the F. T. Stone Laboratory, Put-in-Bay, Ohio, from June 15 to August 30; during the regular school year at the Department of Zoology and Entomology, The Ohio State University, 1735 Neil Avenue, Columbus, Ohio.

PYMATUNING LABORATORY OF FIELD BIOLOGY, UNIVERSITY OF PITTSBURGH

C. A. TRYON, JR.

Pymatuning Lake, Wildlife Sanctuary, Linesville, Pennsylvania is located 80 miles north of Pittsburgh. It is in western Crawford County with part of the Lake being in Ohio. Pymatuning Laboratory is in the southwestern lobe of the boreal flora characteristic of much of Canada. It overlooks a very productive reservoir which is available for instruction and research but is not open to the general public. Nearby are extensive swamps and marshes, as well as wooded uplands. Lake Erie to the north and the Allegheny National Forest are within easy travelling distance.

Pymatuning Laboratory is open for classes from May 1 to September 1, and provides facilities throughout the year for research. Pymatuning's programs are designed primarily for students at a graduate level, whether degree or non-degree, although well-qualified undergraduates

may be admitted.

Courses in plant and animal ecology and in limnology are offered. Field trips are taken to other parts of the continent.

Research chiefly deals with studies of trophic dynamics in aquatic and terrestrial ecosystems, including emphasis on both individual and population energy flows.

The Station consists of three laboratory buildings, a mess hall, sleeping cabins, a boat house, and a library. All necessary equipment for field work in ecology, and for collecting specimens, is available. Laboratory facilities include equipment for radioisotope work and for chemical analysis of soil and water.

The staff consists of three permanent faculty members and one to several visiting investigators.

Pymatuning Special Publications in Ecology is published by the Laboratory.



**THE LABORATORY OF LIMNOLOGY AND ASSOCIATED FIELD
UNITS AT THE UNIVERSITY OF WISCONSIN**

ARTHUR D. HASLER, DIRECTOR

As a consequence of a generous grant from the National Science Foundation, limnological research was given significant encouragement through the construction in 1962 of the Laboratory of Limnology on the campus-shoreline of Lake Mendota. This development solved the needs of an expanding group, the research background of which rests upon a foundation of both tradition and practical development in aquatic research at Wisconsin.

During the formative years following 1875, observation and description led to an understanding of many of the basic mysteries of aquatic ecology. Prof. E. A. Birge found fascination in the planktonic Crustacea and the cycles of temperature

in Mendota, a study that culminated in his classic treatise, "The Work of the Wind in Warming a Lake." Together with Chancey Juday, who joined him in 1905, they measured the dissolved gases of 150 lakes in southeastern Wisconsin, and in addition studied the quantity and chemical composition of the plankton.

Limnology in Wisconsin began on Lake Mendota; however, from 1925 to 1938 the base of operations was shifted to the highland lake district in northeastern Wisconsin, with the establishment of the Trout Lake Laboratory in a county (Vilas) of 350 lakes. From the lakes of the northeastern district came the classic studies on the transmission of solar radiation (*See* Ch. 1, by D. G. Frey *in* North American

Limnology, University of Wisconsin Press, 1963).

Cooperation among many departments of the University, including Botany, Meteorology, Engineering, Physics, Chemistry, Zoology, and Bacteriology, has been a feature of limnological research at Wisconsin. Working agreements with state agencies, such as the Wisconsin Conservation Department and the State Board of Health, have broadened the scope of our research immeasurably.

Experimental limnology, as emphasized by the present staff, stands upon the foundation of descriptive knowledge assembled here and elsewhere. Its principles have been applied to studies of water movements, water chemistry, fish and plankton production, and the lifting of nutrient-rich deep waters to the surface with bubbles of compressed air. Similarly, experimental techniques have been applied to the study of the orientation of fishes (See Ch. 2, by A. D. Hasler in *North American Limnology*).

The Laboratory of Limnology is a division of the Department of Zoology. This section has three professors, four post-doctoral associates, seventeen graduate students at the Masters and Ph.D. level, and a secretarial and maintenance staff of three. Financial support has come from federal and state agencies, and generous individual gifts.

Lake Mendota lies in the valleys of the pre-glacial Middleton and Yahara Rivers, which were dammed with glacial drift during the Pleistocene. For many years the lake has been under the influence of the rich agricultural area which surrounds Madison; today Mendota is biologically a highly productive lake. Detailed faunal lists for various groups have been catalogued within a list of the publications of the laboratory (Juday and Hasler, 1946. *Trans. Wis. Acad.* 36:469-490; and in Hasler, *op. cit.*).

The algal flora of Lake Mendota is of the cyanophyte-diatom type. Large blooms of *Gloeotrichia* and *Lyngbya* develop dur-

ing the summer months; *Cladophora* is abundant on the shores and festoons the large aquatic plants during June. The larger aquatic plants are mainly of the submerged type; *Vallisneria* is most abundant, followed by *Ceratophyllum*, *Myriophyllum*, and three species of *Potamogeton*.

Lake Mendota has approximately 11 species of limnetic Crustacea; the population during one year is likely to be dominated by three cladocerans of the genus *Daphnia* and, among the copepods, two members of the genus *Cyclops*, in addition to *Diaptomus* and *Diaphanosoma*. Two other cladocerans, *Chydorus* and *Leptodora*, appear in considerable numbers. *Chironomus* and *Chaoborus* dominate the deep bottom fauna whereas in the shallow areas molluscs and insects are abundant.

The fish fauna of Lake Mendota is comprised of approximately 59 species in 21 families; of these, 50 species in 18 families are well documented while the remainder are questionable. The families Cyprinidae, with 14 species represented, and Centrarchidae, with a total of 8 species, make the greatest contribution. The yellow perch, *Perca flavescens* (Mitchill), and the white bass, *Roccus chrysops* (Raf.), are dominant among the pelagic fishes and provide for an important sport fishery. The cisco, *Coregonus artedii* LeSueur, has undergone catastrophic die-offs in recent years, and is now a rare species. The yellow perch and the white bass are studied most extensively, especially their movement, activity, reproductive behavior, population dynamics, and homing behavior as related to olfactory and sun orientation.

Research stations located on Trout Lake, among the small lakes of Chippewa County, and on the Brule River in Douglas County permit the study of waters ranging from the largest fresh-water lake in the world (Superior) to small dystrophic bog lakes. The only known meromictic or permanently stratified lakes in the state, in addition to several bogs, ponds, and artificial flowages, occur nearby. Fish of a

unique nature whose distributions are limited within the state include: the muskellunge, *Esox masquinongy* Mitchill; the lake trout, *Salvelinus namaycush* (Walbaum); the lake sturgeon, *Acipenser fulvescens* Rafinesque; and several species of the genus *Coregonus*.

An integrated program of research and teaching in the fields of physical and biological limnology continues. The physiology of fishes is a major interest of the laboratory. A number of our projects deal with the more basic aspects of fisheries biology, in particular homing mechanisms. Apparatus and methods for tracking migratory fishes are being developed. A satisfactory solution would help to solve both the problems of homing of white bass in Lake Mendota as well as the study of salmon and other migratory species on the high seas. Studies of the diel migration of *Daphnia* and the related feeding of white bass are being conducted by artificially manipulating light intensity and quality in the field. Of a somewhat different nature are programs dealing with the microbiological assay of vitamin B₁₂, and the seasonal succession of filamentous algae in Lake Mendota.

In the northern lakes and streams, the ecology of such fishes as the muskellunge, black bass, rainbow trout, and walleye are of central interest, and current studies will provide a basis for future management recommendations. Other fishery problems receiving attention include the ecology of the white bass, studies on larval fishes, and the winter movements of perch in ice-covered Lake Mendota.

Basic studies in physical and chemical limnology are likewise important in our program. A knowledge of water movements in isolated basins is basic to the problem of disposal of atomic waste; and radioisotopes are presently being used to measure water movements in small experimental lakes. Work on problems of physical limnology is underway in the Antarctic in collaboration with the Department of Meteorology. Internal waves and heat propagation in Lake Mendota are studied

through the use of a modern system of data acquisition. A 12 year study of water movements in Lake Michigan is leading to increased interest in it — an interest to be shared with investigators at the Milwaukee campus of the University.

New studies center on chemical limnology, owing to an increased program in water chemistry involving the Department of Sanitary Engineering. Studies on the influence of algae upon denitrification by aquatic bacteria are under investigation.

An attractive formed-concrete building cantilevered over the waters of Mendota has recently been completed. The new Laboratory of Limnology provides offices, laboratories, conference rooms, a library, and supporting facilities for a staff of 35 people, as well as adequate fish-holding and storage facilities. The basement level encloses a boat slip opening to Mendota between concrete entrance piers. A large shop, rooms for gear and boat storage, fish holding tanks, small rooms for recording instruments, motors, and batteries, and a shower room with locker facilities complete the lower floor.

The first floor includes laboratories for graduate students and visiting personnel, for paleo- and latitudinal-limnology, hydrobotany, and microbiology. A dark room, culture room, isotope room, instrument room, and chemical laboratory are also included. The second floor consists of laboratories for the study of the behavior and physiology of fishes, zooplankton and benthos, physical limnology, and fishery biology. Offices of the director, secretaries, a library, large aquarium room, graduate laboratories, and offices for investigators are welded into a working unit. The laboratory was designed, not only for the needs of the students and faculty, but also to meet those of visiting investigators. Honorary professorships and grants for visiting investigators and post-doctoral students are available periodically.

Research papers and monographs are published in the world biological and limnological literature. Reprints are available

upon request and are offered as exchange.

A collection of Wisconsin fishes, birds, and mammals is maintained in the museum of the Department of Zoology, Birge Hall, Madison. The Milwaukee Museum has collections of other groups.

The Laboratory of Limnology is located on the south shore of Lake Mendota in the heart of the main campus of the University. This unique situation, *i.e.*, a campus laboratory embodying the advantages of a summer field station, in addition to those of a large mid-west campus, provides the investigator with adequate housing and cultural opportunities, as well as com-

petent advice in most scientific disciplines through association with groups in supporting sciences. Besides Lake Mendota, the lower lakes of the Yahara system are within ready access. A series of small ponds in the nearby Arboretum of the University has been used for experimental studies. A modest research laboratory at Trout Lake, Boulder Junction, Wisconsin operates the year around, and mobile units enable studies in outlying areas.

Inquiry should be made to the Director: Prof. Arthur D. Hasler, Laboratory of Limnology, University of Wisconsin, Madison 6, Wisconsin.

MOUNTAIN LABORATORIES

THE ALBERTA BIOLOGICAL STATION, UNIVERSITY OF ALBERTA

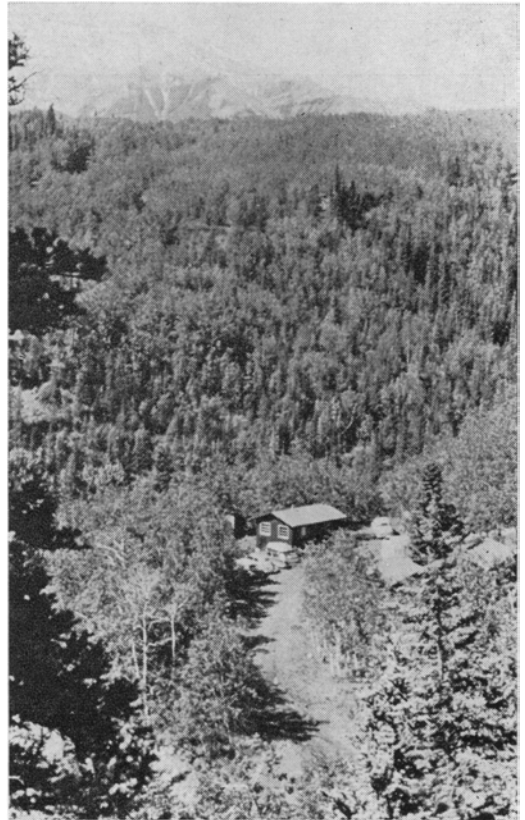
D. M. ROSS, HEAD, DEPARTMENT OF ZOOLOGY

The Alberta Biological Station was established in 1949 by the joint action of the University of Alberta and of the Department of Lands and Forests of the Province of Alberta. The moving spirit behind the venture was the late Dr. R. B. Miller, former Head of the University's Department of Zoology. It was established primarily as a base for Dr. Miller's research on trout; subsequently it also became a center for research on big game, upland game, and wildlife in general.

The Station has continued to be supported both by the University and by the Provincial Government. It is administered by a committee with representatives from the Department of Zoology of the University, and the Fish and Wildlife Division of the Provincial Department of Lands and Forests.

The Station is located at an elevation of 4,500 feet in the foothills of the eastern slopes of the Rocky Mountains, about 70 miles southwest of Calgary, Alberta. It is in the transition zone between extensive stands of aspen and balsam poplar and montane coniferous forest. High-altitude alpine meadows and alpine tundra, as well as low-altitude grasslands, are easily accessible. As the Station is situated in a Provincial Forest Reserve, the nearby area is relatively undisturbed and thus maintains a flourishing flora and fauna.

The facilities are basically designed for field ecological studies. Four permanent buildings are established at the site, three used mainly as living quarters and one exclusively as a laboratory. A diesel generator provides electricity, but it is hoped that a power line will be extended to the Station in the near future. Microscopes and other equipment are made available from the Department of Zoology as re-



Alberta Biological Station, Turner Valley, Alberta, Summer, 1962

quired. Arrangements can be made to house visiting investigators or research assistants in the permanent buildings or in tents for which floors and frames exist. Limited funds are available to support visiting investigators.

Representatives of the vertebrates, certain of the invertebrate groups, and the common plants of the region are kept in the collections of the Department of Zoology of the University, and are available for study. There is no printed publication

from the laboratory, but an annual report giving full summaries of work carried on at the Station is prepared. Copies of these reports may be borrowed for a limited time on request to the Department of Zoology.

The Station can be reached only by car over a graveled forestry road 20 miles from

the nearest town, Turner Valley, Alberta. The nearest airport and main line railway station are at Calgary. Addresses: May to September—Alberta Biological Station, Turner Valley, Alberta. October to April—Alberta Biological Station, Department of Zoology, University of Alberta, Edmonton, Alberta, Canada.



William Chambers Coker Building of Highlands Biological Station

THE HIGHLANDS BIOLOGICAL STATION, INC.

THELMA HOWELL, EXECUTIVE DIRECTOR

The parent organization of the Highlands Biological Station, Inc., was the Highlands Museum of Natural History, founded August 14, 1927, by a group of laymen. Prompted by a number of biologists from the southeastern part of the United States who had suffered from the lack of a biological station in the area, the Founders saw the magnificent opportunity for the establishment of a biological station in the Southern Appalachians. On recommendation of fifteen scientists, representing thirteen important institutions, the organization was incorporated on July 21, 1930, as the Highlands Museum and Biological Laboratory. On September 30, 1949, the charter of the corporation was amended and the name of the organiza-

tion changed to the Highlands Biological Station.

The primary objective was to provide a regional research station where competent investigators may be brought together in mutually helpful relations. The emphasis at the Station has always been on research.

The corporate powers of the Station are vested in a Board of Trustees. An Executive Committee of seven members acts for the Board of Trustees in the formulation and execution of plans and policies approved by the Board.

A new research laboratory, made possible by a grant from the National Science Foundation, was completed in May 1958, and named for the late distinguished botanist, William Chambers Coker, a former

corporation president and director of the laboratory. The Coker building contains research cubicles for 18 investigators; the Reinke Library, named for the late Edwin E. Reinke, first director of the laboratory; executive offices; storeroom; and photographic darkroom. Central heating permits use of the building throughout the year.

The original research laboratory, built in 1931 and named the Sam T. Weyman Building, was remodeled in 1958 and converted into a dining hall-kitchen. The dining hall seats 50 people, and is operated from June 1-August 31.

Four cottages are available for housing.

The Highlands Biological Station is in the southern section of the Blue Ridge Province, commonly called the Southern Appalachians. The region is one of great antiquity, for the Appalachians represent an ancient land mass repeatedly raised into mountains and continuously eroded before the newer Appalachians were born. While other areas of the continent were glaciated, submerged, and exposed to great climatic changes, the Southern Appalachians offered a refuge for many species of plants and animals.

Important studies have been made in several areas of the Southern Appalachians, notably in the Great Smoky Mountains, to (a) determine patterns of forest distribution, (b) look for clues to the question of how forests developed, and (c) study the animal communities and associations and account for their distribution. Although biologists have long known that phyto-geographically important relict populations of liverworts and mosses and vascular plants were present in the gorges of the southeastern escarpment of the Blue Ridge Mountains, no extensive studies have been made to determine the role of a headwater escarpment complex in regional animal and plant distribution.

Near the Highlands area, the southeastern region of the Blue Ridge escarpment (located in southern Transylvania, Jackson, and Macon Counties, North Carolina, and northern Pickens and Oconee Counties, South Carolina) offers a unique area

for the study of the distinctive nature of a whole complex of gorges. The gorges constitute an altitudinal transition between the flora and fauna of the Piedmont and Coastal Plain provinces on the one hand and the mountains on the other. A study of the ecology of these gorges is currently supported by an NSF grant.

The program consists of studies involving two phases, the first being inventory and descriptive and the second analytical and experimental. In addition to floral and faunal surveys, the research to date has included studies of significant marginal, transitional, and isolated populations.

The research program in the gorges provides support for independent investigators, both post-doctoral and pre-doctoral, whose research programs are concerned with the biota of the gorge areas and which require the facilities of the Highlands Biological Station as a base of operations.

In addition to the research program in the gorges, the National Science Foundation has made it possible for the Station to support other research projects of independent investigators.

Institutions and agencies which render financial support to the Highlands Biological Station are: Champion Paper and Fibre Company, Coca-Cola Bottling Company of Asheville, Duke University, Emory University, Florida State University, National Science Foundation, North Carolina State College, State of North Carolina, University of Florida, University of Georgia, University of North Carolina, University of Tennessee, Vanderbilt University, Wesleyan College (Georgia), and the Wm. C. Brown Company.

US Highway #64 passes through the town of Highlands. The nearest train service is Seneca, South Carolina; nearest bus service Franklin, North Carolina; nearest airports Asheville, North Carolina and Greenville, South Carolina.

Requests for use of the facilities, for grants and for information should be addressed to the Executive Director, Highlands Biological Station, Highlands, North Carolina.

JACKSON HOLE BIOLOGICAL RESEARCH STATION, UNIVERSITY OF WYOMING

L. FLOYD CLARKE, HEAD,
DEPARTMENT OF ZOOLOGY AND PHYSIOLOGY

The Jackson Hole Biological Research Station, administered by the University of Wyoming under agreement with the New York Zoological Society, is available for use by research workers in the biological sciences from June 1 to September 10, and at other times during the year by special arrangement. The New York Zoological Society, in cooperation with the Jackson Hole Preserve Inc., and the Wyoming Game and Fish Commission, operated the Biological Research Station from 1947 to 1953. Since 1953 the University of Wyoming has assumed the responsibility for the administration of the Station as a part of an expanding program of research in biological science. The Grand Teton National Park cooperates in the research activity.

The Station is staffed by a director and an assistant director who also participate in the research activities, a permanent caretaker, and an assistant during the summer months. In effect the research investigators constitute the staff, and many have graduate students as assistants. An advisory board appointed by the President of the University of Wyoming assists the director.

The Station is located in Grand Teton National Park, in a grove of lodgepole pines adjacent to the Snake River, one mile east of the Jackson Lake dam, 33 miles north of Jackson, Wyoming, and 20 miles south of the south entrance to Yellowstone National Park. The Station is designed to accommodate research workers in those particular biological fields for which the Jackson Hole area furnishes opportunity for substantial and significant research. A wide variety of biotic communities occurs within reasonable working distance from the Station. This includes sagebrush, mountain grasslands; stream-side communities, such as willows, cotton woods and marshes; coniferous forest of



The Teton Mountains which are in the immediate vicinity of the Station

several kinds; aspens, and alpine communities. Since the composition of most of these communities has not been studied, the opportunities for general ecological studies are practically unlimited. Such studies could be purely qualitative in nature, or they could be quantitative in scope and involve studies of population dynamics. An extensive area to the north of the Station has been designated by the U. S. Forest Service as the Teton Wilderness Area. This area affords undisturbed conditions, since the grazing of domestic stock and the cutting of timber are not permitted.

The area surrounding the Station is big

game country with bighorn sheep, moose, elk, and deer, as well as many species of fur-bearing animals. The U. S. Forest Service and the Wyoming Game and Fish Department have built a number of enclosures which can be used as control areas in making studies of the effects of both domestic livestock and wildlife on the ranges.

Other studies which could be made include: general life history studies of particular species of either invertebrate or vertebrate animals; altitudinal and seasonal distribution studies; studies of behavior, territories and social organizations; studies of reproduction and growth; and both plant and animal taxonomy.

The region offers an abundance of research opportunities in the field of aquatic biology. Rocky Mountain lakes, particularly alpine lakes, present many limnological problems in need of intensive and long-term study. These lakes lie at elevations ranging from 6,000 to over 13,000 feet. Many aspects of stream ecology, a subject which has long been neglected in the field of hydrobiology, can be studied, literally at the front door of the main laboratory. The Snake River, the largest stream in the area, runs right by the Research Station. Medium sized streams are convenient for study, as are smaller creeks and brooks.

Students of fishes and fisheries will find a wealth of research opportunities in the area. The life histories of most of the non-game fishes of the area are virtually unknown, and many aspects of the ecology of the native game fishes are very much in need of long-term investigations. Fisheries management in the lakes and streams, and

many aspects of fish production, and management are in need of further study.

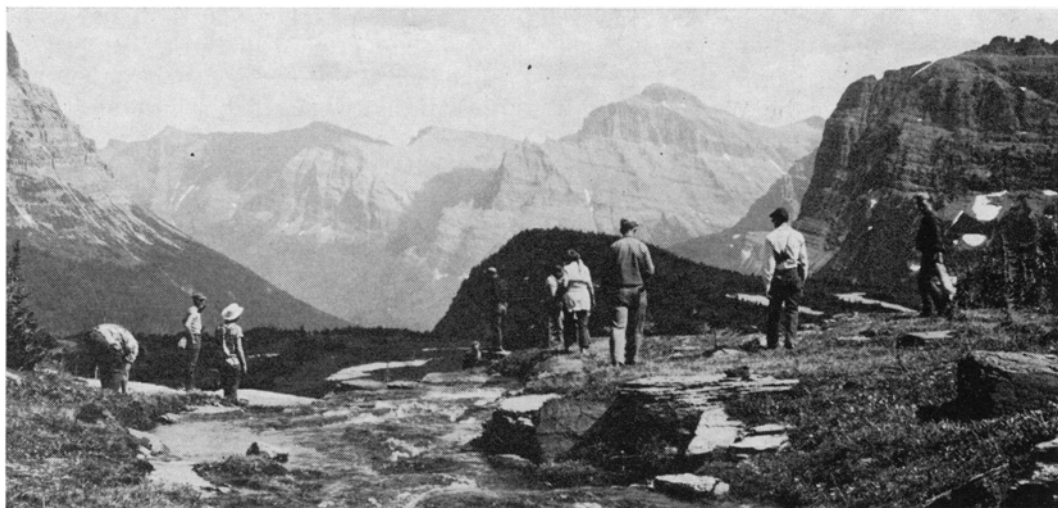
The facilities at the Research Station are also satisfactory for laboratory study in physiology and development which can be correlated with field ecological and life history studies.

The Station buildings are of log construction and include well-equipped zoology and botany laboratories, and ten dwelling units provided with light-house-keeping facilities. A fee is charged for use of living accommodations; no mess accommodations are provided. Available are: a library containing the most essential biological references; an herbarium; a collection of mammals and birds; a shop; a boat with outboard motor; a pickup truck, and passenger car. Electricity, heat, refrigeration and telephone are provided.

Reprints of publications resulting from work at the Station are available in limited numbers. In most cases the individual investigators have arranged for distribution and exchange of their own publications. Checklists of animals of this area are available through Grand Teton National Park and Yellowstone National Park.

Research workers at the Station may register for credit at the University of Wyoming. Grants for research have been supplied in some cases by the New York Zoological Society and in others by home institutions or other agencies.

The Station is easily accessible by airplane or automobile. All inquiries should be addressed to L. Floyd Clarke, Department of Zoology, University of Wyoming, Laramie, Wyoming.



Mammalogy class from Montana State University Biological Station on a field trip in Glacier National Park. (Credit for photograph, Mr. Summer Dow)

THE MONTANA STATE UNIVERSITY BIOLOGICAL STATION

RICHARD A. SOLBERG, DIRECTOR

The Montana State University Biological Station is located on Yellow Bay on the east shore of Flathead Lake at the base of the northern end of the Mission Mountains, 90 miles north of the main university campus at Missoula. The Station also has land on Bull Island and on Polson Bay, and owns the two small Bird Islands. Flathead Lake lies in the Flathead Valley, which was glaciated in the Pleistocene, at the southern end of the Flathead and Purcell Trenches of the Rocky Mountains. The valley, bordered by mountain ranges showing marked differences in geological structure, lies about 40 miles west of the Continental Divide and 100 miles south of the Canadian Border. This valley and the adjacent valleys and mountains form one of the upper reaches of the Columbia River Drainage. The headwaters of the Mississippi and Hudsonian Drainages are easily accessible in Glacier National Park.

Flathead Lake is an oligotrophic lake with a definite thermocline during the summer months. It is approximately 35 miles long with an average width of 7

miles. The maximum depth is approximately 300 feet. The shore line of the lake varies considerably from precipitous, rocky shores on the east side to a sloping sandy bottom at the south end of the lake. The Swan and Flathead Rivers empty into the lake at the north end, and the latter river drains the lake at the south.

The Station was founded in 1899 by Dr. M. J. Elrod, Professor of Biology at Montana State University. The laboratory was originally directed toward providing opportunities for high school and college instructors to carry on field work in the biological sciences. The Station continues to concentrate on presenting upper division courses and graduate work in the fields of botany and zoology that are related to the taxonomic and ecological approaches to the study of these disciplines. The Station stresses research programs primarily concerned with the fauna and flora of Northwestern Montana.

Former directors of the Station were: Dr. Elrod, until 1933; Dr. J. W. Severy, until 1940; and Dr. G. B. Castle, until 1962. Dr. R. A. Solberg was appointed

acting director in 1962. Various members of the Zoology and Botany Departments of Montana State University, as well as noted scientists from many regions of the United States, have been active in teaching and research done at the Station.

The first permanent Station structure was a brick laboratory, built in 1911-12, which is now used for a student store, student offices, and a social center. The area at present contains over 60 individual buildings, including 12 staff and faculty cabins, 35 student cabins, general commissary, 5 buildings containing teaching and research laboratories, and numerous maintenance buildings and facilities managed by a year-round resident custodian.

The Station is a unit of the State University Summer School, and is administered by the University through the Dean of the College of Arts and Sciences.

Habitats in the vicinity of the Station range from lakes and valleys at 3,000 ft. altitude, to mountain peaks of 10,000 ft. altitude. Plant associations include palouse prairie; sagebrush; montane, coast, and spruce-fir forests; sub-alpine meadows; and tundra. Aquatic environments include eutrophic and oligotrophic lakes, glacial pot-holes, ponds, swamps, bogs, streams, and rivers. All aspects of northern Rocky Mountain ecology are represented in close proximity to the Station. Major research has centered around the following areas: limnology, mammalogy, invertebrate zoology, ornithology, entomology, algology, systematic botany, and ecology. The resident faculty has varied in number from five to eight, depending on the number of grant-supported Institutes being held at the Station during any one summer.

Qualified students who are officially enrolled in the Graduate School may take course work and do research at the Station toward a master's degree. Master's degrees are offered in Botany, Zoology, Wildlife Technology, and Teaching of Biological Sciences. Credits applicable toward a Ph.D.

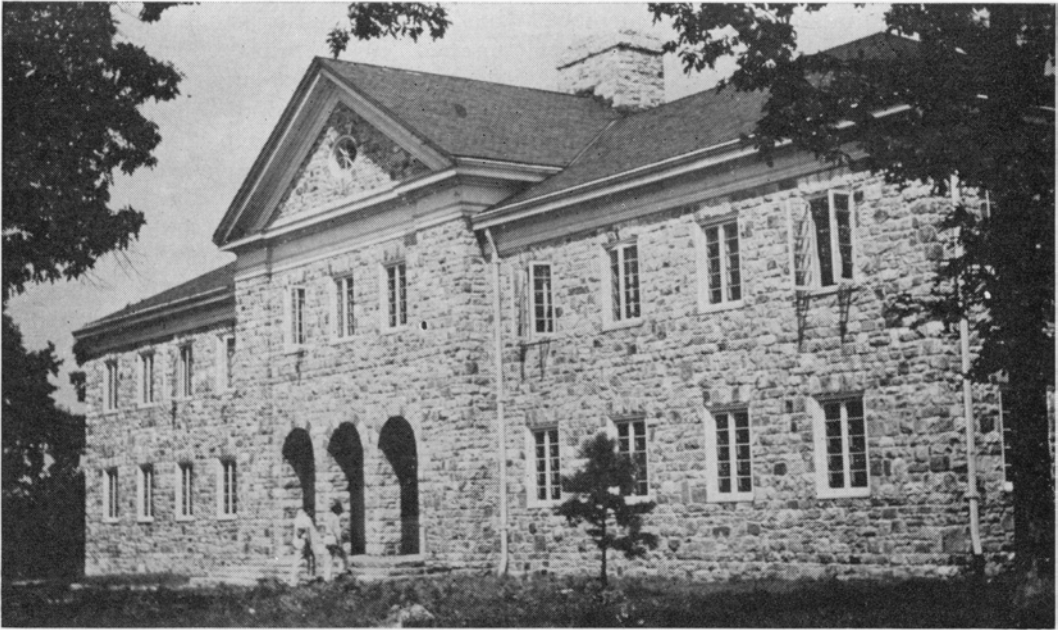
in Zoology are also available. Students interested in earning a master's degree through successive summers at the Biological Station should write to the chairman of either the Department of Botany or Zoology of the University for information.

Each summer finds independent researchers using the Station facilities for their respective projects. These have included such areas of study as bird nesting habits and lake microbiology. A checklist of birds and mammals of the area is available from the Department of Zoology, Montana State University, as well as checklists of unique taxonomic groups of other animals. The Botany Department of the University has information available concerning flora of the vicinity. Collections of fauna and flora are available for research and teaching through these departments.

The academic staff is composed of professors in addition to teaching assistants. The non-academic staff contains one full-time resident maintenance man, a summer assistant, a full-time secretary, a full-time chef, three assistants, and a student store operator.

The facilities and active cooperation of many state and federal agencies are available to the staff and research workers of the Biological Station. Research projects are conducted independently and in cooperation with biologists and naturalists in Glacier National Park, at the Rocky Mountain Laboratory in Hamilton, at the National Bison Range at Moiese, with the Cooperative Wildlife Research Unit on the Missoula campus, and with the State Fish and Game Department in various sectors of the State. Both long-range and short-term research projects are feasible under these arrangements.

Further information is available from the Director, Biological Station, Bigfork, Montana (in summer); Department of Botany, Montana State University, Missoula, Montana (in winter).



The Mountain Lake Biological Station Main Laboratory

THE MOUNTAIN LAKE BIOLOGICAL STATION, UNIVERSITY OF VIRGINIA

JAMES L. RIOPEL, DIRECTOR

The Mountain Lake Biological Station is located in the Allegheny Mountains of southwestern Virginia. The Station is financed and controlled by the State and the University of Virginia. It was established in 1930 as a branch of the University of Virginia to provide facilities for advanced instruction and research in field biology and related areas.

Courses at the Station are offered under the Summer Session of the University of Virginia. There are two five-week terms and four graduate courses are given each term. Different courses are offered each summer so that the curriculum is diversified and serves the interests of a larger group of students. Zoological courses frequently given are ecology, entomology, herpetology, ichthyology, helminthology, mammalogy, ornithology, and protozoology. Student enrollment in most courses is limited to 12.

Students may undertake at Mountain

Lake a program of courses and research for the Master's degree from the University of Virginia. The Ph.D. degree is not given during the Summer Session, but credit towards that degree can be obtained for work done there. Credit is also transferable to other institutions.

The teaching staff at Mountain Lake consists of eight instructors who are invited to the Station from universities throughout the country. With the rotating curriculum, a different staff is in residence each summer. At the same time, staff continuity is maintained by inviting instructors to return when their courses are offered again. The remaining personnel varies from year to year. In 1962, there were present: 11 senior scientists, 7 research fellows, 1 research assistant, 1 secretary, 1 librarian, 1 caretaker, 3 cooks, and 4 maintenance men.

The physical plant consists of 24 buildings. The main laboratory building con-

tains 4 classrooms, 2 photographic rooms, 3 stockrooms, 15 private research areas, a library, herbarium, constant temperature room, an auditorium, and a seminar room. In addition, a smaller laboratory building is now being equipped to provide research facilities and living accommodations during the off season. This building will be ready for use by June 1963. Comfortable lodging is provided in individual cottages which have one or two bedrooms. Most of the cottages have an open fireplace in the living room, and all have electric lights, hot water, and private bathrooms with showers. All meals are served in a common dining room.

Equipment at the Station for instructional and research purposes includes such items as automobiles, boats, collecting equipment, traps, seines, field glasses, and microscopes. Also available are microtomes, incubators, embedding ovens, autoclaves, photometers, and many other items used in general work. The Station usually provides for all stains and reagents used in research, if notified in advance by visiting investigators. Funds are available from the National Science Foundation to support research at Mountain Lake during the summer months, or for shorter periods at other times of the year. Application for these awards should be made to the Director.

The actual site for Mountain Lake is on a wooded ridge at 4,000 feet on top of the divide between the Atlantic and Mississippi drainage areas. The Station property includes 1,200 acres, and has an additional 1,500 acres adjacent to the Station recently set aside as a scenic area to be preserved in its natural state. The Jefferson National Forest also adjoins the

Station property, and over 100,000 acres of woodland are available for study.

The Station is surrounded by many rich and diversified habitats which offer excellent opportunities for study of aquatic and terrestrial organisms. Several mountain streams, a small natural lake, mixed deciduous forests, rocky ridges, a sphagnum bog, and stands of red spruce, hemlock, and white pine, are among the many interesting habitats within walking distance of the Station.

No specific research areas of zoology are stressed at Mountain Lake, nor can it be said that the area is especially unique in the organisms present. Studies recently published from work at the Station include such diverse subjects as: taxonomy of Heliozoa; life history of trematodes; helminths of mammals; epizootic ostracods and branchiobdellids of crayfish; chromosomes of aquatic pulmonate snails; taxonomy, life history and ecology of crayfish; sex induction in wood roaches; initiation of function of the islets of Langerhans in tadpoles of the frog during metamorphosis; and ecology of cave salamanders.

Mountain Lake is located 20 miles from Blacksburg, Virginia, and may be reached by highway. Bus service is available to the town of Christiansburg, which is 28 miles from the Station. A commercial airport is located in Roanoke, 60 miles from Mountain Lake. A Station vehicle is available to meet persons at either of these locations. During the summer months, the mailing address is the Mountain Lake Biological Station, Route 1, Pembroke, Virginia. From September to June, all mail should be directed to the Department of Biology, University of Virginia, Charlottesville, Virginia.



A field crew near timberline on the way to the Alpine Tundra Research area. (Near Science Lodge Mountain Research Station)

SCIENCE LODGE MOUNTAIN RESEARCH STATION, UNIVERSITY OF COLORADO

JOHN W. MARR, DIRECTOR,
INSTITUTE OF ARCTIC AND ALPINE RESEARCH

Science Lodge Mountain Research Station is a year-round field establishment in the central Rocky Mountains. It is located at 9,500 feet elevation on the east slope of the Front Range in northern Colorado, twenty-five miles from the campus of Colorado University in Boulder, and forty-five miles from Denver over paved highways. Extensive research areas at elevations from 5,500 feet to 13,000 feet are accessible from Science Lodge in less than one hour of travel time in all seasons. The variety of easily accessible mountain habitats makes Science Lodge an excellent center for introducing people to mountain landscapes and teaching methods of field research. The Lodge is conveniently located for changing from conventional clothing, equipment and vehicles to the specialized types essential for field work in the higher mountains. Science Lodge provides efficient living accommodations for scientists working at higher elevations because most people do not rest well above 9,500 feet,

and high altitude acclimatization is impossible at lower elevations. Science Lodge can be reached by traveling 17 miles west of Boulder to Nederland on highway 119, the north 7 miles on highway 160 and finally 1 mile west on a gravel road.

The administration of Science Lodge is the responsibility of the Institute of Arctic and Alpine Research, an official agency of the University of Colorado. The Institute assumed administration of Science Lodge in 1951, after it had functioned for over 30 years as a summer field class establishment, and made it a center for year-round field research activities. It is now used extensively by the Institute in its programs of research, research education, seminars and symposia, and to provide accommodations and facilities for visiting scientists and graduate students.

Most of the staff of the Institute of Arctic and Alpine Research are concerned with the activities at Science Lodge and reside there at times during the year. A manager-

caretaker lives at the Lodge on a full-time basis to provide continuity of operations at the facility throughout the year. The Institute staff is presently composed of the following personnel: a director, an associate director, administrative assistant, manager of facilities, four research associates, two secretaries, five research assistants, a field technician, two laboratory and field assistants, and a visiting scientist. During the summer the staff includes several maintenance men, a cook and her assistant, and additional research assistants. However, the number and composition of the Institute staff varies somewhat with the season and year.

The Institute is governed by a Council composed of several professors and administrative officers of the University. The Director, appointed by the President upon the recommendation of the Council, supervises the affairs of the Institute including Science Lodge.

The research programs are largely concentrated in the Front Range, and most of the projects emphasize an ecological approach in which the ecosystem is the basic unit of study. Hence the projects do not necessarily separate the ecosystem components (plants, animals, environment factors, and ecological processes) for research purposes. Some of the projects presently in progress include studies of environment in four climax regions, radiation ecology, pattern and process of fallout radiation in an alpine watershed, plant and animal interactions, energy exchange between organisms and their environment, cytotaxonomy of the alpine flora, and genesis of patterned ground. Research projects more specifically in zoology are a study of the behavior and life history of the pika, and a study of small mammal populations in alpine tundra habitats. Several other zoological projects of scientists not on the Institute staff are in progress within the Science Lodge area.

In the immediate vicinity of Science Lodge, an 80 square mile segment of landscape has been delimited for long-range investigation. Within this relatively small

area there is a very great number of basic habitats including a diversity of organisms, parent materials, soils, and climates. Five distinct but adjacent climax regions and their transitional ecotones are to be found in this area, and all can be reached in less than one hour from Science Lodge. These regions are: the Great Plains grassland, lower montane forest, upper montane forest, subalpine forest, and alpine tundra climax regions. Probably the most unique feature of this area is the extensive, well developed, yet relatively accessible alpine tundra, some of which has gentle topography and deep soil; most of the research at Science Lodge is concentrated in this portion of the landscape.

The entire study area is relatively free from use by tourists, ranchers, lumbermen, and sportsmen, especially when the close proximity to a large population center and the good transportation to the area is considered. There are no permanent homes or ranches within three miles of Science Lodge, and disturbance to research installations is infrequent.

Science Lodge consists of 200 acres of land surrounded by the Roosevelt National Forest. Facilities include the Alpine Laboratory (a new 27 room winterized building), housing for 70 summer and 25 winter residents, a central dining room for residents who do not have cooking facilities in their cabins, and office, maintenance, research, and service buildings. Three small buildings are located on the Niwot Ridge Alpine Tundra and Ecotone Research Area, one at 12,300 feet elevation, one at 11,700 feet elevation and one at 11,000 feet elevation, for use by researchers. Niwot Ridge can be reached from Science Lodge in less than 30 minutes via an Institute maintained road four miles long. Research equipment, instruments, special field gear, and vehicles for all season mountain travel, including over-snow vehicles, are available at Science Lodge.

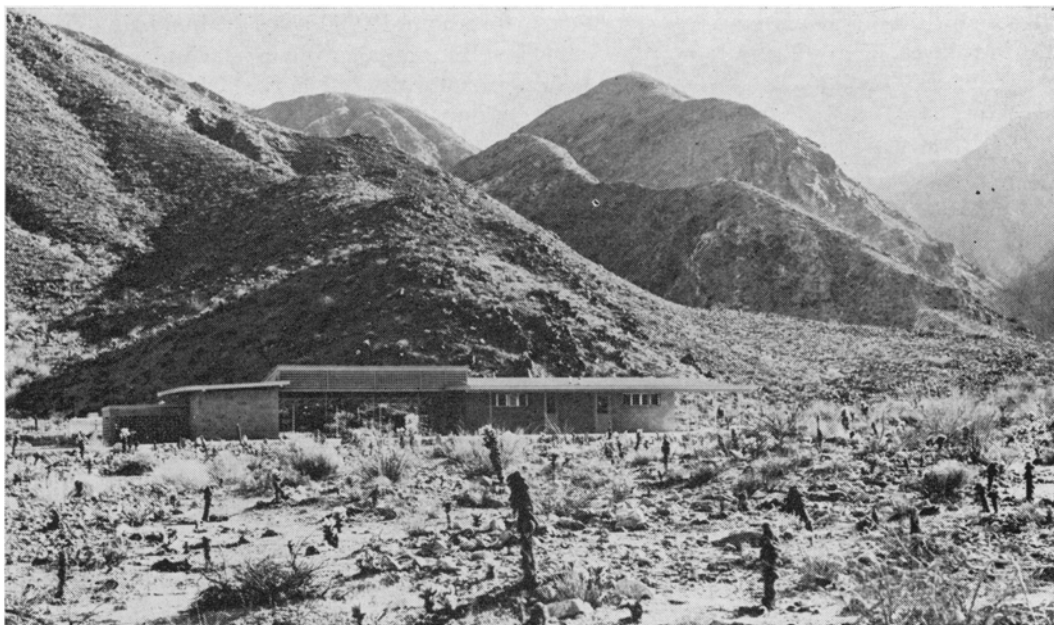
Two projects of interest to scientists at Science Lodge are the Mountain Library, a collection of mountain literature, and the Front Range collections, a representative

collection of plants, animals, and rocks. These projects are in their early stages, and much work remains before they will be of more than limited benefit to researchers. The Institute sponsors a contribution series of Institute publications which are available to all interested persons and organizations, preferably on an exchange basis.

The Institute cooperates with visiting investigators who can benefit from the use of its facilities, knowledge, and experience. At the present time, living accommodations for visiting scientists at Science Lodge are limited, and many requests cannot be

filled. However, new facilities including winterized housing, summer camping facilities, and additional research and service buildings, have been planned and will be constructed as rapidly as funds become available. Since Science Lodge is a non-profit facility, nominal charges varying with the status of the visitor are made for housing, research space, and equipment.

Further information about Science Lodge Mountain Research Station and the Institute of Arctic and Alpine Research can be obtained from: The Director, The Institute of Arctic and Alpine Research, Hale Science Building 102, University of Colorado, Boulder, Colorado.



A view of the Philip L. Boyd Desert Research Center near the mouth of Deep Canyon, Riverside County, California. The air-conditioned laboratory and living quarters are on the right with the cistern and generators housed in the buildings on the left.

DESERT LABORATORY

DEEP CANYON DESERT RESEARCH AREA AND THE PHILIP L. BOYD DESERT RESEARCH CENTER

RODOLFO RUIBAL,
CHAIRMAN CONTROL COMMITTEE

The University of California established the Deep Canyon Desert Research Area at the western edge of the Colorado Desert near Palm Springs, California. This 10,000 acre preserve, including the lower gorge of Deep Canyon itself, is located at the base of the Santa Rosa-San Jacinto Mountains some 75 miles from the Riverside Campus of the University. The area has been set aside to provide wild land where biologists can make continued studies of native desert plants and animals in an undisturbed environment.

The Deep Canyon Area has a range of elevations from 250-1,550 meters (700 to 4600 feet). Mt. San Jacinto with an elevation of 3,600 meters (10,800 feet) is 40 miles by road to the west. Immediately

north and east of Deep Canyon is the low-lying part of the Colorado Desert whose lowest point is the Salton Sea, 78 meters (235 feet) below sea level.

The average annual rainfall in this region is approximately three inches. This rain usually falls in the winter months although Deep Canyon is also subject to occasional summer floods. The mean maximum temperature in July is 41° C and the mean minimum temperature in January is 4°C.

The Area includes the following desert habitats, which are listed together with their most characteristic vegetation:

Higher elevations (4,000 feet)

Pinyon (*Pinus monophylla*);

Juniper (*J. californica*).

Desert hillsides and plateaus

Mojave Yucca (*Yucca*);
Agave (*Agave*).

Alluvial fan

Creosote bush (*Larrea*);
Sandbur (*Franseria*);
Ocotillo (*Fouquieria*);
various cacti.

Desert wash

Smoke tree (*Dalea*);
Palo Verde (*Cercidium*);
Desert Willow (*Chilopsis*).

Intermittent stream and permanent water hole

California fan palm (*Washingtonia*).

The presence of permanent water holes in Deep Canyon is a major factor in bringing about a summertime concentration of animal life and year-round populations of amphibians (*Hyla* and *Bufo*) and of big-horn sheep (*Ovis canadensis*), which range at elevations from 1,000 to 4,000 feet on the eastern slope of the Santa Rosa Mountains.

Along the western rim of Deep Canyon is the Palms-to-Pines Highway, State Highway 74, which in conjunction with State Highway 111 provides access to both the higher elevations of the Upper Sonoran (Pinyon-Juniper Association) and Transition (Yellow Pine Forest) life zones, and to the lower portions of the Colorado Desert (Lower Sonoran), where habitats such as sand dunes and alkali flats are available.

In addition to University ownership of about 4,000 acres, the Bureau of Land Management, U. S. Department of Interior, has recently agreed to retain 6,400 acres along the eastern and southern boundaries of the area in public ownership and to manage them under a co-operative program to aid the research studies of the University. A protected area

of about 10,000 acres is thus being created.

The area is not a teaching facility, but is administered entirely for research. The Control Committee for Deep Canyon does not administer any research funds for individuals.

In the spring of 1962, an air-conditioned building containing a research laboratory and living quarters was completed at the Deep Canyon Desert Research Area. This new facility, The Philip L. Boyd Desert Research Center is available to qualified investigators for either long-term studies within the area, or as a base for studies in the surrounding desert or mountains. The laboratory is equipped with gas, electricity, and running water, as well as dissecting microscopes and lamps. The living quarters consist of a bedroom, bath and kitchen, all air-conditioned; the kitchen includes a refrigerator and range. The laboratory is located near the mouth of Deep Canyon and is readily accessible by road from Palm Desert. Water is available from a well, and it is pumped to a cistern for storage. Electricity as 110 or 220-volt current is available from generators. Facilities are sufficient to accommodate from two to four resident researchers. The use of the living quarters and of the laboratory is free of charge.

Research on various aspects of desert biology is currently being undertaken by Lloyd Tevis, Resident Research Biologist, at the Philip L. Boyd Desert Research Center. The administration of the area is by a Control Committee. Currently, Chairman of the Committee is Dr. R. Ruibal. Anyone interested in utilizing the area or the laboratory should write to: Control Committee, Deep Canyon Desert Research Area, Division of Life Sciences, University of California, Riverside, California.

SPECIAL LABORATORIES

THE INSTITUTE FOR THE STUDY OF NATURAL SPECIES, THE CATHOLIC UNIVERSITY OF AMERICA

ROSS H. ARNETT, JR., DIRECTOR

The formal organization of The Institute for the Study of Natural Species took place early in 1961 when the Rector of The Catholic University of America established it as a part of the Department of Biology. The Institute, however, has been in effective operation since 1957 when the first mobile laboratory unit was used in the field. With its headquarters in the biological laboratories at the University in Washington, D. C., each summer is spent in the field studying and sampling natural populations of plants and animals.

The purpose of this Institute is to study in the field, by observation and experimentation, those groups of organisms about which there is still so little known that ordinary laboratory study is impossible. This is accomplished by taking staff members and students into the field with sufficient laboratory equipment so that experimental study may be possible. The actual laboratory is a specially outfitted truck (see illustration) equipped with a 110 v. gasoline generator, self-contained water supply, sink, gas stove, and space for microscope study, dissecting, and the preparation of material. The truck also draws a well-equipped trailer which provides comfortable living quarters for the staff and students, as well as space for rearing organisms. Field manuals for identification of specimens, portable tape recorders for the recording of data while in the field, and weather instruments are among the special facilities available. The use of this unit is open to any qualified person as funds permit. As the demand increases, more mobile units are contemplated.

The work of the Institute falls into three categories: research, training, and publication. At the present time, research studies



Mobile laboratory unit in operation at the Pena Blanca study area in southern Arizona.

are being undertaken on various groups of beetles and on the speciation in one group of plants. Several students have gathered data used in their doctorate dissertations, or have made use of specimens collected during the summer work of the Institute. The monograph series *Studies on Speciation* is sponsored by the Institute and is published by The Catholic University of America Press. The laboratory is supported and administered by The Catholic University of America and has received funds from The National Science Foundation, The American Philosophical Society, and private sources. The present staff includes specialists representing the fields of Invertebrate Zoology, Vertebrate Zoology, and Systematic Botany. When in the field, the operation of the mobile units is carried on with the help of faculty members and graduate students.

For the past several years the Institute has been operated in Texas, southern Arizona, and northern Mexico. Because of the mobile nature of the laboratory almost any area of North America may be studied. However, a specific site is selected, and studies are made in a single area for several seasons as needed. It is for this reason that many types of experimental studies may be made that cannot be made

at any other laboratory. The work of the biologists so far associated with the laboratory has been confined to the arid and semi-arid regions of North America, but it is by no means limited to such studies. As research plans are developed and more units become available, other areas will be investigated. The emphasis is placed, however, on the comparative study of populations of organisms with the hope of arriving at a better understanding of the factors and mechanisms of speciation, and by so doing, gain a better understanding of the principles of natural evolution. Insofar as studies fall within this particular phase of biology, the laboratory is open to any project or approach.

At the present time, the beetles of the Pena Blanca region, near Nogales, Arizona, are under study. Several populations of beetles are being studied. A check-list of the beetles is being prepared. Detailed weather data have been collected and correlated with the changes in the fauna and flora of the area throughout the summer season. By means of marking techniques, the movements and habits of these beetles are under study. Progress of the development of the gonads during the reproductive stages has been studied by making frequent dissections of samples in the mobile laboratory. This has yielded many valuable data and has resulted in the discovery of structures and functions previously unknown in any beetles. These kinds of studies have also provided significant samples for further study in the laboratory at the University during the winter months. The statistical analysis of population samples is emphasized. Desk calculators are available for use in the field or at the University. The University also has available an IBM computer system which is being employed in these studies.

The future sites of study will be determined according to the demand for use of these facilities. Every effort is made to minimize "housekeeping" chores and to provide comfortable quarters in even the most remote of areas so that the maximum

amount of time may be spent on research. In this way, the laboratory provides many advantages over the conventional "camping" type of field work. Also, by having laboratory equipment at hand, facilities are available so that full advantage may be taken immediately of any interesting discovery, instead of having to wait until the following season to continue the study. At the present time, most of the operating expenses are covered by specific grants to the University. Those who may desire to use these facilities should make advance arrangements with the Institute.

In addition to these researches, arrangements have been made with the University to grant qualified graduate students formal credit for work accomplished during the field trips for that portion of study which is not directly a part of their dissertation research.

The monograph series *Studies on Speciation* provides a suitable outlet for research at the Institute. This publication is open to others as well. The immediate results of these researches are published in *The Coleopterists' Bulletin* sponsored by the Department of Biology, or in other suitable journals. All of these publications are available for exchange, either from the individual, through the University Libraries, or may be purchased from the Press.

The insect collection and the herbarium maintained by the Department of Biology constitutes the principal collections of the Institute. The beetle collection amounts to over 250,000 specimens with numerous types. The herbarium, already notable because of the collections of the Arctic Institute, with its many types, is being expanded by the plant material collected during these summer studies. All of these specimens are available for study by specialists upon request, and are also available to qualified graduate students. Exchanges will be made on an individual basis. Because of the close proximity of the United States National Museum, only specialized collections are maintained, and all type-specimens of insects are eventually de-

posited in the U. S. National Museum collections.

During the months of June through September, the Institute's mailing address is: P. O. Box 128, Nogales, Arizona. The permanent address is: Department of Biology, The Catholic University of America, Washington 17, D. C. Further information regarding the current activities of the Institute, including details of cost, and specific facilities or space available may be obtained by writing to either address. It should be emphasized that this laboratory

is still in an active stage of development and those interested in this novel approach to population studies are urged to contact the Institute for further details. It is hoped that by team work effort, specific problems may be studied concurrently from several different approaches, and in this manner much can be accomplished toward the discovery of facts that might not otherwise be assembled for many years. Thus, the Institute is a mobile symposium in the making.

LABORATORY OF RADIATION ECOLOGY, AEC SAVANNAH RIVER PLANT

The laboratory is located eighteen miles southeast of Augusta, Georgia and 14 miles south of Aiken, South Carolina within the Savannah River AEC Reservation. The nearest airport is Augusta, Georgia; all visitors must first contact the laboratory by letter or telephone to obtain a visitors pass at the administrative building.

By contract with the Atomic Energy Commission, the Institute of Radiation Ecology of the University of Georgia is conducting research in Radiation Ecology on the AEC Savannah River Reservation. The permanent laboratory (which operates through the year) was established in 1961, following ten years of exploratory studies of the fauna and flora of the reservation by staff and students from several universities. Approximately 250,000 acres are included in the reservation, from which the public is excluded. Only a very small part of the area is directly affected by the operation of atomic energy facilities. Approximately one-third of the reservation is former croplands now undergoing natural succession or planted with pines which will be harvested on a continuous yield basis by the U. S. Forest Service. Two-thirds of land area is in natural forests, ranging from scrub oak and long leaf pine stands on the dry sandhills to moist bottomland

hardwoods along the streams. A Forest Service Laboratory is located adjacent to the Ecology Laboratory. In addition to the Savannah River, five small streams, natural ponds, and a large artificial impoundment are available for aquatic studies. The reservation is located on the upper coastal plain physiographic province with a mild temperate climate which favors year-round field work.

In addition to basic equipment for biological work, the laboratory has special facilities for work with radionuclide tracers and for experimental work on the effects of ionizing radiation. Extensive facilities are available for maintaining wild animals for experimental purposes. Field experimental facilities are being developed, including large enclosures for small mammals. Conditions are especially good for experiments involving the use of tracers in the field.

In addition to biological work relating to the environmental aspects of atomic energy, research in basic functional ecology of populations and in game and fish population biology is being emphasized.

Facilities and limited financial support are available for pre-doctoral and post-doctoral investigators who wish to carry out research or obtain special training in tracer

technics. However, only U. S. citizens may work within the restricted area. No living accommodations are maintained, but housing can be readily obtained in Aiken, Augusta, or other nearby towns.

A list of publications and reprints of papers is available from the director. A library of key books and papers and a reference museum are being developed to supplement material available at the University campus. The Savannah River Plant maintains a technical library which in-

cludes AEC documents and other important material in the atomic energy field.

For further information, contact Dr. Eugene P. Odum, Director, Institute of Radiation Ecology, Biological Sciences Building, University of Georgia, Athens, Georgia, or Dr. Frank B. Golley, Director, Laboratory of Radiation Ecology, AEC Savannah River Operations Office, Building 772-G, P. O. Box A, Aiken, South Carolina.



Aerial view of the Main Laboratory complex of the Roscoe B. Jackson Memorial Laboratory showing 12 of its 27 buildings. Upper left: Morrell Park Laboratory. Lower left: Animal Health Research Laboratory. At right is the Main Laboratory, which houses a large part of the Laboratory's research program.

ROSCOE B. JACKSON MEMORIAL LABORATORY

EARL L. GREEN, DIRECTOR¹

The purpose of the Roscoe B. Jackson Memorial Laboratory is to increase knowledge of development, growth, reproduction, physiological and psychological behavior, and inborn ailments through re-

search with genetically controlled experimental animals. Populations of inbred, hybrid, and mutant-bearing mice, of inbred and mutant-bearing rabbits, and of five breeds of dogs, along with some rats and guinea pigs, are the principal sources of research animals.

The Laboratory, located in Bar Harbor,

¹ The assistance of Alan P. Russell and Jean Davison in the preparation of this article is gratefully acknowledged.

Maine, was founded in 1929 as a private, non-profit research laboratory by Dr. C. C. Little, who continued as its director until his retirement in 1956. Initially the research work of the Laboratory was devoted to the basic aspects of the cancer and the radiation problems for which inbred strains of mice were most valuable. In the ensuing years, research has grown to cover many other areas in which genetics and genetically controlled strains are vital. These include muscular dystrophy, tissue grafting, immunology, blood anomalies, morphogenesis, teratology, behavior, cell biology, and cytology.

The Laboratory has 35 staff scientists with doctoral degrees, 90 research and technical assistants, an administrative staff of five, and other supporting personnel to make a total of 300 employees. There is no formal organization of the staff into departments or divisions. Rather, the functional units of the Laboratory are the research projects, numbering about 50, each with space, personnel, and budget. New projects are added and old ones dropped as staff members develop new leads and new interests. A given staff member may be concerned with two or three projects at the same time.

The basic research of the Laboratory is unified by the strong thread of genetics which extends through all its projects. About one-half the staff members are geneticists; the others are biochemists, physiologists, immunologists, psychologists, embryologists, and pathologists. Each staff member selects and develops his own research projects, limited only by the space, funds, and animals available.

One of the staff members has carried out an intricate breeding system to uncover and isolate the genetic factors which govern histocompatibility in the mouse. Others have worked on the immunological and biochemical characterization of immune antigens. Another has developed new, simple, chemically defined media for the growth of cells in culture. Still another has found a way of curing a type of

hereditary anemia in mice. The discovery of obese and of dystrophic mutant mice in the Laboratory's strains created new fields of research by providing the first experimental animals for studying these diseases. A testicular teratoma found in one inbred strain added another phase to the cancer research program. These are but a few examples of the numerous types of investigation now in progress at the Laboratory.

Summer training programs for precollege students and for college, graduate, and medical students are conducted by the Laboratory. A short course in medical genetics for members of medical school faculties is given each summer in collaboration with The Johns Hopkins University School of Medicine. The precollege program of nine weeks provides a research apprenticeship for each student, since each works intimately with a staff member on a research project of his own choosing. The 10-week program for college, graduate, and medical students is also devoted to providing a personal research opportunity for each student. In addition, the Laboratory receives predoctoral and postdoctoral fellows, usually six or eight each year.

Visiting investigators may come to the Laboratory at any time throughout the year for a period of collaborative work and study with a staff member. The essential feature of the visiting investigator program is that each must be sponsored by a staff member, who provides space and facilities for the investigator. No fee is charged for such cooperative projects.

The Laboratory produces about 1,000,000 mice per year for use in its own research projects. Another 1,000,000 mice are produced and, after first being observed for unusual types which may be valuable new genetic mutations, are distributed to research workers elsewhere. In order to accomplish this large scale production, the stocks of mice are organized into five units.

The Foundation Stocks contain about 30 inbred strains of mice which are propagated to continue the strains and to supply breeding pairs to the second unit, the

Pedigreed Expansion Stocks. Here 17 of the inbred strains are expanded through three generations and supply breeding pairs to the next unit, the Production Stocks, where mice of inbred strains and hybrids between certain inbred strains are produced in large numbers. All of the strains have been inbred by at least 20 generations of brother-sister matings, some for over 100 generations.

A fourth unit, the Mutant Stock Center, maintains over 130 named mutations in the mouse and carries out studies on allelism and linkage. Among the mutations are a great variety affecting coat color as well as neuromuscular, skeletal, and metabolic characteristics.

The Tumor Stocks Center, the fifth unit, propagates about 30 transplantable tumors of the mouse. The tumor stocks and mutants are a rich but as yet relatively untapped source of research material, available to qualified investigators at other institutions.

The principal buildings of the Laboratory are located in three places. The Main Laboratory, south of Bar Harbor, is a modern brick and aluminum building erected in 1949-50 following a forest fire in 1947 which demolished the previous laboratory. The Morrell Park Laboratory, just south of the Main Laboratory, is a brick building of 30,000 square feet erected in 1959-60 for the production of mice for research. Hamilton Station, a cluster of buildings near Salisbury Cove about 10 miles from the Main Laboratory, is devoted to work with rabbits and dogs. In addition the Laboratory has a few small cottages for

visiting investigators, a summer residence adapted to house precollege students, and cottage-dormitories for college, graduate, and medical students in the summer.

The annual operating budget is about 2.5 million dollars. Funds to cover each year's expenses are derived from three sources: grants-in-aid for research and training, 60%; sales of animals, 35%, and contributions, 5%.

The Laboratory is owned and governed by a Board of Trustees of 60 members. From its membership the Board of Trustees elects a Board of Directors which formulates policy. The Trustees also elect a Board of Scientific Directors to guide and review the Laboratory's research program.

The Main Laboratory complex is on State Route 3 about one mile south of the town of Bar Harbor on Mt. Desert Island, which is connected to the mainland by a bridge. Bar Harbor may be reached by Northeast Airlines from Boston to Bangor and by limousine from Bangor to Bar Harbor; or one may travel by private car on the Maine turnpike, taking Route 3 from Augusta, Maine. The Laboratory is located on the edge of Acadia National Park overlooking Frenchman's Bay in a setting of year-round beauty.

Additional information about the Jackson Laboratory may be obtained by requesting copies of the Annual Report, the Summer Bulletin, the Handbook of Genetically Standardized Jax Mice (\$1.00), or by asking to be put on our reprint exchange list to receive the 60 or more reprints of scientific papers published each year. Address: Bar Harbor, Maine.

BUREAU OF COMMERCIAL FISHERIES

**UNITED STATES DEPARTMENT OF INTERIOR, THE BUREAU
OF COMMERCIAL FISHERIES**

DONALD L. MCKERNAN, DIRECTOR
AND THE STAFF OF THE BUREAU

INTRODUCTION

The Bureau conducts a comprehensive program of research, development, and services for the commercial fishing industry of the United States. The purpose of these diverse activities, many of which are carried out cooperatively with industry and with the States, is to strengthen the fishing industry and conserve the resource.

The organization of the Bureau consists of a Headquarters Office in Washington, D. C., five Regional Offices, and two Area Offices. The Headquarters Office includes the Office of the Director and four staff divisions: Administration, Resource Development, Industrial Research, and Biological Research. Field programs are under the supervision and control of Regional Offices in Region 1 at Seattle, Washington; Region 2, St. Petersburg Beach, Florida; Region 3, Gloucester, Massachusetts; Region 4, Ann Arbor, Michigan; and Region 5, Juneau, Alaska. To meet special needs, Area Offices have been established in California at Terminal Island, and in Hawaii at Honolulu.

As the population of the world continues its dramatic increase, many nations are turning to the sea to harvest much-needed supplies of protein food. This has intensified two problems of the United States industry: increasing competition for our coastal resources with the high-seas fleets of other nations, a competition which has raised difficult conservation problems; and a need to increase the efficiency of our own fishing fleets to meet foreign competition. To solve these problems on a friendly yet equitable basis, the Bureau is becoming involved more deeply each year in International Fishery Conventions. We

now participate in nine International Fishery Commissions with some 25 to 30 nations, and are active in many other international activities with FAO, UNESCO, and other international organizations. Much of our research is done in close cooperation with other nations, often on the high seas far from our own shores. Basic research is an important part of our international and domestic research programs. Our purpose is to understand the interactions of the resource with its environment, to learn how to harvest fishery resources for maximum sustainable yield, and eventually to farm our natural waters to increase the yield of useful protein.

Scientific studies of the living resource in its environment are carried out at research laboratories on all coasts of the United States, and on the Great Lakes. In Alaska, Hawaii, and on the Atlantic, Pacific, and Gulf of Mexico coasts are 19 Biological Laboratories and 5 Exploratory Fishing and Gear Research Bases. In the Great Lakes area are a Biological Laboratory and an Exploratory Fishing Base. Most of the work of the coastal laboratories forms a part of the Federal Government's National Oceanographic Program. Oceanographic programs include studies of physical and chemical oceanography; biological productivity of the waters; distribution, abundance, and migrations of fishes, crustacea, and mollusks; and identification and ecology of plankton organisms, especially fish, crustacean, and molluscan eggs and larvae. Special work includes studies of diseases of fishes and mollusks, and development of serological techniques to identify fish populations. In the estuarine environment we are learning how to control shellfish predators, and are

studying the effects of pesticides on marine animals. In fresh waters our scientists have developed methods to control the predatory sea lamprey in the Great Lakes; they are investigating spawning and survival of salmon in rivers and lakes; and are developing methods to pass migrating adults and young anadromous fishes safely over dams. Marine mammal investigations include studies of biology and management of fur seals and whales. Investigations of the fisheries themselves are many and varied, concerned with the dynamics of fishery populations and the effects of fishing upon the stocks; yields under different intensities and methods of fishing; and development of techniques for optimum fishing strategy. These are but a few of the Bureau's diverse and complicated investigations of the ecology of fishery populations and the effects of man's activities upon them.

The Bureau publishes more than 300 scientific and technical reports each year. These range from highly specialized scientific papers to popular articles in trade journals and national magazines. Articles on biological research appear in national and foreign scientific journals and in the following publication series of the Department of the Interior: *Fishery Bulletin*, *Special Scientific Report—Fisheries*, and *Commercial Fisheries Review*.

In support of this program the Bureau is now engaged in a large construction program to replace old laboratories and research and exploratory vessels, and to provide new facilities where needed. Where space is available, visiting scientists will be welcomed at our laboratories and on our ships. Brief summaries of our programs follow.

BIOLOGICAL LABORATORY, SEATTLE,
WASHINGTON

Clinton E. Atkinson, Director

Salmon Research

This laboratory is situated on Portage Bay across the Lake Washington Ship Ca-

nal from the University of Washington. It shares space with a Technological Laboratory and an Exploratory Fishing and Gear Research Base. Construction of additional laboratory and office facilities is scheduled for 1963-64. The new building will include experimental hatchery and wet-laboratory facilities.

The Biological Laboratory conducts research on salmon in the North Pacific Ocean, the Bering Sea, and in the Columbia River and other fresh waters of the Pacific Northwest. The studies are designed to provide basic knowledge on the life history and environmental requirements of the five species of Pacific salmon. Factors influencing survival and productivity receive special attention.

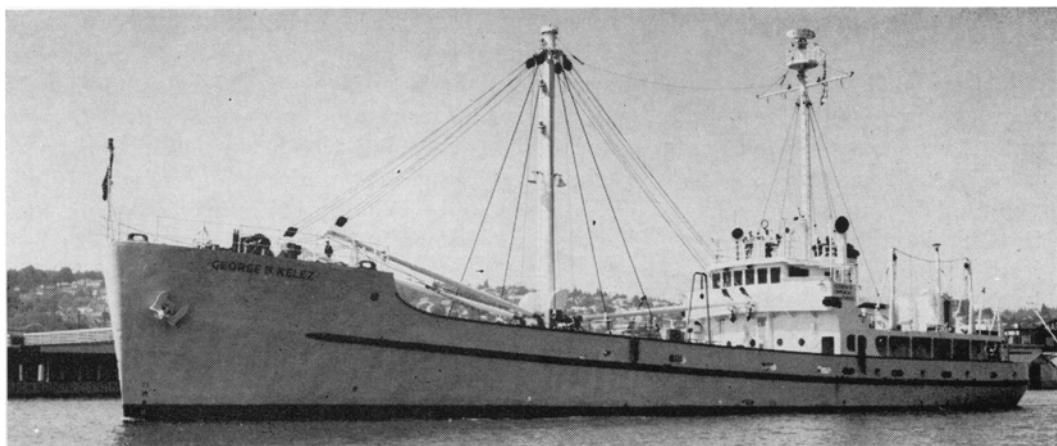
The International North Pacific Fisheries Convention between Canada, Japan, and the United States designates longitude 175° W as a line separating Asiatic and North American stocks of salmon. The Japanese agreed to abstain from high seas salmon fishing east of this line while scientists sought methods for identifying the continental origin of salmon caught on the high seas and, thus, to determine the distribution and degree of intermingling of salmon of Asian and North American origin.

Research includes studies of (1) the high seas environment and how it affects the distribution of salmon at sea; (2) mortality of salmon at sea; (3) identifying the origin of salmon found at sea by tagging, immunology, morphology; (4) migrations; (5) growth; and (6) physical oceanography.

The laboratory operates the research vessel *George B. Kelez*, a converted U. S. Navy AKL-type ship, 177 feet long.

Salmon research in fresh water is concerned with life histories, times of migration, distribution, behavior, spawning, nursery area requirements, environmental effects, and predator-competitor relationships.

The Columbia River system, which supports valuable commercial and sport fisheries for salmon and steelhead trout, has



Biological Research Vessel *George B. Kelez*. Photograph taken for dedication ceremonies held July 20, 1962, Seattle, Washington.

been modified extensively by dams. More than 70% of original salmon spawning areas have been blocked, and major ecological changes are taking place. Production of chum salmon in a controlled-flow artificial spawning channel is under observation on Abernathy Creek near Longview, Washington. Spawning requirements of chinook and silver salmon and the effects of flooding and silting are being studied at a field station at Mill Creek, California. A field station at Shea Creek on the Yakima River near Ellensburg, Washington, is set up for salmon predator-competitor research. A new program to study salmon in the estuarine environment is commencing on the Columbia River Estuary.

Special programs include compiling a compendium of salmon literature and developing techniques for identifying individuals and stocks of salmon by chemical or dietary marking during early life.

Service units provide technical assistance in biometrics, audio-visual presentations, literature research, and translations. Proximity to the College of Fisheries and Fisheries Research Institute at the University of Washington is a decided asset.

Space for visiting scientists is limited at present, but consideration will be given to applications.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, 2725 Montlake Boulevard East, Seattle 2, Washington.

Fish Passage Research
Dr. Gerald B. Collins, Director

The Fish Passage Research Program is devoted to studying the Pacific salmon during its fresh-water life cycle, particularly the effect of the changing environment in the Columbia and Snake Rivers. Originally these salmon migrated up free-flowing streams to spawn. Now they encounter a series of low-head dams and impoundments, increasing water temperatures, pollutants, loss of spawning beds through inundation, impassable dams such as Grand Coulee, and lack of water caused by increasing irrigation demands. When the juveniles migrate to sea, they no longer are afforded the protection of high, rapidly-flowing turbid water from spring runoff. Instead, these waters are now controlled by the series of dams, which not only create areas of clear slack water for easier predation, but also result in an increased mortality rate of the young fish passing over the spillway or through the turbines. The condition now exists in the Columbia River and is planned for the Snake River.

The aim of this laboratory is to apply

knowledge gained from studying changes in migration behavior in those rivers, such as the Columbia, where the environment has been altered, to future river developments. The present research is in cooperation with fishery agencies of Washington, Oregon, Idaho, and California.

Briefly, the program has the following objectives:

1. Effect of impoundments created by dams on fish migration (recruitment, survival, escapement, limnological effects, permanent residence in the impoundment, size, condition and age of fish);

2. collection of downstream migrants from streams and rivers (guiding fish away from areas of high mortality);

3. passage of migrant fish at dams (improving fish passage facilities, new techniques, energy studies, physical limitations of fish, and reducing injury and mortality in spillways and turbines);

4. adaptability of salmon to new environments created by dams (racial behavior and physiology, homing instinct, reaction to temperature and oxygen changes).

Facilities include the headquarters office located at the U. S. Naval Air Station, Seattle, Washington; Fisheries-Engineering Research Laboratory at Bonneville Dam (description in U. S. Fish and Wildlife circular 98); Fish Behavior Laboratory—2725 Montlake Blvd., Seattle (description in Special Scientific Report—Fisheries No. 271); Reservoir Studies, Washington Hotel, Weiser, Idaho; and numerous field stations. Facilities for visiting investigators can be made available at each of the field laboratories and they are, of course, welcome at the Seattle office.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, U. S. Naval Air Station, Building 67, Seattle 15, Washington.

Marine Mammal Research
Ford Wilke, Director

Another Biological Laboratory in Seattle is a center for research on pinnipeds (except walrus) and cetaceans. Its research

program aims primarily to conserve and improve management of the Alaska fur seal herd, and to study whales and whaling. The results, in part, are used by the North Pacific Fur Seal Commission, representing four nations, and by the International Whaling Commission, representing 18 nations.

The permanent staff includes eight biologists, all headquartered in Seattle. At various times, members of the staff carry out research at the field laboratory on St. Paul Island, Alaska; at sea on the North Pacific Ocean collecting fur seals or marking whales; at one of the commercial shore-whaling stations in California; or with Eskimo whaling crews in Arctic Alaska. In the summers of 1960 and 1961, American biologists visited fur seal breeding grounds in the USSR while Soviet biologists were on the Pribilof Islands, breeding grounds of the seal herd in Alaska.

The laboratory maintains close working relationships with the Bureau of Sport Fisheries and Wildlife, especially with a biologist specializing in studies of sea otter, walrus, polar bear, and marine birds. It also cooperates with various departments of the University of Washington and with the Washington State Museum on the university campus.

The laboratory has facilities for statistical analysis (including an IBM key punch); for examining stomachs and reproductive tracts; for veterinary research; and for anatomical studies of teeth, skulls, baleen plates, whale ear-plugs, eye lenses, and pelage. It has a library on marine mammals, a reference collection of organisms found in marine mammal stomachs, and a synoptic collection of cetacean parasites. It has no aquarium, public museum, special instruments, or special set-ups. In a sense, its "workshop" is the ocean and adjacent shores.

The St. Paul Island branch laboratory is open from about June to October. Here biologists collect or examine specimens in the fur seal kill, a harvest which includes annually about 60,000 males and 30,000

females. Fifty thousand seal pups are tagged in September. Extensive collections of data for population dynamics studies are made annually.

By arrangement, and to fill important scientific or educational needs, the biologists will collect, or help visiting specialists to collect organs, tissues, skeletal parts, blood, entire bodies, and photographs of marine mammals.

The Seattle laboratory is three miles northeast of the University of Washington. Since the laboratory is on military ground, visitors are asked to obtain an entry pass at the gate, or telephone the Director in advance. Address the Director, Bureau of Commercial Fisheries Biological Laboratory, U. S. Naval Air Station, Building 192, Seattle 15, Washington.

BIOLOGICAL LABORATORIES, BEAUFORT,
NORTH CAROLINA

Fishery Research

Fred C. June, Acting Director

Radiobiological Research

Dr. Theodore R. Rice, Director

On a small island, located one-half mile from Beaufort, North Carolina, stands the second oldest Government marine research station in the United States. Since its establishment in 1899, this Laboratory has been in continuous operation. Most of the original wooden buildings recently were replaced by brick and concrete block structures, which include a fishery laboratory, a radiobiology laboratory, a small dormitory for visitors, a residence for the Director, a small warehouse, and a maintenance building with wood- and metal-working shops.

Other research facilities include nine small outdoor concrete tanks, and two 30 × 40 foot concrete ponds, each supplied with running sea water; a 30 × 40 foot fresh-water pond; a 30 × 80 foot tidal pond; two motor vessels (a 26-foot launch and a 50-foot cabin cruiser); and several skiffs equipped with outboard motors.

The diversity of habitats surrounding the laboratory—the adjacent Atlantic

Ocean and nearby navigable inlet; offshore bars; marshes; several large rivers with extensive estuarine areas; and several large sounds of salt and brackish water—provides unusual opportunities for marine research.

The permanent staffs consist of 28 scientists, 8 scientific assistants, 6 administrative and clerical assistants, and 6 maintenance men. Facilities for visiting scientists are available, but limited.

The fishery laboratory provides office space for research and administrative personnel and houses a photographic darkroom, a 4,000-volume library, and a scale-reading room. Facilities for conducting chemical analyses and biological experiments also are provided, and include water tables supplied with running sea water, gas and compressed air outlets, and fume hoods. Scientific studies, directed toward the solution of basic biological and fishery problems, are divided into three programs. These are concerned with determining the cause and predictability of variations in abundance of blue crabs, menhaden, shad, and striped bass; problems of fish passage over dams; and estuarine and coastal hydrographic studies.

The radiobiology laboratory, located in a separate building, includes a counting room, an algal-culture room, an experimental-aquarium room, and two constant temperature rooms. Also there are separate rooms for chemical analyses and physiological experiments. The work, sponsored in part through a cooperative agreement with the Atomic Energy Commission, is concerned with accumulation and retention of radionuclides by marine organisms and sediments; application of radioisotopic methods to studies of estuarine ecology and pond culture; and determination of the effects of radiation on marine organisms.

Summer visitors to the laboratories may reach Beaufort by air. During the remainder of the year there are regularly-scheduled flights to New Bern, North Carolina, and bus transportation is available from

New Bern to Beaufort. Dormitory facilities for three or four persons are available for official visitors. Requests should be placed in advance with one of the laboratory directors. Address the Acting Director, Bureau of Commercial Fisheries Bio-

logical Laboratory (Fishery Research), Pivers Island, Beaufort, North Carolina, or the Director, Bureau of Commercial Fisheries Biological Laboratory (Radiobiological Laboratory), Pivers Island, North Carolina.



Bureau of Commercial Fisheries, Biological Laboratories, Beaufort, North Carolina (Radiobiological Laboratory is on the waterfront, right foreground)

BIOLOGICAL LABORATORY,
BRUNSWICK, GEORGIA

William W. Anderson, Director

This Laboratory is engaged in studies of ocean waters adjacent to the coast of the United States from Cape Hatteras, North Carolina, to the Florida Straits. Included is a biological inventory to determine the presence, identity, distribution, and interrelationships of marine forms of the area. Special attention and effort are directed to fish larvae and juveniles, life histories of important species, and systematics of selected groups of fishes in the western North Atlantic Ocean. More limited efforts are directed to the biochemistry of the waters to establish distribution and concentrations of nutrients, trends in tem-

peratures and salinities, and composition of bottom sediments.

Coastal Georgia is characterized by a series of heavily wooded offshore barrier islands, numerous passageways between the islands, large sounds, and a 10- to 15-mile-wide, rich, marshy estuarine area between the islands and the mainland. This marsh area is cut with numerous salt water rivers, creeks, and guts. Normal tidal rise and fall is approximately six feet, but in the fall this may reach 10 to 11 feet. Five fresh-water rivers enter the ocean in Georgia's 90 miles of coast—the Savannah, Ogeechee, Altamaha, Satilla, and St. Marys.

The fauna is typical of the South Atlantic coast of the United States. The dominant fish group is the croaker family (*Sciaenidae*) and the most abundant large



Federal Building, Brunswick, Georgia, U. S. Bureau of Commercial Fisheries Biological Laboratory occupies one-half the top floor.

crustaceans are shrimp (*Penaeus*) and crabs (*Callinectes*).

The Laboratory occupies approximately one-half the top floor of the Federal Building in Brunswick, Georgia. In addition to standard chemical and biological laboratory facilities there are photographic and darkroom space and equipment, X-ray equipment, drafting room, library, and an excellent reference collection of fishes from the general study area and from the Gulf of Mexico and the Caribbean. There is no running sea-water system.

Working space and equipment can be provided for one or two visitors for short periods. There are no living accommodations at the Laboratory, but reasonably-priced hotels and restaurants are available nearby. The Federal Building is located on Gloucester Street in Brunswick.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, P. O. Box 280, Brunswick, Georgia.

BIOLOGICAL LABORATORY,
GULF BREEZE, FLORIDA

Dr. Philip N. Butler, Director

The Laboratory consists of nine buildings with approximately 5,000 square feet of working space devoted to offices, dry laboratory rooms, and administration; 1,000 square feet of wet laboratory rooms;

and 2,000 square feet for storage and shop facilities. A permanent staff of 15 (2 Ph.D.; 5 M.S.), including the Resident Director, is conducting a research program devoted primarily to estuarine ecology. Special emphasis is placed on studies of cyclic changes in animal populations, the biology of commercial shellfish, and the effects of pollution due to agricultural chemicals.

The Laboratory is located on a 15-acre ballast rock island in the center of a complex of shallow communicating bays, a sound, and the Gulf of Mexico. Several small rivers entering the area have a 4,000 square mile drainage basin. Habitats vary from fresh-water rivers to the open Gulf with a salinity approximately 32‰. Fresh- and salt-water marshes are extensive and less than half of the shore line is developed. The bottoms are predominantly clean hard sand with mud only in the deeper channels. The fauna is extremely diverse, and relatively few species are found in abundance.

Standard laboratory equipment is available, including fluorometer, spectrophotometer, and facilities for Carbon-14 studies. There is a photographic darkroom and a well-equipped shop. The wet laboratory has a continuously flowing, plastic-pipe water system with a gravity flow of sea water to 120 linear feet of concrete water tables. A 36-foot diesel-powered work boat is equipped for trawling and dredging. There are several outboard-powered smaller collecting boats.

Sea-water salinity fluctuates with the single daily tide and typically ranges from the spring lows of 15-20‰ to 25-28‰ in late fall and winter. Water temperatures range from 10° to 30°C. Average summer and winter air temperatures are 27° and 13°C respectively. Temperatures below 0°C rarely occur.

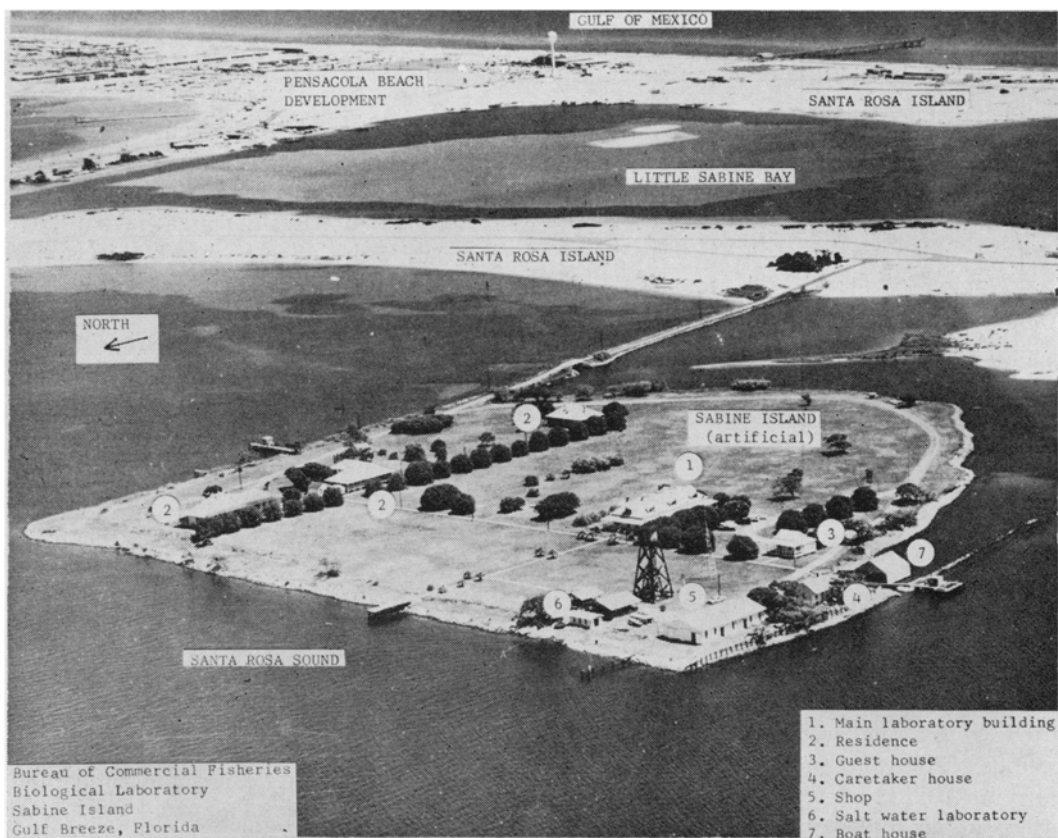
A limited amount of research space is available (no fees) to qualified workers as well as dormitory facilities (nominal charge) for men. Applications for space

should be made well in advance of the time desired.

Nearby Pensacola Beach is a typical summer vacation area with expensive housing facilities in season. Pensacola, serving a metropolitan area with a population of 75,000, is 12 miles north and has ample

residential and shopping facilities. Pensacola airport (EAL, NAL) is 15 miles from the laboratory.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Gulf Breeze, Florida.



Bureau of Commercial Fisheries Biological Laboratory, Gulf Breeze, Florida

BIOLOGICAL LABORATORY,
GALVESTON, TEXAS

Milton J. Lindner, Director

The Laboratory is on the Gulf of Mexico, and in a residential area of Galveston (population 71,000). A large sea-water station four miles from the main laboratory is built over an estuarine lagoon. Hotel and motel accommodations in Galveston are excellent and reasonably priced. The climate is suited to year-round field activity.

Facilities include a fully-equipped chemistry laboratory, large controlled-temperature rooms, recirculating and constant flow sea-water systems, culture rooms, physiological apparatus, a good marine library, a 40-foot diesel vessel and smaller boats for estuarine work, and modern oceanographic apparatus for field sampling. Off-shore work on the continental shelf from Brownsville to the Mississippi River is conducted from larger chartered vessels.

The research program is concerned with the life history and dynamics of several



Bureau of Commercial Fisheries, Biological Laboratory, Galveston, Texas

species of shrimp, physiology and behavior of shrimp and local estuarine fishes; ecology, distribution, life histories and abundance of estuarine species; oceanography of the continental shelf as it affects the fauna, including hydrographic and biological aspects; methods for controlling blooms of marine protozoa; chemistry of sea-water; and related problems that may bear on the above research. Quantitative biology is stressed.

Arrangements for a limited number of visiting investigators in marine biology or oceanography may be made. By air, one deplanes at Houston and travels 50 miles by limousine to the Laboratory. Galveston is also served by major railway and bus companies.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Fort Crockett, Galveston, Texas.

A field station was established at St. Petersburg Beach to conduct research on the Florida red tide. A two-story building and a dock-side garage incorporate some

7,000 square feet of space for biological and chemical laboratories, library, conference room, offices and storage. In January 1962, funds were appropriated for research on estuaries in the eastern portion of the Gulf of Mexico. The research program, no longer associated with red tide, became known as East Gulf Estuarine Investigations. The chief objectives are to study the ecology of estuarine organisms and the effects of urbanization, industrialization, and engineering upon resident biota. The research program is largely fundamental and is designed to include the following projects: Hydrology-Plankton, Chemical Environment, Faunal Production, Circulation Dynamics, Benthic Communities, and Engineering Effects. The staff consists of nine scientists, clerk-stenographers, a librarian and a vessel captain.

The center of investigation is Tampa Bay, one of the largest and most productive estuaries connected with the Gulf of Mexico. Visiting investigators can make

arrangements by writing the Director, Region 2, Bureau of Commercial Fisheries, St. Petersburg Beach, Florida.

BIOLOGICAL LABORATORY,

BOOTHBAY HARBOR, MAINE

Bernard E. Skud, Director

This is the largest year-round marine laboratory on the United States coast of the Gulf of Maine. The original facility was established in 1905 as a hatchery for lobsters and groundfishes. Hatchery efforts were abandoned in the 1940's, and various marine research projects were substituted. Several recent additions and renovations have expanded the research facilities.

The staff numbers 35 employees: 15 biologists, 10 technicians, and 10 in various supporting services. Research efforts are divided into two major components. The larger is the Herring Program, concerned with the biology of *Clupea harengus* and its utilization in the Maine sardine industry. The other is the Clam Program concerned with the soft-shell clam, *Mya arenaria*, and the surf clam, *Spisula solidissima*. Herring research includes studies of age and growth, abundance and availability, biostatistics, diseases, migration, behavior, and serology. Clam research includes studies of environmental requirements, laboratory rearing, feeding, reproductive cycles, basic physiology and various population parameters.

The Laboratory, centrally located in the Gulf of Maine, affords the opportunity of studying estuarine and marine habitats. The fauna is rich and varied. Herring are the dominant pelagic species, but many other fishes, such as mackerel, are abundant, and larger species of shark and tuna are also available. Groundfish populations are varied and plentiful. The numerous

shellfish stocks include clams, scallops, mussels, and oysters — the American and the introduced European species. There are extensive fisheries for lobsters and marine worms. Other bottom invertebrates such as starfish and sea urchins abound.

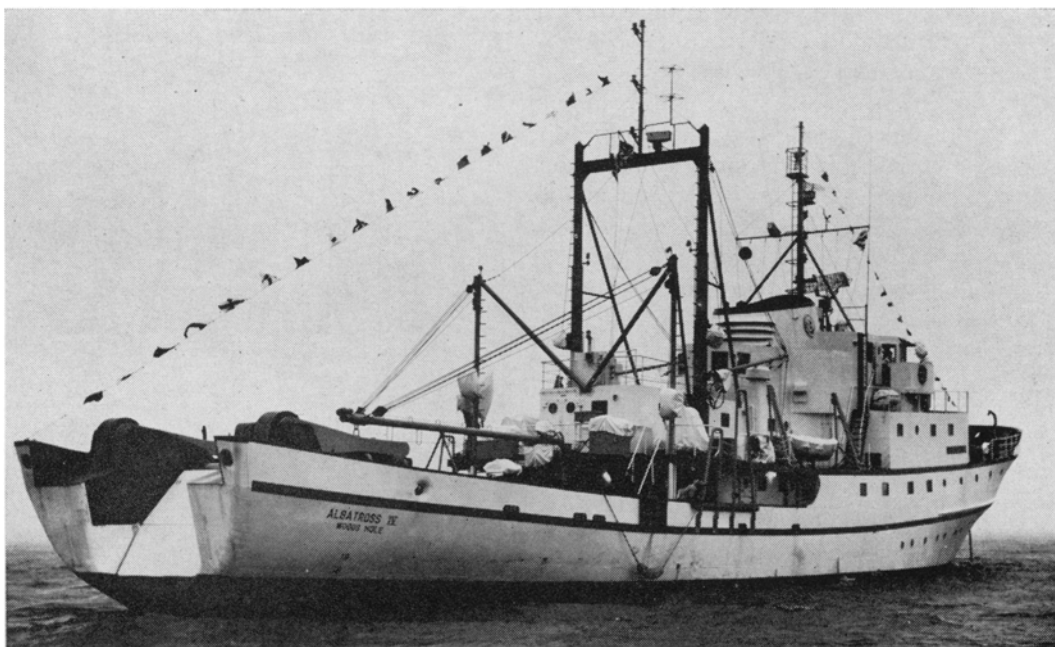
The research facilities of the Laboratory include a sea-water system which provides over 200 gallons per minute. There is an array of tanks and water tables of various sizes and shapes for experimental work. A recent addition to this system includes a controlled temperature and salinity unit, delivering 100 gallons of water per hour at temperatures from 0°C to 30°C and salinities from fresh to 30 ‰. The dry and wet laboratories contain a refrigerated centrifuge, tissuematon, electrophoresis apparatus, and other experimental equipment. A modern photographic darkroom provides wide flexibility for experimental studies as well as for publication needs. Drafting services are also available at the Laboratory. Vessels are limited to a 40-foot research vessel, *Phalarope II*, and several smaller outboard craft. The wharf facilities are excellent, and deepwater anchorage is available for large sea-going vessels.

The Maine Department of Sea and Shore Fisheries operates a marine aquarium on the Federal property, and conducts a research and management program on lobsters and clams.

Space for visiting scientists in the laboratory is available, but limited to two or three individuals. Housing can be obtained readily in the local community.

No public transportation serves Boothbay Harbor, thus automobile transportation is necessary. Commercial airlines from Boston serve Portland, Maine. Arrangements can be made to transport visitors to the Laboratory — a distance of 50 miles.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Boothbay Harbor, Maine.



Albatross IV, commissioned 1962

BIOLOGICAL LABORATORY,
WOODS HOLE, MASSACHUSETTS*
(Shown in frontispiece.)

Dr. Herbert W. Graham, Director

The program of the Bureau of Commercial Fisheries Biological Laboratory at Woods Hole is concerned with research on the offshore commercial groundfish of the Northwest Atlantic: their life histories, ecology, and conservation. Principal species under study are cod, haddock, silver hake, redfish, flounder, and sea scallop. Particular emphasis is placed on the study of population changes in these and associated species of groundfish. These studies involve assessment of the effects of fishing upon the various stocks and the effects of the environment. As part of the environ-

mental studies, the Laboratory has a broad program of studies of benthic fauna, plankton, and hydrography. The areas of interest include the Gulf of Maine and Georges Bank, a portion of the Atlantic Coastal Shelf with highly productive fishing banks.

The laboratory staff consists of 25 professional scientists and a supporting staff of 40 which includes subprofessional scientific personnel, administrative staff, and maintenance personnel.

Physical facilities include two buildings, two research vessels, and a deepwater dock. The laboratory building is a three-story structure with 24,000 square feet of floor space, 33 research rooms, large tank room, conference room, library, administrative offices, and walk-in refrigerators. The first floor rooms are supplied with running salt water. The second building houses a public aquarium of 16 tanks in which local species of fishes are exhibited, an experimental tank area, and maintenance shops. The seawater in this building is filtered and temperature controlled.

* The history of this laboratory is described in Galtsoff, P. S., 1962, The Story of the Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, Massachusetts. U. S. Dept. of Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries, Circular 145, Washington, D.C.

The *Albatross IV*, based at the Laboratory, is a 1,000-ton modern fishery-oceanographic research vessel with accommodations for 16 scientists. It is equipped for all kinds of oceanographic and groundfish research and makes regular cruises to the area of interest, each cruise lasting about two weeks. The *Blueback* is a 40-foot motor vessel used for inshore collecting.

The Laboratory is operated on a year round basis and no special accommodations are provided for summer investigators. Scientists working on problems related to the laboratory program are welcome to use facilities when these can be made available. They may also participate in the cruises of the *Albatross IV*, but diversion of the vessel from its regular schedule usually cannot be made.

Living accommodations are available in Woods Hole and in the nearby town of Falmouth, although rates are very high during the tourist season which extends from about the 15th of June to the 1st of September. Woods Hole is two hours from Boston, Massachusetts, by bus or car.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Woods Hole, Massachusetts.

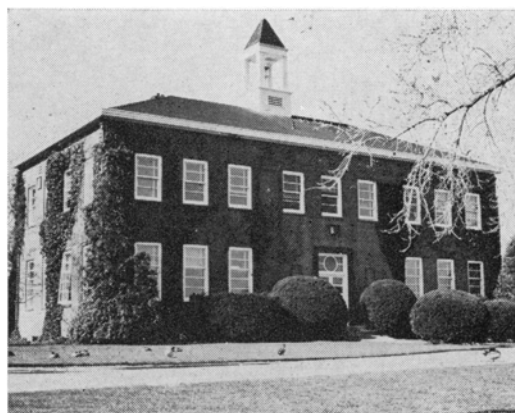
BIOLOGICAL LABORATORY,

MILFORD, CONNECTICUT

Dr. James E. Hanks, Director

Naturally-occurring populations of oysters and clams have supported fisheries in Long Island Sound for centuries. The Eastern oyster, *Crassostrea virginica*, and the hard clam, *Mercenaria mercenaria*, are the major species. Some softshell clams, *Mya arenaria*, and black mussels, *Mytilus edulis*, are harvested by local shellfishermen.

The first permanent assignment of a full-time biologist and establishment of a laboratory were in November, 1931. This small program was concerned with biological problems facing the Connecticut shellfish



Bureau of Commercial Fisheries Biological Laboratory, Milford, Connecticut

industry. Construction of the present laboratory building was completed in 1940.

The Laboratory has made significant contributions to the knowledge of temperature, salinity, and turbidity tolerances of adult oysters; and of gametogenesis, spawning, and metamorphosis of these and other pelecypod mollusks. Studies of environmental requirements and tolerances of bivalve larvae have reached a point where establishment of commercial hatcheries seems feasible. Considerable progress has also been made in developing methods for control of the various predators and competitors of shellfish.

The Laboratory has facilities for all phases of research in marine biology. Warm and cold running sea water is piped to a number of water tables and can be provided throughout the building for experiments in trays or aquaria. Large outdoor tanks are also available, with either tidally exchanged or continuously-pumped sea water, for experimental or storage use.

Supplemental algal food, suitable for most filter-feeding invertebrates, is pumped to the research rooms from a 2,000-gallon culture tank. In addition, a collection of approximately 80 species of marine algae is maintained in bacteria-free culture. Several of these are reared, using continuous culture techniques, so that as much as 48 liters per day of unialgal, bacteria-free

algal suspension are available for experimental work.

Workshop facilities are located on the grounds, and experienced personnel can construct most types of specialized laboratory equipment on order.

The laboratory's 50-foot research vessel operates on a year-round basis in Long Island Sound. It is outfitted with standard hydrographic gear, in addition to dredge equipment for sampling benthic organisms. The vessel has a 10- × 14-foot research laboratory on the main deck, supplied with A.C. and D.C. current, which can accommodate a complement of four to six scientists. Several smaller outboard-powered boats are available for inshore work. The laboratory has standard SCUBA equipment including an air compressor unit, and there is a trained diver/biologist on the staff.

A limited library of reference and reprint material is maintained at the Laboratory. Complete library facilities are available through Yale University and the Bingham Oceanographic Laboratory at New Haven, Connecticut, only a few miles away.

The research program has three objectives: (1) basic studies of the physiology and ecology of larval and adult pelecypod and gastropod mollusks, in particular in the Eastern oyster, *Crassostrea virginica*, hard clam, *Mercenaria mercenaria*, and oyster drills, *Urosalpinx cinerea* and *Eupleura caudata*; (2) development of techniques to improve the culture of commercial shellfish under controlled and natural conditions; and (3) development of methods for mechanical and chemical control of shellfish predators.

The staff consists of eight fishery biologists; two microbiologists; and supporting administrative, maintenance, and clerical personnel.

The Laboratory is located on Milford Harbor in a distinctly estuarine environment. Within a modest distance are salt-marsh areas, natural salt-water ponds, a number of tidal estuaries, and various ben-

thic conditions in Long Island Sound from soft mud to sand and rock bottoms. Although large sections of the local inshore waters are devoted to oyster production, many natural areas exist where benthic marine communities and predator-prey ecology can be studied. Salinities range from 27-30 ‰ in the open Sound to 10-12 ‰ in areas of river discharge.

Facilities are available at no charge throughout the year for one or two visiting investigators. Living accommodations are not available at the Laboratory, but convenient room rental arrangements can be made locally. Requests for the use of facilities and an outline of the research program contemplated must be submitted three months in advance of desired occupancy.

The Laboratory can be reached by airline, train, or bus service to Bridgeport and New Haven, Connecticut.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Milford, Connecticut.

BIOLOGICAL LABORATORY,

OXFORD, MARYLAND

James B. Engle, Director

Marine biological research in Chesapeake Bay by the Bureau of Commercial Fisheries and predecessor agencies dates back almost 100 years. Present investigations, concerned directly with shellfish biology, ecology, and culture, began in 1944. Since 1960 the work has been based at newly constructed facilities near Oxford, Maryland. Early investigations were short-term intermittent observations on unusual mortalities, and were efforts to demonstrate systems of culture such as methods of seed production, transplantation, and feeding of oysters. The present program includes basic marine biology and ecology; survival, growth, and condition; and methods of culture and management. Close liaison is maintained with State research and management agencies and the shellfish industries.

The principal early efforts of the investi-



Bureau of Commercial Fisheries Biological Laboratory, Oxford, Maryland

gations included ecological and biological surveys, precise area population studies, and general hydrographical observations. More recently, studies of factors affecting reproduction, growth, survival, recruitment, and genetics were added to the program of research. Strong emphasis is given to research on problems of shellfish mortalities, including identification, life histories, control of predators, micropathogens, and the effects of environmental changes.

There are other mollusks and crustaceans of commercial significance in this area. In Chesapeake Bay the soft clam *Mya arenaria*, the hard clam *Mercenaria mercenaria*, and the blue crab *Callinectes sapidus*, are harvested commercially in considerable quantity.

The Laboratory is located on a typical estuary with a salinity range from fresh to oceanic water. It is an excellent breeding, nursery, and feeding ground for many sport and commercially important fishes. In the ocean adjacent to this area and in seaside bays, are surf clams (*Spisula solidissima*), hard clams, crabs, and many fish species of recreational and commercial importance.

Floor space of 10,000 square feet includes laboratory facilities for chemical, microbiological, and physiological research. Running sea water is available in some rooms. A limited amount of space is available for visiting investigators. Living accommoda-

tions are available in the town of Oxford within walking distance of the Laboratory, which is situated on the Tred Avon River one mile south of the town.

Oxford is 10 miles west of Easton, Maryland. Interstate buses connect Easton with all sections of the country. Baltimore, Maryland, and Washington, D. C. are the nearest rail and air terminals, and Easton can be reached by bus from both cities.

The staff is composed of 12 professional scientists and an equal number of supporting aids and technicians.

A small substation (3,000 square feet of floor space), located on a seaside bay, Chincoteague, at Franklin City, Virginia, contains most of the facilities listed for the Oxford Laboratory. The salinity is oceanic (32 ‰) most of the time. There are no accommodations for extended research by visiting investigators, although scientists are invited to use the laboratory as a starting place for field collection trips. It is isolated and not accessible by public carrier.

Boats equipped for general hydrographical and biological sampling are assigned to each laboratory.

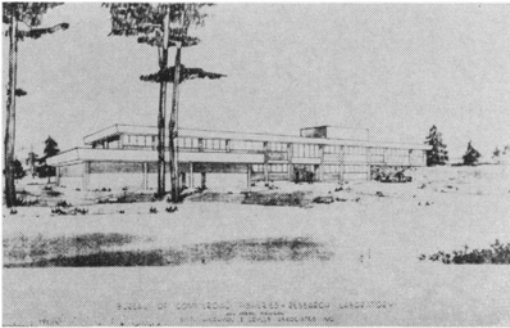
Address the Director, Bureau of Commercial Fisheries Biological Laboratory, P. O. Box 278, Oxford, Maryland.

BIOLOGICAL LABORATORY,

ANN ARBOR, MICHIGAN

Dr. James W. Moffett, Director

This laboratory, located about 40 miles west of Detroit, near the intersection of highways I-94 and US-23, can be reached by bus, railroad, or via commercial airlines to Detroit Willow Run or Metropolitan airports. Field biological stations are located in Wisconsin at Ashland; in Ohio at Sandusky; and in Michigan at Ludington, Marquette, Millersburg, and Northville. Field activities are supported by three research vessels, 45 to 60 feet long — the motor vessels *Cisco*, *Siscowet*, and *Musky II*.



Architect's sketch of Bureau of Commercial Fisheries Research Laboratory, Ann Arbor, Michigan

The Great Lakes have a connected water area of 95,170 square miles. Each lake stratifies thermally and has at least partial ice cover in winter. Other physical, chemical, and biological characteristics vary widely among the five lakes and to a large extent within each of them. The deepest and largest, Lake Superior, has an average depth of 487 feet (maximum, 1,333); an area of 31,820 square miles; average maximum surface water temperature, 66°F; dissolved solids, 60 p.p.m.; and an annual commercial fish production of less than 1 pound per acre. Corresponding data for Lake Erie, the shallowest, are: average depth, 58 feet (maximum 210); area, 9,930 square miles; average maximum surface water temperature, 78°F; dissolved solids about 200 p.p.m.; and average fish production about 7 pounds per acre. Fishes produced in the Great Lakes are primarily from the genera *Coregonus*, *Perca*, *Stizostedion*, *Salvelinus*, and in recent years, *Osmerus*; total commercial production (U. S. and Canada) is seldom less than 100,000,000 pounds per year.

Federal research in fisheries and limnology on the Great Lakes has been continuous since establishment of the laboratory in 1927. Since its inception, the work has been carried out in close cooperation with the University of Michigan, and the facility's headquarters have been on the University campus. The original small staff has increased to a current full-time complement of 90, of whom 50 are fishery biologists.

The laboratory's biological research is directed primarily toward development of a basic understanding of Great Lakes fish stocks — the life history, ecology, and interrelations of different species; factors of fluctuations in growth and abundance; and the effects of the environment and of varying rates of exploitation. Since 1949, a major portion of the effort has been concerned with studies of the effects of predation by the sea lamprey, *Petromyzon marinus*, on fishes in Lakes Superior, Huron, and Michigan; the development of methods for its control; the experimental application of control methods; and the rehabilitation of stocks of lake trout, *Salvelinus namaycush*, which the sea lamprey brought to commercial extinction. A second major field of study has been the relation of recent pronounced changes in the limnology of certain waters and the accompanying major shifts of species abundance.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, 1220 East Washington Street, P. O. Box 640, Ann Arbor, Michigan.

BIOLOGICAL LABORATORY,

AUKE BAY, ALASKA

Dr. George Y. Harry, Director

This laboratory serves as research headquarters for the Bureau in Alaska. It is located in Southeastern Alaska 12 miles north of Juneau, the State Capital. Completed in 1960, the two-story building houses facilities for controlled experiments relating to the biology and physiology of fish and shellfish in fresh and salt water. Nearby Auke Lake and Mendenhall Lake serve as natural fresh-water experimental areas, while adjacent Auke Bay is used for estuarine studies.

The Laboratory also houses a growing reference collection of over 300 species of fresh- and salt-water fishes and shellfishes native to Alaskan waters. Other facilities include a comprehensive scientific library,



Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska

a complete water chemistry laboratory, photographic dark room, and statistical section with IBM card processing equipment. The building also contains office and laboratory space for about 30 scientists and 12 supporting personnel. In addition, the Bureau maintains an 86-foot power barge fitted out for oceanographic investigations now being conducted throughout Southeastern Alaska waters by laboratory personnel.

Other investigations currently under way include studies of the physical, chemical, and biological factors affecting the fresh-water and early marine survival of Pacific salmon, studies of the population dynamics and biology of the commercially important shrimp species and king crab in Alaska, and a study of the effects of DDT appli-

cation as a forest insecticide on salmon survival in southeastern Alaskan streams.

The area adjacent to the laboratory includes a variety of ecological situations in terrestrial and aquatic environments. Alpine tundra, Sitka spruce rain forests, glacial out-wash plains, glaciers, and permanent snow fields all lie within easy access from the laboratory. Clear and glacial lakes, ponds, short coastal streams and rivers provide a variety of fresh-water environments for study. The many estuaries, islands, and miles of beaches afford numerous opportunities for those wishing to study intertidal and marine environments.

Visiting investigators are welcome. Laboratory facilities usually are available from June to the end of August, a time when many resident biologists conduct their

studies at various field stations located throughout the State. Living accommodations may be obtained either in Juneau or in the smaller communities of Douglas or Auke Bay. Reservations for housing should be made well in advance of the proposed field season. Often arrangements can be made through the laboratory staff to rent from resident biologists spending the summer at outlying field stations. Investigators considering southeastern Alaska as a study area should include at least 25% addition to their cost-of-living budget over other regions of the United States.

Juneau can be reached by air or water but not directly by car. Several commercial airlines and a state-operated marine highway system provide regularly scheduled service. Ferries with automobile facilities connect with the Alcan Highway at Haines, and there is ferry service from Prince Rupert.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, P. O. Box 1155, Auke Bay, Alaska.

BIOLOGICAL LABORATORY,

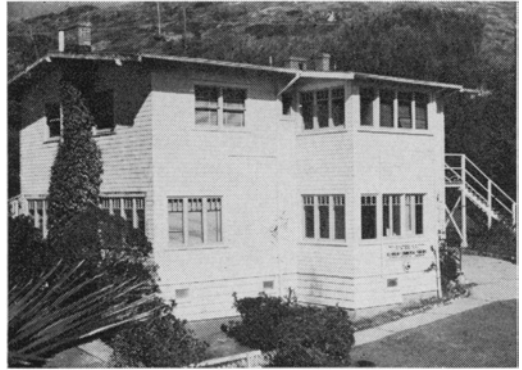
STANFORD, CALIFORNIA

Dr. O. E. Sette, Director

This laboratory is engaged in the study of ocean-wide, medium-term changes in the oceanographic conditions in the Pacific Ocean, the processes that cause them, and the effects they have on the abundance of Pacific marine fish populations. The Laboratory uses published and unpublished time-series data on the atmosphere, ocean, and fisheries. It does not engage in collection of data, but is assembling an extensive "library" of published and unpublished data of this description.

The Laboratory is located in the School of Biological Sciences on the Stanford University campus. No space is available for visiting scientists.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, 450 B Jordan Hall, Stanford, California.



Bureau of Commercial Fisheries Biological Laboratory, La Jolla, California

BIOLOGICAL LABORATORY,

LA JOLLA, CALIFORNIA

Dr. Elbert H. Ahlstrom, Director

This laboratory at present is housed in a two-story white frame house on the campus of the University of California at San Diego, Scripps Institution of Oceanography. A new modern laboratory for which plans are almost completed should be ready for occupancy in early 1964.

The San Diego area has become one of the leading fishery research centers in the United States. Within easy commuting distance of each other are two laboratories of the Bureau of Commercial Fisheries, the Inter-American Tropical Tuna Commission, Scripps Tuna Oceanography Research, and the Marine Life Research Program of the Scripps Institution of Oceanography. All except the last-named will be housed in the new laboratory. In addition, the new building will provide generous facilities for visiting scientists interested in studying marine life.

The Laboratory is investigating population dynamics of pelagic fishes, particularly the Pacific sardine and ecologically associated species including northern anchovy, Pacific mackerel, and jack mackerel. Research on the sardine and related species forms part of the California Cooperative Oceanic Fisheries Investigations (CalCOFI).

In its investigation of the habitat of pelagic fishes in the area of the California Current system, the laboratory operates a 133-foot research vessel, the *Black Douglas*. Cruises, varying in length from a day to a month, are made off the coasts of California and Baja California, Mexico.

Particular emphasis has been placed on investigation of factors underlying success or failure of year broods of pelagic marine fishes. Another problem being given increased attention is the interactions of fishes within the same trophic level — particularly the interaction of Pacific sardine and northern anchovy populations. As one result of the bio-oceanographic cruises, this laboratory has accumulated one of the more extensive collections of larval marine fishes in the world. Most of these have been identified.

The Laboratory is situated on the southern California coast about 15 miles from San Diego and 35 miles from the Mexican border, easily accessible by auto, bus, train and plane. A variety of housing is available. The climate is classified as Mediterranean with mild summers and mild winters. The average temperature is 65°F. Rainfall averages about 9 or 10 inches a year, most of which falls in winter.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, P. O. Box 271, La Jolla, California.

BIOLOGICAL LABORATORY,

SAN DIEGO, CALIFORNIA

Gerald V. Howard, Director

The Bureau established this laboratory in 1959 as its center for oceanographic and biological research on the tunas of the eastern Pacific Ocean and for studies of tuna fishing operations. The primary function is to apply oceanographic and biological findings to specific problems of the tuna fishing industry. Included in the program are service functions as well as basic research in oceanography and biology.

Three principal investigations occupy

the research staff: (1) operations research to develop an optimum fishing strategy based on the integrated experience of all segments of the tuna fishing fleets and the results of biological and oceanographic research; (2) oceanographic research to secure information about the tunas and their environment, to understand the distribution of tunas, and eventually make possible predictions of variations in availability; and (3) research on responses and behavior of tunas, to provide scientific information to improve fishing methods. Laboratory scientists work in close cooperation and frequently in collaboration with scientists of the Scripps Institution of Oceanography, the Inter-American Tropical Tuna Commission, and the California Department of Fish and Game. A part of the laboratory's oceanographic research is done under contract to Scripps Institution.

Service functions in oceanography include preparation and distribution of monthly sea-surface temperature charts of the eastern Pacific, useful to tuna fishermen in locating concentrations of tuna, and to marine scientists studying changes in the oceanic environment. The laboratory also has a cooperative endeavor with the University of California in producing a series of topographic charts of the ocean floor for regions of the eastern Pacific. The oceanographic research is directed at analyses of physical, chemical, and biological data, and historical sea-temperature observations to detect features of the environment that have value in predicting time and space occurrence of tunas.

Research on tuna behavior is centered on the phenomenon of schooling. Studies are under way of the vertical distribution of tuna in relation to thermocline depth and of underwater visibility to determine variations in success of purse seine sets as this may be related to avoidance. Laboratory experiments with juvenile scombroids are being conducted to learn about visual stimuli associated with schooling.

Observations at sea are made from research vessels assigned to other Bureau lab-

oratories, oceanographic vessels operated by Scripps Institution and chartered tuna clippers. The Laboratory anticipates operating its own ocean research vessel within three to four years.

The San Diego laboratory is housed in Building 331 of the U. S. Navy Electronics Laboratory at the tip of Point Loma in San Diego. In the summer of 1964, it will move to a new laboratory building, under construction by the Bureau on the campus of the Scripps Institution of Oceanography, University of California at San Diego, La Jolla, some 15 miles north of Point Loma.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, P. O. Box 6317, San Diego 6, California.



Bureau of Commercial Fisheries Biological Laboratory, Honolulu, Hawaii

BIOLOGICAL LABORATORY,

HONOLULU, HAWAII

John C. Marr,

Area and Laboratory Director

The research program of this laboratory is designed to increase our knowledge of biological and oceanographic processes in relation to high seas fishery resources, especially the tunas, in the Pacific Ocean.

Work in progress is grouped as follows: oceanography, trade wind zone oceanography, skipjack ecology, albacore ecology, behavior, and subpopulations.

All oceanographic station data available from the Pacific Ocean are being examined to determine (1) average conditions, (2) annual and seasonal variations from the

average, and (3) areas in which additional observations are needed. Computing facilities are being used in these studies.

A recent study of all oceanographic data available from a three-million-square-mile area around the Hawaiian Islands, plus heat budget considerations, led to a description of the oceanographic climate of the area and an hypothesis that the major observed annual changes are due to advection effects. A two-year period of intensive observations in the area is planned in order to test the hypothesis (as well as some of the assumptions in the heat budget calculations) and to measure the rates at which oceanographic processes occur.

Owing to the seasonal nature of the occurrence of skipjack, the Hawaiian Islands constitute a natural laboratory for the study of the relationship of skipjack to their environment. It has been observed that the availability of skipjack is directly related to dynamic features of the oceanographic climate; studies are in progress to attempt to learn the nature of this association. Extensive studies of the life history of this species are also in progress.

Observation of tuna at sea, through underwater observation ports, has suggested lines of inquiry hitherto impossible. For example, skipjack exhibit a pattern of vertical bars when feeding, in contrast to their usual pattern of horizontal stripes. This suggests a form of communication; *i.e.*, the behavior of other skipjack may be influenced upon observing this barred pattern. Skipjack prove to be easily conditioned to respond to stimuli, and experiments are in progress to determine their sensory acuity and other factors governing behavior character.

Other problems include the identification of discrete population units, or subpopulations. Results thus far show the existence of several distinct subpopulations of skipjack in the Pacific basin. It would be particularly useful to find a characteristic known to be under genetic control and capable of defining subpopulations. Blood-group systems constitute such a

characteristic; several blood-group systems are recognized in tunas.

Most effort has been expended on skipjack and albacore tunas, but these studies now are being expanded to include yellowfin and bigeye tunas, billfishes, and some pelagic sharks.

The existence of special facilities of the Laboratory may be noted, including (1) its location in the trade wind zone of the Pacific, (2) the local availability of several species of tunas, (3) underwater observation ports in the research vessel *Charles H. Gilbert*, (4) extensive collections of zooplankton and bathypelagic fishes, and (5) experimental facilities for studies of behavior-physiology on pelagic predators. Visiting investigators are welcome. Housing is available in Honolulu, but it is relatively expensive.

Address the Area Director, Bureau of Commercial Fisheries, P. O. Box 3830, Honolulu, Hawaii.

ICHTHYOLOGICAL LABORATORY,

WASHINGTON, D. C.

Dr. Daniel M. Cohen, Director

This laboratory occupies space in the Natural History Building of the U. S. National Museum in Washington, D. C. The present professional staff consists of two ichthyologists and one malacologist. The objectives of the laboratory are several: (1) original revisional research in systematic zoology; (2) provide technical information on fish, fisheries, and systematics to the Fish and Wildlife Service, other Government agencies and the general public; (3) liaison between the Bureau of Commercial Fisheries and the Smithsonian Institution.

Major research projects presently underway are:

1. A study on the systematics of scombroid fishes, particularly the large, tuna-like forms. This is being carried on in cooperation with personnel of the Smithsonian Institution and with the assistance

of fishery laboratories and museums all over the world.

2. Contributions to the monographic series *Fishes of the Western North Atlantic*. Sections on clupeoid fishes, benthic Iniomi, and argentinoid fishes have been prepared and editorial assistance has been furnished. At present sections on halfbeaks, needlefishes, and cod-like fishes are being prepared.

3. Studies on continental slope and abyssal fishes of the suborder Ophidioidea.

4. Studies on bivalve mollusks of the family Tellinidae.

5. Studies of the mainly fresh-water fish family Percidae.

The Ichthyological Laboratory does not direct a field program. Personnel from the laboratory have cooperated with field programs of other Government agencies and private institutions and worked in the North Atlantic, the Gulf of Mexico and Caribbean, the North Pacific, and the Tropical Central Pacific.

No accommodations are available for visitors.

Address the Director, Bureau of Commercial Fisheries Ichthyological Laboratory, U. S. National Museum, Washington 25, D. C.

BIOLOGICAL LABORATORY, WASHINGTON, D. C.

Thomas S. Austin, Acting Director

Research at this laboratory is directed to broad geographic aspects of fisheries and oceanography in the Atlantic Ocean. A special responsibility of the Laboratory Director is to plan and coordinate the entire Oceanography Program of the Bureau.

The largest current activity is the Tropical Atlantic Fishery-Oceanography Program, concerned with the equatorial Atlantic as a system for the production of food resources. Specific aspects of research are: (1) physical and chemical properties of environment; (2) processes of organic production; (3) zooplankton fauna and its role in the marine ecosystem; (4) nekton community and its relationship with ad-

jacent trophic levels; and (5) distribution, abundance, and biology of the tunas of the Tropical Atlantic. The research vessel *Geronimo* is fully assigned to this program in 1963. Full assignment of the *Geronimo* and a second research vessel is scheduled for 1964 and thereafter. The program, during 1963, is part of the International Cooperative Investigation of the Tropical Atlantic, in which some seven nations are scheduled to participate.

The Environmental Oceanographic Research Program has the principal objective of developing techniques for describing and explaining the geographic distributions of sedentary marine organisms in terms of environmental conditions. Species are selected to demonstrate contrasting distributional characteristics; information on their environmental requirements is obtained by field study; and charts are drawn to show the distribution of limiting environmental factors.

The Oceanographic Instrumentation Program has the following functions: (1) servicing instruments for the laboratory, (2) development of new instruments for the Bureau, and (3) coordination of oceanographic instrumentation development within the Bureau, and with other Government agencies.

The *Geronimo* is a 143-foot ocean-going tug converted for research. Navy docking facilities are available adjacent to the laboratory on the Anacostia River. The Laboratory is designed for a staff of about nineteen investigators and ten technicians. There are accommodations for two visiting investigators. General research facilities are centralized laboratories for processing preserved biological collections, for chemistry, and for oceanographic instrumentation development and testing. There is a small library, a conference room, and nineteen individual offices or office-laboratories for professional staff. There is no special provision for maintenance of living marine life. Emphasis is on facilities for data processing and analysis. There are no living accommodations for visitors, but a

variety of reasonably-priced accommodations is available in Washington, D. C., and in the adjacent suburbs of Virginia and Maryland.

The Laboratory is in proximity to several other Government agencies and facilities with oceanographic missions: National Oceanographic Data Center (one block away), Navy Hydrographic Office, National Museum, Geological Survey, Coast and Geodetic Survey, Weather Bureau, and Bureau of Mines. Convenience of contact with these organizations and of access to their large supplies of oceanographic data (hydrological, biological, bathymetrical, geological and meteorological) are definite assets.

The Laboratory is located in Building 74, Washington Navy Yard Annex, Washington 25, D. C. Entrances to the Navy Yard Annex are at 8th and M Streets, S. E. and at 1st and N Streets, S. E.

Address the Director, Bureau of Commercial Fisheries Biological Laboratory, Building 74, Naval Weapons Plant, Washington 25, D. C.

EXPLORATORY FISHING AND GEAR RESEARCH BASES

Five Exploratory Fishing Bases, located throughout the United States, are devoted to studies for improved utilization of fisheries resources. The mission for each base is fundamentally research and development in exploratory fishing and gear research. Each base is more or less centrally located in the area for which it is responsible.

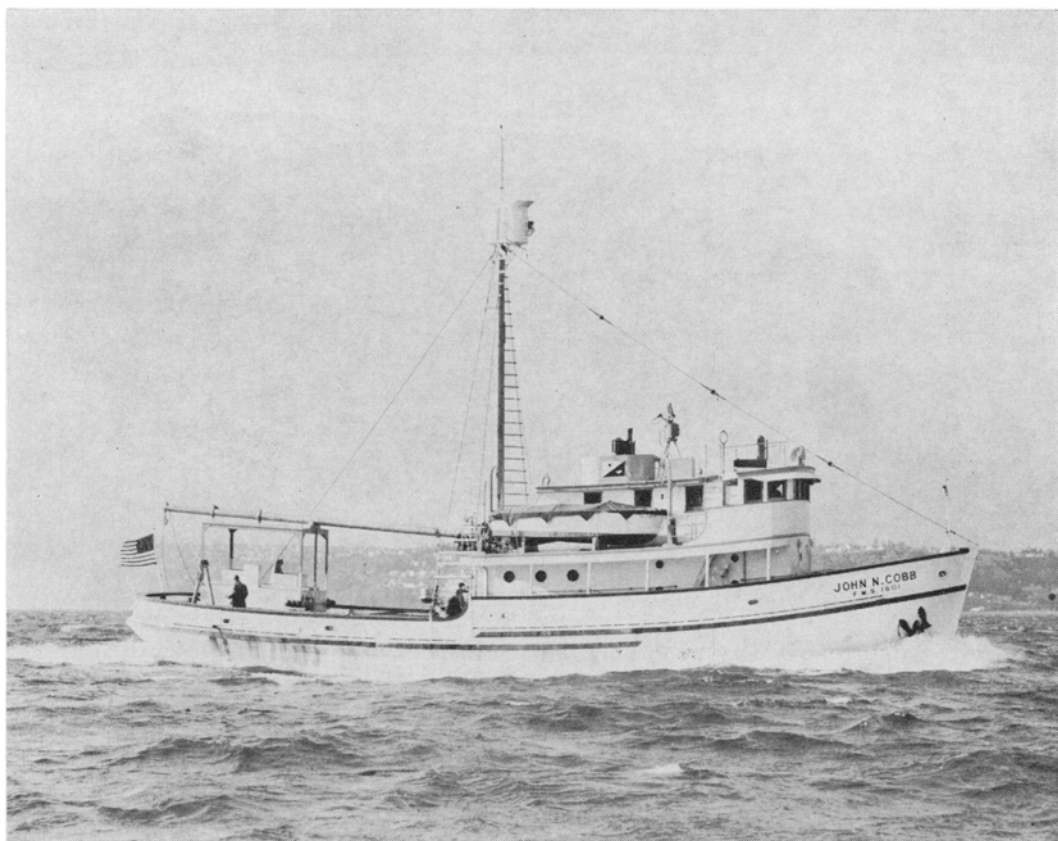
Ultimate objectives of the exploratory fishing programs are to define, on a seasonal basis, the quantitative and qualitative distribution of marine resources having a potential for commercial utilization and to provide an appraisal of the commercial value of these resources. Exploratory fishing vessels are equipped with standard and experimental capturing devices and instrumentation useful in navigation, fish detection, and fish capture.

Objectives of the gear research programs are to improve harvesting techniques and devices, and to demonstrate their application to industry. Studies are conducted on fish behavior, and the mechanics and performance of fish-catching devices. This information is applied to designing, modifying, and increasing the effectiveness of fishing gear.

Due to the specific nature of the programs, very limited biological research facilities are available at the exploratory fishing bases. Field collection of indigenous species on a cooperative basis is invited. Catches usually contain a variety of fishes and invertebrates and opportunities for ecological studies are particularly good. Facilities aboard exploratory vessels are available on a first come basis. Cruises and areas to be explored are scheduled well in advance. Address the Base Director of the pertinent Exploratory Fishing Base for information on cruises designed to explore a particular species or geographical area. Living facilities are not

provided at the bases themselves, but are generally available in the adjacent areas. Physical facilities at each base house personnel and equipment used in exploratory fishing and gear research, and provide some general and shop working areas. All five bases are readily accessible by boat, rail bus, and private vehicle, with the possible exception of the Region V base at Juneau, Alaska, where accessibility can be seasonally limited.

Accounts of the basic research programs conducted in each geographical region follow. In addition to the included programs, projects specific to particular areas or fisheries are conducted from time to time. For example, the Region II Exploratory Fishing Base (Pascagoula, Mississippi), is currently conducting a two-year exploratory fishing survey of the spiny lobster (*Panulirus*) resource and potential in the Atlantic and Pacific Oceans adjacent to Panama. This survey is being done under a contract with the United States Agency for International Development (AID).



Exploratory fishing vessel *John M. Cobb*. The 93-foot *Cobb* conducts exploratory fishing and gear research in the Northeastern Pacific and is based at Seattle, Washington.

EXPLORATORY FISHING AND GEAR RESEARCH
BASE, SEATTLE, WASHINGTON

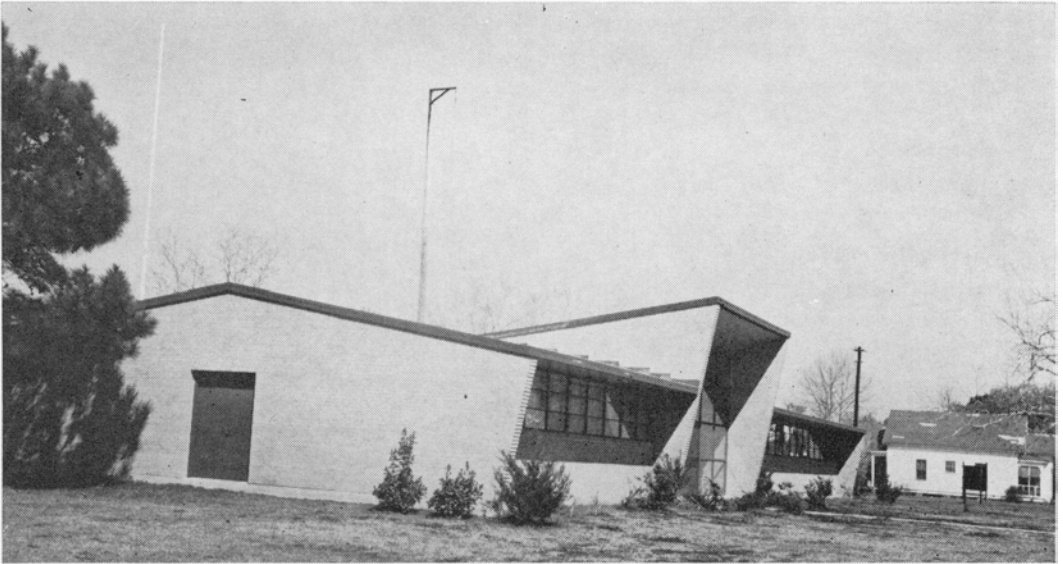
Dayton L. Alverson, Director

Area stressed: Northeastern Pacific.

Habitat investigated: Bottom exploration of Continental Shelf and slope to 2000 fathoms; coastal and oceanic midwaters.

Vessel: *John N. Cobb*. Home port: Seattle, Washington. 93-foot wooden exploratory fishing vessel equipped for commercial scale fishing operations. Can accommodate up to two visiting investigators.

Address the Director, Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, 2725 Montlake Boulevard East, Seattle 2, Washington.



The Exploratory Fishing Base, Pascagoula, Mississippi

EXPLORATORY FISHING BASE, PASCAGOULA,
MISSISSIPPI

Harvey R. Bullis, Jr., Director

Area stressed: Gulf of Mexico, Caribbean Sea, and the southern North Atlantic Ocean.

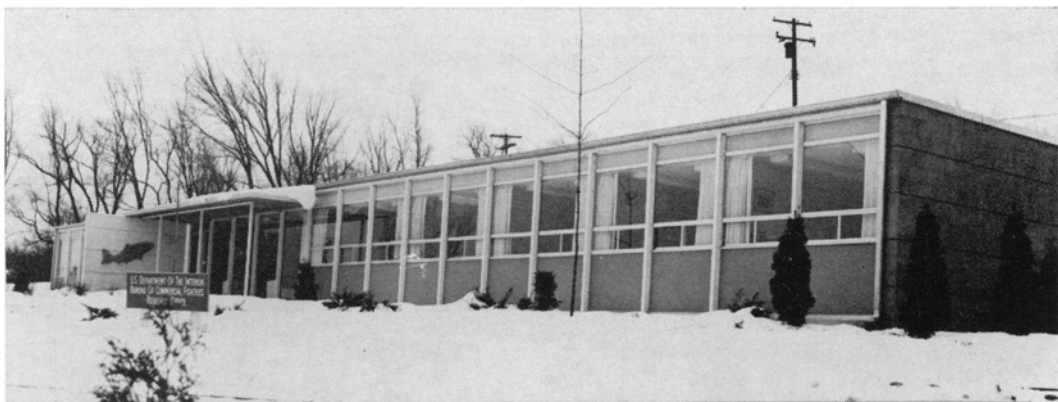
Habitat investigated: Bottom exploration of Continental Shelf and slope to 2,000 fathoms; coastal and oceanic mid-waters.

Vessels: Oregon. Home port: Pascagoula, Mississippi. 100-foot steel, West Coast-type combination trawler equipped for commercial scale fishing operation. Can accommodate up to four visiting investigators. Primary areas of operation are the Gulf of Mexico, Caribbean Sea, and Central Tropical Atlantic Ocean to Brazil.

Silver Bay. Home port: Brunswick, Georgia (Exploratory Fishing Field Station). 96-foot steel North Atlantic trawler equipped for commercial scale fishing operations. Can accommodate up to four visiting investigators. Primary area of operation is the southwestern North Atlantic Ocean.

George M. Bowers. Home port: Panama City, Florida (Gear Research Field Station). 73-foot wooden shrimp vessel equipped for gear research and development including underwater diving observations. Can accommodate up to two visiting investigators. Primary area of operation is the Gulf of Mexico.

Address Director, Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, Post Office Drawer D, Pascagoula, Mississippi.



Bureau of Commercial Fisheries Regional Office, Region 4 Headquarters of the Exploratory Fishing Base, Ann Arbor, Michigan

EXPLORATORY FISHING AND GEAR RESEARCH
BASE, ANN ARBOR, MICHIGAN

Melvin L. Greenwood, Director

Area stressed: Great Lakes, principally Lake Michigan and Lake Erie. Farm ponds, lakes, and reservoirs in central United States.

Habitat investigated: Bottom and mid-water areas of the Great Lakes, farm ponds, lakes and reservoirs.

Vessel: Kaho. Home port: Saugatuck, Michigan (vessel base). 65-foot steel exploratory fishing vessel equipped for commercial scale fishing operations. Can accommodate up to two visiting investigators.

Address Director, Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, 5 Research Drive, Ann Arbor, Michigan.

EXPLORATORY FISHING AND GEAR RESEARCH
BASE, JUNEAU, ALASKA

Warren F. Rathjen, Director

Area stressed: Gulf of Alaska and North Pacific Ocean.

Habitat investigated: Bottom exploration of Continental Shelf and slope; coastal and oceanic mid-waters.

Vessel: No permanent vessel in operation. Field work carried out with chartered vessels which may vary in size, type,

and available accommodations. Primary area of operation is the Gulf of Alaska.

Address Director, Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, P. O. Box 2481, Juneau, Alaska.

EXPLORATORY FISHING AND GEAR RESEARCH
BASE, GLOUCESTER, MASSACHUSETTS

Keith Smith, Director

Area stressed: North Atlantic Ocean, generally north of North Carolina.

Habitat investigated: Bottom exploration of Continental Shelf and slope; coastal and oceanic waters.

Vessel: Delaware. Home port: Gloucester, Mass. 148-foot steel trawler equipped for commercial scale fishing operations. Can accommodate two to four visiting investigators.

Rorqual. 65-foot vessel for inshore exploration and gear research.

Address the Director, Bureau of Commercial Fisheries Exploratory Fishing and Gear Research Base, State Fish Pier, Gloucester, Mass.

SUMMARY

The foregoing descriptions of our varied studies of the living resource in its environment represent only a part of the entire Bureau program. We operate five Fishery Technological Laboratories and two Tech-



Exploratory Fishing Base, Gloucester, Massachusetts showing the station and the *M/V Delaware* moored at the adjacent pier.

nological Stations, which conduct scientific studies of nutritive value of fishery products, develop methods for improving quality and attractiveness, and are active in research on fish meal and oil, and on fish protein concentrates for human food.

The Bureau assists the industry with market promotion, carrying out test kitchen research, staging fish cookery demonstrations, cooperating with the States in the National School Lunch Program, and generally educating the consumer in a variety of ways. Economic research and services are concerned with transportation and consumption of fishery products, fishermen's cooperatives, and the effects of foreign competition. Statistical services pro-

vide up-to-date information on fishery landings; imports; production; holdings of frozen, canned, or other processed fishery products; and provide a daily market news service to the domestic industry. The Bureau manages the Pribilof fur seal herd and reservation and enforces high seas fishery regulations. It is responsible for administration of three financial programs including a Vessel Loan Program, a Fishing Vessel Construction Subsidy Program, and a Mortgage Insurance Program. These highlights give a general impression of the diversified and comprehensive program provided by the Federal Government for the commercial fishing industry of the United States.