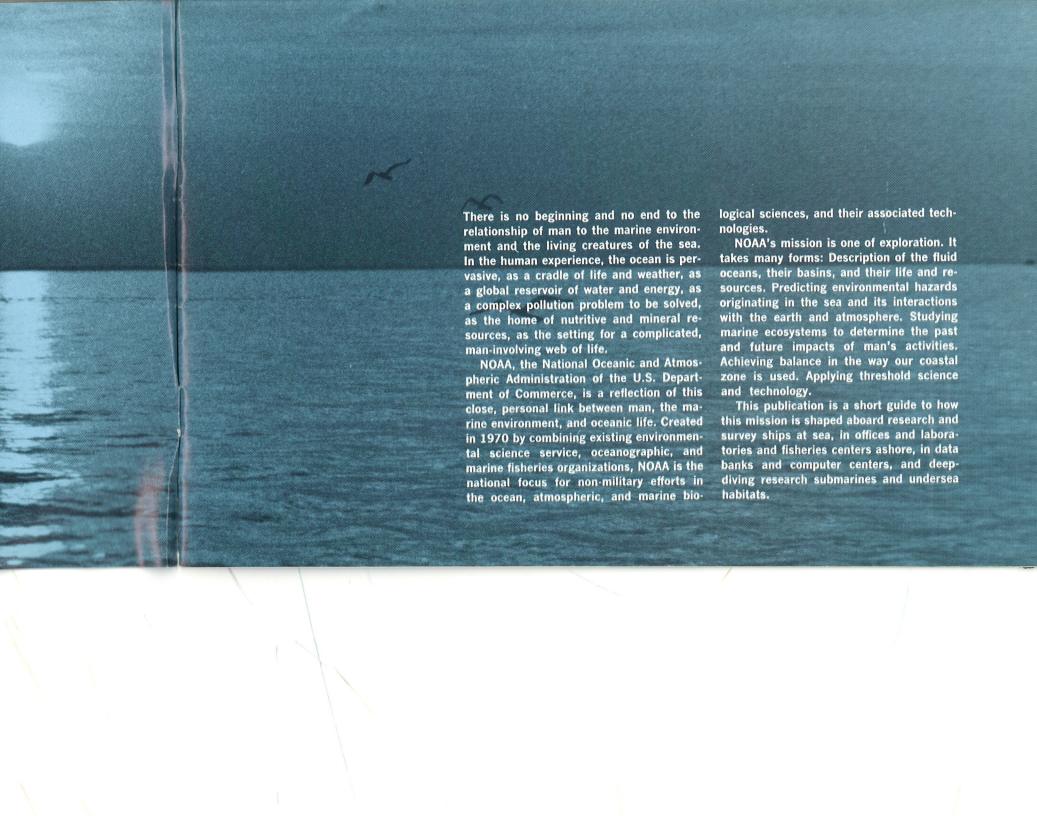
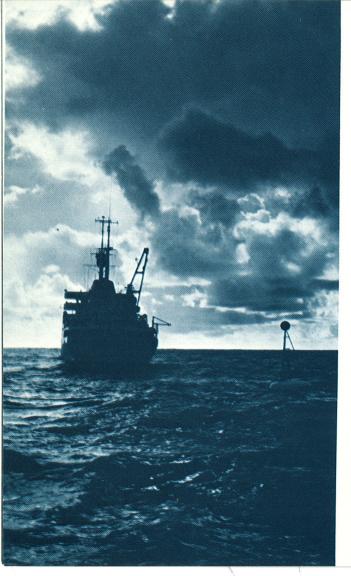


CONTENTS 4 New Knowledge From the Global Sea Man and the Marine Environment Managing America's Coastal Zone 10 The Marine Environment, Past, Present, Future Surveys, Charts, Predictions The Laboratory of Atmosphere and Ocean 16 Marine Environmental History: NOAA's Data Banks NOAA and the Living Resources of the Sea Comprehending Oceanic Life 22 Marine Mammals and Endangered Species Help for a High-Risk Industry 26 Advancing New Technologies 28 Sea Grant: New Strength in the Marine Sciences











NOAA's ocean and Great Lakes research laboratories use the full spectrum of tools to garner knowledge of marine and lake processes, properties, and ecosystems. At far left, the NOAA ship Oceanographer puts over a radar tracking buoy. A diver checks a current meter at left, and a battery of ocean remote-sensing devices peers at the ocean from NOAA's C-130 research aircraft. The Miami laboratories' research vessel Virginia Key is shown above.

NEW KNOWLEDGE FROM THE GLOBAL SEA Research into the physic aspects of the marine three centers of action vironmental Research La lantic Oceanographic a Laboratories in Miami, I Marine Environmental attle, Washington; and the vironmental Research L Arbor, Michigan. Much o centers is linked to res colleague laboratories v biological laboratories of rine Fisheries Service, fo investigators in univers industry. Individuals ar ceiving support from N program often share pro oratories, as do many s multinational research o

Work at the Miami cludes the Physical Oce tory, Marine Geology and oratory, Sea-Air Interaction Ocean Remote-Sensing been associated main! Stream and other major coastal and estuarine proment transport, waves



Great Lakes research laboraspectrum of tools to garner e and lake processes, properis. At far left, the NOAA ship sover a radar tracking buoy. current meter at left, and a mote-sensing devices peers at JAA's C-130 research aircraft. ories' research vessel Virginia e. Research into the physical and geophysical aspects of the marine environment has three centers of action within NOAA's Environmental Research Laboratories: the Atlantic Oceanographic and Meteorological Laboratories in Miami, Florida; the Pacific Marine Environmental Laboratory in Seattle, Washington; and the Great Lakes Environmental Research Laboratory in Ann Arbor, Michigan. Much of the work at these centers is linked to research activities in colleague laboratories within NOAA-the biological laboratories of the National Marine Fisheries Service, for example—and to investigators in universities and private industry. Individuals and institutions receiving support from NOAA's Sea Grant program often share projects with the laboratories, as do many state, regional, and multinational research organizations.

Work at the Miami facility (which includes the Physical Oceanography Laboratory, Marine Geology and Geophysics Laboratory, Sea-Air Interaction Laboratory, and Ocean Remote-Sensing Laboratory) has been associated mainly with the Gulf Stream and other major current systems, coastal and estuarine processes, shelf sediment transport, waves and other air-sea

interactions, and plate tectonics and continental drift. In recent years, these laboratories have been making earth-orbiting satellites the servants of oceanographers, and advancing the state-of-the-art of oceanic remote sensing. There has also been a sharp confrontation with marine environmental problems. Miami scientists, for example, have been major participants in such investigations as the ongoing New York Bight project of NOAA's Marine Ecosystems Analysis (MESA) program, and their plate tectonics studies are providing keys to the processes which concentrate mineral deposits on land and under the sea.

At the Pacific Marine Environmental Laboratory, there is strong emphasis on coastal and estuarine processes, particularly as these are affected by man's activities in and around Puget Sound. The laboratory is also taking a prominent part in a continuing study of the marine ecosystems of Alaska's continental shelf regions. The Seattle facility has a strong hand in developing buoy techniques for monitoring air-sea interactions and in developing models of various aspects of the marine environment. Another part of this activity is in the Joint Tsunami Research Effort, con-

ducted jointly by NOAA and the University of Hawaii in Honolulu. This group is studying the generation, open-ocean propagation, run-up, and other properties of tsunamis, the destructive wave trains generated by some oceanic earthquakes. They are also "exporting" some of their wave sensing and modeling techniques to the other laboratories.

The Great Lakes Environmental Research Laboratory is concerned with the physics and ecology of America's fresh water ocean. This effort seeks to view the Great Lakes in all their aspects, and determine how they are affected by the dense population which lines their shores.

International studies are pervasive at NOAA's oceanographic and Great Lakes laboratories. Some of the large field projects in which they have been participants include the International Field Year for the Great Lakes (IFYGL), Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR), International Decade of Ocean Exploration (IDOE), Mid-Ocean Dynamics Experiment (MODE), French-American Mid-Ocean Undersea Study (FAMOUS), and the Global Atmospheric Research Program Atlantic Tropical Experiment (GATE).







MAN AND THE MARINE ENVIRONMENT

An increasingly central feature of NOAA's ocean-directed research is the establishment of environmental baselines and processes. These are detailed descriptions of regional marine life and environment used to determine past and future impacts of man's activities on marine ecosystems. The descriptions come from intensive studies of areas selected for the environmental stresses they are under, or likely to come under in the near future.

The Marine Ecosystems Analysis (MESA)



NOAA's studies of man's im Bight and of probable impac a view of New York, with w samples at the fisheries labo

program, managed by Notal Research Laborator with the impact of man vironment, such practicing, and regional marin ment. The first MESA 1973 in the New York Bistretching from the moout to the edge of the and from Long Island ware. A second MESA 1975 in Puget Sound.

Under the Marine Pr and Sanctuaries Act of 1 for the Secretary of Con with initiating comprehe ing programs to moni ocean dumping, and the



central feature of NOAA's esearch is the establishnental baselines and proce detailed descriptions of ife and environment used st and future impacts of n marine ecosystems. The e from intensive studies of the environmental stressr, or likely to come under

osystems Analysis (MESA)



NOAA's studies of man's impact on marine ecosystems include an intensive study of the New York Bight and of probable impacts of energy-related developments offshore and in coastal areas. At left, a view of New York, with water samples aboard the ship Ferrel (far left) and sorting of biological samples at the fisheries laboratory at Sandy Hook, New Jersey.

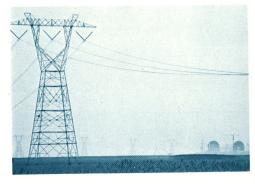
program, managed by NOAA's Environmental Research Laboratories, is concerned with the impact of man on the marine environment, such practices as ocean dumping, and regional marine life and environment. The first MESA project began in 1973 in the New York Bight, a broad region stretching from the mouth of the Hudson out to the edge of the continental shelf, and from Long Island southward to Dela-1975 in Puget Sound.

Under the Marine Protection, Research and Sanctuaries Act of 1972, NOAA (acting for the Secretary of Commerce) is charged with initiating comprehensive and continuing programs to monitor the effects of ocean dumping, and the long-range effects

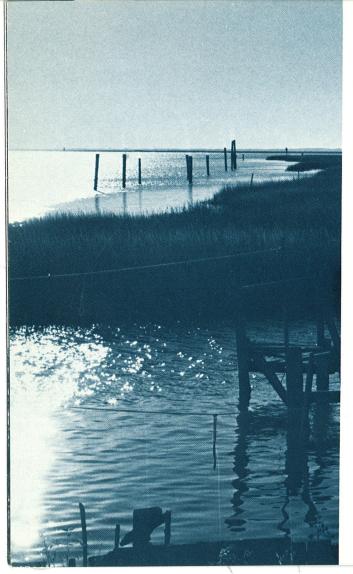
of pollution, over-fishing, and man-induced changes of ocean ecosystems. This responsibility has partly shaped the New York Bight and Puget Sound projects. But these projects are also compiling a comprehensive view of these marine ecosystems that should have continuing benefits for the millions of people who live along Puget Sound and the New York Bight.

Another MESA project is examining the ware. A second MESA project began in life and environment around the Pacific sites where deep ocean mining of manganese nodules will begin. DOMES (the Deep Ocean Mining Environmental Study) seeks to determine what the ecological effects of such mining will be before mining becomes an operational fact in the open ocean.

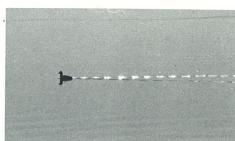
The Alaska Outer Continental Shelf En-



vironmental Assessment program, also managed by the Environmental Research Laboratories, is funded by the Interior Department's Bureau of Land Management. Its specific goal is to establish baseline measurements along Alaska's continental shelf against which probable effects of offshore oil development can be detected and monitored. The program brings together many NOAA elements, and many other federal agencies, universities, and private institutions to produce this comprehensive ecological picture. And it takes them into some of the most forbidding environments on earth-to the northern rim of the Gulf of Alaska, to portions of the Bering and Chukchi Seas, and to the Beaufort Sea, where Alaska and the Arctic Ocean merge.











Increasing, conflicting demands on the nation's coastal land and water resources reflect the fact that this boundary is all things to all people—a place to play, fish, paddle, build, and turn a profit, to name a few examples.

MANAGING AMERICA'S COASTAL ZONE The pressing need for thin strip of land, wat coastal zone led to enal Zone Management 92-583). This legislareconcile increasing mands on coastal land brought NOAA and it Zone Management in ship with the nation Lakes states.

The Office of Coast has the mission of ending states in the de management programs of coastal land and w office is also charge state activities and s and national interests

The state coastal zo gram is a plan to exercise full authority protection of coastal it tending three miles out state plans are being of tion with citizens' growernment agencies who affect the state's coaby law, the development



ng demands on the nation's iter resources reflect the fact is all things to all people—a , paddle, build, and turn a w examples.

The pressing need for balanced use of the thin strip of land, water, and life called the coastal zone led to enactment of the Coastal Zone Management Act of 1972 (P.L. 92-583). This legislation, which seeks to reconcile increasing and conflicting demands on coastal lands and resources, has brought NOAA and its Office of Coastal Zone Management into a unique partnership with the nation's coastal and Great Lakes states.

The Office of Coastal Zone Management has the mission of encouraging and assisting states in the development of sound management programs to achieve wise use of coastal land and water resources. This office is also charged with coordinating state activities and safeguarding regional and national interests in the coastal area.

The state coastal zone management program is a plan to encourage states to exercise full authority over the use and protection of coastal lands and waters extending three miles out to sea. By law, the state plans are being developed in cooperation with citizens' groups and various government agencies whose activities directly affect the state's coast. Also as required by law, the development plan must be ap-

proved by the Secretary of Commerce before it can be put into effect.

Once the Secretary approves a state development program, all federal activities in the coastal zone, or which may affect the coastal zone—including the award of grants, loans, licenses, and permits—must be conducted in a manner consistent with the approved state plans.

The Office of Coastal Zone Management assists states in the development of their program by providing broad technical and financial assistance. The office provides states with annual matching grants with which it supports two-thirds of program costs (the state pays the remaining third), and is authorized to provide states up to three annual grants to develop their coastal zone management program. Additional "implementation" or administration grants are awarded by the Office of Coastal Zone Management only after a development program has been approved by the Secretary of Commerce. These grants help the state put its plan into effect.

Thirty states and four United States territories are eligible to participate in the coastal management program, including

the states fronting the five Great Lakes. All but one had applied for and received development grants by mid-1975.

Section 312 of the Coastal Zone Management Act adds another important dimension to this office's functions. It authorizes NOAA, on behalf of the Secretary of Commerce, to provide financial and technical aid to coastal states in establishing estuarine sanctuaries that would serve as natural laboratories to study processes that occur within the estuaries of the coastal zone. Two grants have been awarded: to Oregon to develop the South Slough of Coos Bay, and to Georgia to develop a section of Sapelo Island.

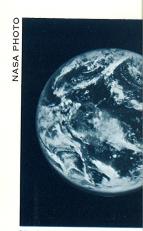
The Office of Coastal Zone Management also administers the marine sanctuaries program established as part of the Marine Protection, Research, and Sanctuaries Act of 1972 (P.L. 92-532). The purpose of this program is to preserve or restore certain areas of the ocean for their conservation, recreational, ecological, or esthetic value. The sunken remains of the USS Monitor—the Civil War "ironclad"—and the ocean area where she rests were designated the nation's first marine sanctuary in 1975.







THE MARINE ENVIRONMENT PAST, PRESENT, FUTURE

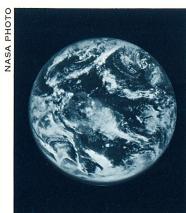


Marine weather services puse the sea. Developed frolaunch at far left), radar

Much of the marine changeable that the b is a prediction. Weather hazards of atmospher the subjects of marine diction development at

Meteorologists in Weather Service put to "puzzle" from measure dreds of surface locat ships and weather recofrom satellite photographics.













spacecraft (above, left) a portrait of present and future marine environmental conditions is disseminated by a variety of methods, among them the NOAA VHF Radio Weather transmission at far right.

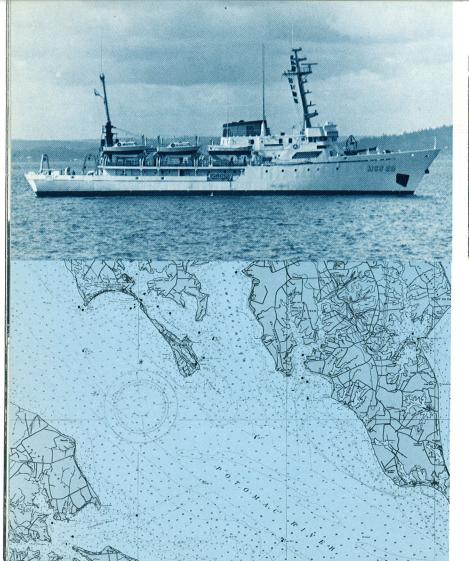
Much of the marine environment is so changeable that the best description of it is a prediction. Weather, sea state, and the hazards of atmosphere and ocean are all the subjects of marine environmental prediction development at NOAA.

Meteorologists in NOAA's National Weather Service put together their weather "puzzle" from measurements made at hundreds of surface locations, on oceangoing ships and weather reconnaissance aircraft, from satellite photographs and radar im-

ages, and from profiles of temperature and humidity made by sensor-bearing balloons and by experimental sensors aboard earth-orbiting satellites. Weathermen and their high-speed computers, using mathematical models of the atmosphere, then predict what future conditions will be. More knowledge of conditions at the air-sea boundary, and over the sparsely covered ocean area, will improve the accuracy of these forecasts.

MAREP (from Marine Environmental Prediction) is the acronym given to the

efforts of the Department of Commerce and other federal agencies to bring together into one unified predictive system NOAA's marine weather services, predictions of tides and currents and of sea state and surf conditions, forecasts of fish abundance, and other existing and planned services. This involves new sensors and platforms—for example, satellites and ocean-moored buoys—and significant advances in our comprehension of oceanic life and its relation to marine environmental processes.







Hydrographic surveys by new ships like the Fairweather (left) produce raw data for nautical charts. Chart shoreline is obtained from aerial photographs, like these paired panchromatic (above, left) and infrared (above, right) photos.

SURVEYS, CHARTS, PREDICTIONS

NOAA's National Ocean Survey is a longstanding chartmaker to the nation's coastal and Great Lakes shippers and sailors. For more than a century and a half, this organization has mapped depths, shoreline, and other navigationally important features.

Modern survey ships equipped to gather such data automatically, now forward hydrographic data to their home ports in computer-ready form. This information, combined with shoreline maps compiled from aerial photographs, is produced in the form of nautical charts. Related prod-



Circulatory surveys by t to measure currents, ten currents and to manage

ucts such as tidal cu tidal current predicti products designed to istics as the topog cover of the ocean flo

A coastal network the rise and fall of the baseline information tide predictions, shor and for tidal correction depths. They also pro to develop storm surgings for coastal comm



rweather (left) produce raw ned from aerial photographs, nfrared (above, right) photos.

Ocean Survey is a longter to the nation's coastes shippers and sailors, century and a half, this napped depths, shoreline, onally important features, ships equipped to gather utically, now forward hyto their home ports in orm. This information, horeline maps compiled ographs, is produced in call charts. Related prod-



ucts such as tidal current charts, tide and

tidal current prediction tables, and special

products designed to show such character-

istics as the topography and sediment

cover of the ocean floor are also produced.

baseline information for pollution studies,

tide predictions, shore and sea boundaries,

and for tidal corrections to nautical chart

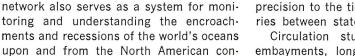
depths. They also provide information used

to develop storm surge and tsunami warnings for coastal communities. The tide gage

A coastal network of tide gages records the rise and fall of the tides, and provides



Circulatory surveys by the NOAA ship Ferrel (above, left) use sensors suspended from anchored buoys to measure currents, temperature, and salinity at preselected depths. These data are used to predict tidal currents and to manage pollution in estuarine areas.



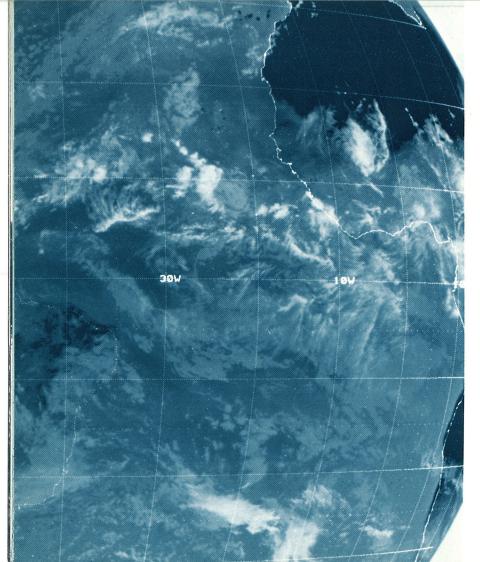
tinent, over decades of time.

As with NOAA's marine research, there has been increasing emphasis on mapping activities in the coastal zone, and in applying traditional forms of such information to solving today's urgent environmental problems. Coastal maps are being produced that show inundation contours for projected hurricane tides. Others bring

precision to the tidal and offshore boundaries between state and federal resources.

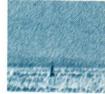
Circulation studies in estuaries and embayments, long used to develop tidal current predictions, are being applied to helping environmental managers predict estuarine flushing rates and other pollution-related information. Techniques developed by the National Ocean Survey are being applied to such intensive ecosystem studies as the MESA New York Bight project and NOAA's baseline work on the Alaskan outer continental shelf.







THE
LABORATORY OF
ATMOSPHERE
AND
OCEAN



The largest environr gram Atlantic Tropic left, a GATE-proved pants: the bee-like bow-mounted solar

The search for in niques and better environmental dat its colleague organ major experiments Oceanographic an ment, studied about tropical Atlantithe stratosphere for

GATE, the Global Program's Atlantic which BOMEX was international expensions in man's larget to date. Through some 40 ships, a buoys, satellites, a scientific cadre sulantic between Afr



TORY OF HERE



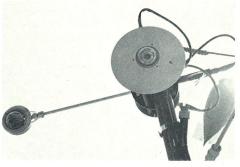
The largest environmental experiment in history was GATE (from Global Atmospheric Research Program Atlantic Tropical Experiment), which took place during 100 days in the summer of 1974. At far left, a GATE-proved tool: the well-resolved images from a geostationary satellite. And some participants: the bee-like C-130 from the United Kingdom (left), the NOAA ship Oceanographer and her bow-mounted solar radiation sensors (above), and a Soviet ship on-station in the Atlantic (right).

The search for improved prediction techniques and better ways to gather and use environmental data has taken NOAA and its colleague organizations into the field for major experiments. BOMEX, the Barbados Oceanographic and Meteorological Experiment, studied about 90,000 square miles of tropical Atlantic, from the sea floor to the stratosphere for three months in 1969.

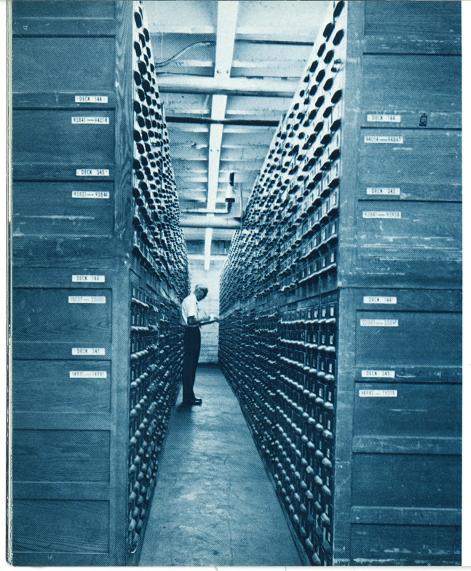
GATE, the Global Atmospheric Research Program's Atlantic Tropical Experiment (of which BOMEX was a precursor), was an international experiment involving 70 nations in man's largest environmental study to date. Through the summer of 1974, some 40 ships, a dozen research aircraft, buoys, satellites, and a large multinational scientific cadre subjected the tropical Atlantic between Africa and South America

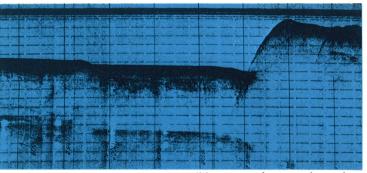
to intensive study, to see how this air-sea "solar boiler" affects global weather and climate. Data from GATE are now being used in advanced mathematical models of the ocean and atmosphere, and their interactions.

Other major field experiments involving air and ocean include *Project Stormfury*, which is trying to determine whether hurricanes can be beneficially modified, and studies (under the Global Atmospheric Research Program) of the Indian monsoon system. Another cooperative study carried out by the United States and Canada—the International Field Year for the Great Lakes, or IFYGL—is the source of a continuing analysis of physical, chemical, and biological processes at work in the Great Lakes.

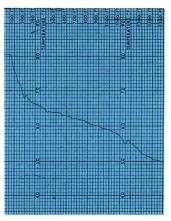








Past descriptions of environmental conditions come in many forms from NOAA's Environmental Data Service—weather observations from the National Climatic Center (left), seismic reflection profiles (above) from the National Geophysical and Solar-Terrestrial Data Center, and "wet" data from the National Oceanographic Data Center, including expendable bathythermograph profiles (below, left), retrievable in such forms as a video display (below, right).



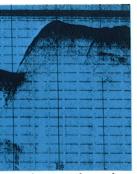




MARINE ENVI

Properly archived, data become a kind this history is disper ographic, climatic, centers of the Envir

The National Oce houses the world's I of marine data, ret forms. Some 40 n observations are a form at the National



come in many forms from observations from the Naprofiles (above) from the as Center, and "wet" data ncluding expendable bathysuch forms as a video dis-





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Better ways to handle marine environmental data engage managers and data specialists at the National Oceanographic Data Center, which processes massive quantities of information like ocean station printouts (above) on its batteries of high-speed computers.

MARINE ENVIRONMENTAL HISTORY: NOAA'S DATA BANKS

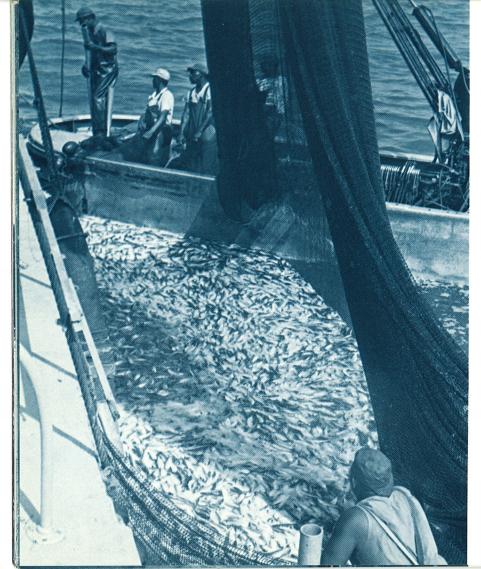
Properly archived, marine environmental data become a kind of history. At NOAA, this history is dispersed through the ocean-ographic, climatic, geophysical, and other centers of the Environmental Data Service.

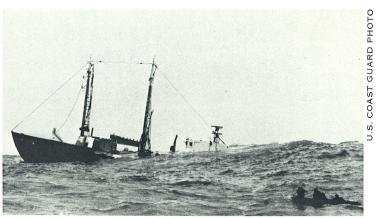
The National Oceanographic Data Center houses the world's largest usable collection of marine data, retrievable in a variety of forms. Some 40 million marine weather observations are archived in retrievable form at the National Climatic Center, Ashe-

ville, North Carolina, the repository for all weather data obtained by federal agencies and cooperating meteorological services abroad. Geomagnetic, geodetic, seismological, bathymetric, and marine geophysical data are available from the National Geophysical and Solar-Terrestrial Data Center in Boulder, Colorado. These facilities also administer their corresponding World Data Center.

Special collections are developed by the

Center for Environmental Experiment Design and Data Analysis. These include a special archive of processed BOMEX data, and a growing mountain of data from 1974's GATE field phase in the tropical Atlantic. The Center for Climatic and Environmental Assessment is using environmental data to evaluate the human and ecological impacts of such climatic shifts as the fluctuations of winds and coastal upwelling off Peru.





The good and bad of commercial fishing: a rich menhaden catch off the mid-Atlantic coast and a storm-battered fishing vessel sinking off the Grand Banks. NOAA's National Marine Fisheries Service attempts to mitigate the risks of taking a living from the sea.

NOAA AND THE LIVING RESOURCES OF THE SEA



Comprehending, assess other side of the Fishe species like skipjack t (above, right). Much e (right), where many in lives, and where threats

Man's efforts to ta the sea have been make him the ocear and to make him to the eye of a stud conserver; we no United States, that can survive the mer

Those who ventu livelihood or for the fight touch a frag



ich menhaden catch off the vessel sinking off the Grand ce attempts to mitigate the





Comprehending, assessing, and managing our living marine resources is the other side of the Fisheries Service mission, both the open-ocean commercial species like skipjack tuna (above, left) and marine game fish like marlin (above, right). Much effort goes to understanding the ecology of estuaries (right), where many important marine species spend critical periods of their lives, and where threats of pollution and "development" are severe.

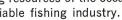
touched in return—sport fishing, a major industry today, depends absolutely on the continued abundance of marine game fish, which is not certain; and commercial fishermen live with the specters of varying fish abundance, the destruction of fishing grounds by coastal pollution, the dispersal of fish species by environmental changes, formidable foreign competition, rising costs, and the harsh realities of the marketplace.

A century ago, the Federal Government

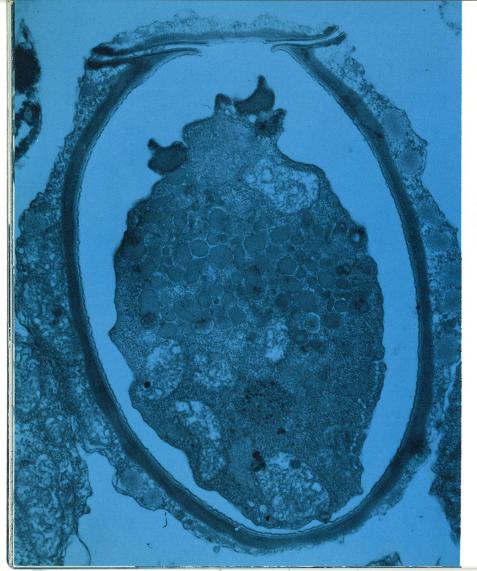
first moved to confront the difficult ecological, economic, institutional, and human problems associated with America's living marine resources-her fisheries-and the men who fish them, the industries which move them, the people who buy them. Now, this federal effort resides in NOAA and its National Marine Fisheries Service, which seeks to comprehend, develop, use, and conserve the living resources of the oceans, and to foster a viable fishing industry.

Man's efforts to take food and feed from the sea have been successful enough to make him the ocean's preeminent predator, and to make him look at oceanic life with the eye of a student, a husbandman, a conserver; we no longer believe, in the United States, that unmanaged resources can survive the men who tap them.

Those who venture seaward to fish for livelihood or for the excitement of a marlin's fight touch a fragile resource, and are











Researchers at more than a score of National Marine Fisheries Service laboratories on all U.S. coasts investigate the life cycles, behavior, and population dynamics of important species. At left, electron-photomicrographed Minchinia spore, believed to be the infective stage of a serious mid-Atlantic oyster disease; above, zooplankton from the Gulf of California (left) and tuna larvae (right) collected in Pacific resource-assessment surveys.

COMPREHENDING OCEANIC LIFE

Following the resources they seek to comprehend, National Marine Fisheries Service researchers today work at more than a score of laboratories along United States' coasts. At these biological centers, scientists study the important marine life of the region—New England groundfish, sea scallops, marine sardines, lobsters, and the big marine game fish taken for sport off Atlantic ports; shellfish and menhaden off the mid-Atlantic; scallops, shrimp (our richest fishery), and other



Much of the job must to of other nations. A scut the interior of a tuna laboratory brave the No there. At right, the Sovie (background) engage in

shellfish, menhaden, Gulf of Mexico; Pa groundfish, king cra northern California t the fur seal herds of big game fish from tor, tuna from San Fi

The research is as it studies, and deals shellfish disease a serology and other ming between fish subbut non-breeding sto estuaries, where moperiods of their earl threat of pollution as



rine Fisheries Service laboraes, behavior, and population photomicrographed Minchinia serious mid-Atlantic oyster ifornia (left) and tuna larvae rveys.

urces they seek to com-Marine Fisheries Service work at more than a les along United States' piological centers, scienimportant marine life ew England groundfish, rine sardines, lobsters, ne game fish taken for a ports; shellfish and mid-Atlantic; scallops, est fishery), and other





Much of the job must be done outside the laboratory, some with scientists of other nations. A scuba diver off Baja California (above, left) investigates the interior of a tuna purse seine, while scientists from the Woods Hole laboratory brave the North Atlantic winter to evaluate groundfish abundance there. At right, the Soviet research vessel Albatros and NOAA's Albatross IV (background) engage in cooperative fisheries research off New England.



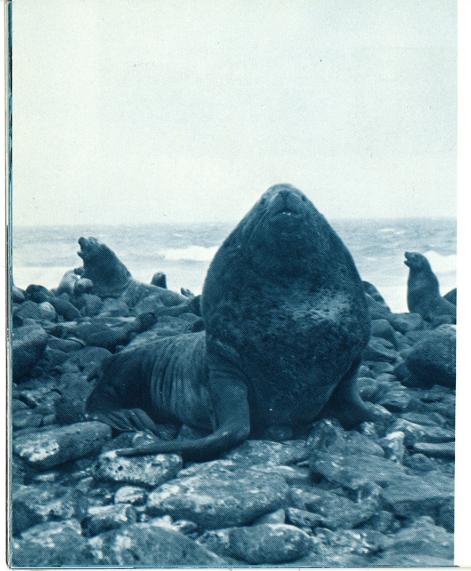
shellfish, menhaden, and sports fish in the Gulf of Mexico; Pacific salmon, herring, groundfish, king crab, and shrimp from northern California to the Bering Sea, and the fur seal herds of the Pribilof Islands; big game fish from California to the equator, tuna from San Francisco to Peru.

The research is as broad as the resources it studies, and deals in certain specialties: shellfish disease and mortality; blood serology and other methods of discriminating between fish subpopulations (mingling but non-breeding stocks); investigations of estuaries, where most fish spend critical periods of their early life, and where the threat of pollution and environmental de-

struction is most severe; the interrelationship of ocean creatures and their physical environment; anadramous fish like the Pacific salmon, and their survival in the face of heavy pelagic fishing and structural and thermal hazards along such once-wild spawning and migration runs as the Columbia River; experimental culture of shrimp, northern anchovy, pompano, salmon, and other species; surveys, assessments, and predictions of seasonal abundance.

The National Marine Fisheries Service, with the U.S. Coast Guard, conducts surveillance and enforcement patrols, to ensure the effectiveness of negotiated controls. Much of the biological laboratories' work

supports United States negotiations with other countries in managing offshore fisheries resources, and advances the cooperative work of numerous international fishery commissions in conserving internationally fished resources. But the investigations also serve the laboratories' strong parallel mission: to develop an essentially full understanding of oceanic life, its populations, and its responses to natural and man-generated changes of environment. As with other marine environmental research in NOAA, these activities are enhanced by close links with Sea Grant and other institutions and projects, and by ties between the laboratories and their regional equivalents.





MARINE MAMMALS AND ENDANGERED SPECIES

Of all oceanic life, none holds the public interest more than marine mammals. Although splendidly adapted to their marine environment, these whales, porpoises, seals, and sea lions are quite sensitive to pressures caused by their deliberate and inadvertent pursuit by man. Long gestation



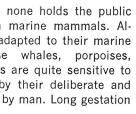
A gallery of marine mamm way, and a cheerful-looking

and nursing periods a make it difficult for ma lations to spring back once they have been f

The Marine Mamma 1972 seeks to ease placing an immediate taking or importing or and marine mammal prexceptions, and through forcement activities to the Act is carried out administered on behalf Commerce by the Marin of NOAA's National Service.

Under the Act, NOA minister certain regul the Act, conduct inquiri







A gallery of marine mammals: a sea lion, fur seals on the Pribilof Islands, a finback whale under way, and a cheerful-looking bottle-nosed dolphin.

once they have been fished down.

the Act is carried out. This legislation is

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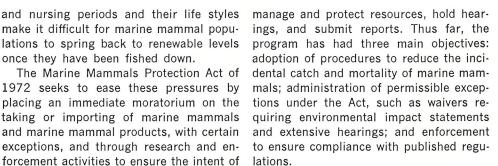
of NOAA's National Marine Fisheries

minister certain regulatory provisions of

the Act, conduct inquiries, process permits,

Under the Act, NOAA is required to ad-

Service.



On the research side. NOAA's efforts involve investigations of the life histories and population dynamics of whales, porpoises, and seals to establish management controls and techniques for the animals' protection and conservation. Special emphasis has been placed on the development of new fishing gear and operational



techniques to reduce incidental porpoise mortality during tuna seining operations. These research efforts also provide the scientific data supporting the United States' position in continuing negotiations of the International Whaling Commission.

The Endangered Species Act of 1973 added a new dimension to NOAA's conservation activities, making the agency responsible for the conservation of endangered and threatened species of marine life and their ecosystems. The endangered species program will administer and enforce the Act, develop regulations, review and study state laws and management programs, administer contracts and grants with the states, issue permits for imports and exports, and review applications for scientific research and economic exemptions.





The National Marine Fisheries Service helps fishermen improve their gear and working grounds. The sablefish pot at left, one of many improvements developed by the exploratory fishing and gear research base in Seattle, Washington, protects the catch from other fish, allows undersize fish to escape, and prevents the fish-on-fish damage common to trawl net fishing. Financial assistance helps fishermen buy modern fishing vessels like the one shown above.

HELP FOR A HIGH-RISK INDUSTRY



The National Fisheries market information ser retailers, and consumer agency market-development

Fishing is a high-ris the fish are netted a the element of chance the legion of probuyers, sellers, and together in the ma Marine Fisheries Se family of services.

At exploratory search bases on the fields a strong efform resources, better woones, and ways to mof fishing safer. A fi



ishermen improve their gear one of many improvements r research base in Seattle, sh, allows undersize fish to common to trawl net fishing, ern fishing vessels like the





The National Fisheries Service provides statistical analyses and a nationwide market information service, based on interviews with fishermen, processors, retailers, and consumers. Both the industry and the consumer are served by agency market-development activities.



Fishing is a high-risk business even before the fish are netted and on deck. To reduce the element of chance for the fishermen and the legion of processors, distributors, buyers, sellers, and consumers who come together in the marketplace, the National Marine Fisheries Service provides a special family of services.

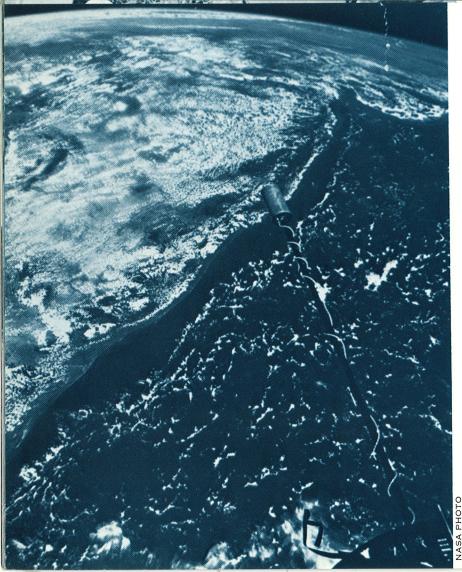
At exploratory fishing and gear research bases on three coasts the agency fields a strong effort to develop alternative resources, better ways to harvest existing ones, and ways to make the hazardous work of fishing safer. A financial assistance pro-

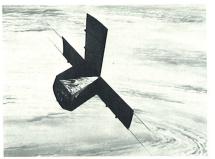
gram aids commercial fishermen in obtaining capital to purchase and improve their fishing vessels.

Fishery food scientists at laboratories around the country have led the way to today's wide assortment of convenient fishery products and are working on still better ways to present the consumer with wholesome fishery products for the table. A voluntary in-plant inspection program, paid for by the fishing industry, provides continuous inspection and grading of fishery products. Attention is directed now to protecting the consumer against the recently

detected hazards of heavy metals and pesticide contamination of some fish products.

Economists and marketing experts reduce the levels of risk to the industry by recording and forecasting market conditions. The National Marine Fisheries Service also helps the entire industry and ultimately the consumer through the dissemination of information on the nutritional and health values of fishery products, through programs to relieve supply-demand imbalances, through the development of markets for underutilized species, and through other consumer oriented activities.







The marine environmental promise of earth photographs from manned satellites is apparent in the photo of the Indian peninsula at left, in which the trained eyes of NOAA oceanographers detect areas of upwelling, warm and cool currents, and various coastal processes. Satellites in the NOAA series (above, left) already support products useful to oceanographers and fisheries scientists, and NOAA's developing data buoy (above, right) will provide essentially continuous marine environmental observations.

ADVANCING NEW TECHNOLOGIES

The marine environmental and marine biological activities of NOAA are expanding our comprehension of the physical world and the oceanic creatures with whom we share it. These activities also impel a broad range of new technologies, many of them at or beyond their nominal state of the art.



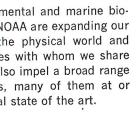
NOAA's National Ocean evaluating marine envir at sea. Fisheries engir detecting fish and obs (above, right). Submers as direct-observation pla

Computer techno er modeling of env biological events, industry and elsewh tions of bigger, faste to collect and move environmental data.

Earth-orbiting sat are producing data for ly—for example, so maps—and satellite remote sensors to renvironment and Oceanographic and Apollo photographs



graphs from manned satelnsula at left, in which the s of upwelling, warm and ellites in the NOAA series eanographers and fisheries above, right) will provide



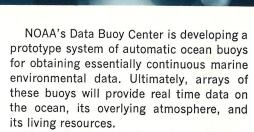




NOAA's National Oceanographic Instrumentation Center provides a focus for evaluating marine environmental sensors, in the laboratory (above, left) and at sea. Fisheries engineers are developing remote sensing techniques for detecting fish and observing them, for example, by underwater television (above, right). Submersibles like Deepstar (right) will be used in the future as direct-observation platforms by NOAA's marine scientists.

Computer technology, especially comput-scientists showed rich details of oceanic er modeling of environmental and marine circulation and upwelling, estuarine mixing, biological events, is driving research in thermal contrasts, and other features that industry and elsewhere toward new genera- real-time marine environmental and re-

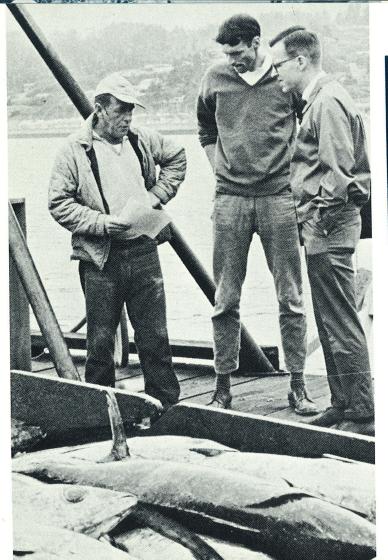
As new instruments come along, scientists at NOAA's National Oceanographic Earth-orbiting satellites with new sensors Instrumentation Center test and evaluate are producing data for new products routine- them in a wide variety of laboratory simulaly-for example, sea surface temperature tors and in the marine environment itself. maps—and satellites will eventually include This Commerce Department service proremote sensors to monitor both the marine vides information for science, industry, and environment and its near-surface life, the interested public on the reliability of Oceanographic analyses of Gemini and marine environmental sensors and sam-Apollo photographs interpreted by NOAA plers, and helps develop standards.



There is no substitute for first-hand observation by scientists in scuba gear, deep-diving submersibles, underwater habitats, and environmental monitoring ranges. Man-in-the-sea technology is a central feature in NOAA's long range research plans, to add the essential human "sensor" to the work of describing the oceans.

tions of bigger, faster, "brighter" machines sources monitoring systems will require. to collect and move the mountain of marine environmental data.

27





Sea Grant aid has permitted selected institutions to develop into centers of strength in the marine sciences, and to provide valuable service programs. Oregon State University Sea Grant students talk with local tuna fisherman (left). Sea Grant scientists at the Scripps Institution of Oceanography have developed a tethered floating breakwater that can protect beaches by reducing wave energy (above).

SEA GRANT: NEW STRENGTH IN THE MARINE SCIENCES NOAA's Sea Grant Program provides a broad and flexible means by which federal support can be used to stimulate development, conservation, and use of the marine environment and its resources, and to advance related natural and social sciences. Beginning with the National Sea Grant College and Program Act of 1966, Sea Grant has provided almost two-thirds of the funds for a wide variety of projects in universities, industry, and other organizations. By 1975, 703 Sea Grant projects were under way in 145 universities, 203



At other institutions ture, like this now left), artificial cultu Hampshire (right), Hawaii's design for

industries, and 1 26 of the 30 c states had Sea Gr

Sea Grant insticused on certain 1975, eight instition of Sea Grant University, Texas versities of Was Wisconsin, Califo consortium forme of New York and and other centers



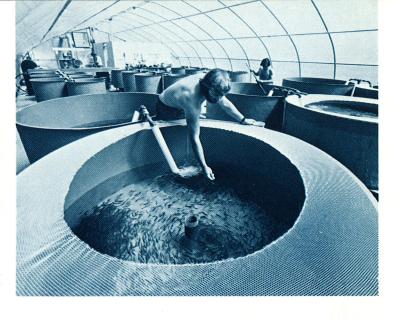
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At other institutions, Sea Grant has emphasized such things as aquaculture, like this now-commercial Gulf shrimp culture experiment (above, left), artificial culture of Pacific Coho salmon at the University of New Hampshire (right), and engineering studies such as the University of Hawaii's design for an island city of the future (center).



industries, and 156 state agencies, and 26 of the 30 coastal and Great Lakes states had Sea Grant programs.

Sea Grant institutional support has focused on certain major universities. In 1975, eight institutions held the designation of Sea Grant College: Oregon State University, Texas A&M University, the universities of Washington, Rhode Island, Wisconsin, California, and Hawaii, and a consortium formed by the State University of New York and Cornell University. These and other centers of strength in the marine

sciences have also helped develop a strong liaison between federal, state, and local governments.

Among the successes in the Sea Grant Program have been commercial-scale harvests of pond-grown shrimp, identification of harvestable minerals, studies of marine resources law, the development of seaweed farming techniques, advancement of new businesses and product lines, and the derivation of new drugs and pharmaceuticals from marine organisms.

NOAA's Marine Advisory Service, which

developed from and is now administered by the Office of Sea Grant, takes the agency's and universities' expertise out to the grass roots. The advisory service seeks to disseminate marine sciences information and guidance to people who know and use the ocean and its resources—and to get back the type of comment from these users that will further shape the service. The form taken by the Marine Advisory Service varies from state to state. The common denominator is involvement at the local level.







SOME SHIPS OF NOAA'S RESEARCH AND SURVEY FLEET













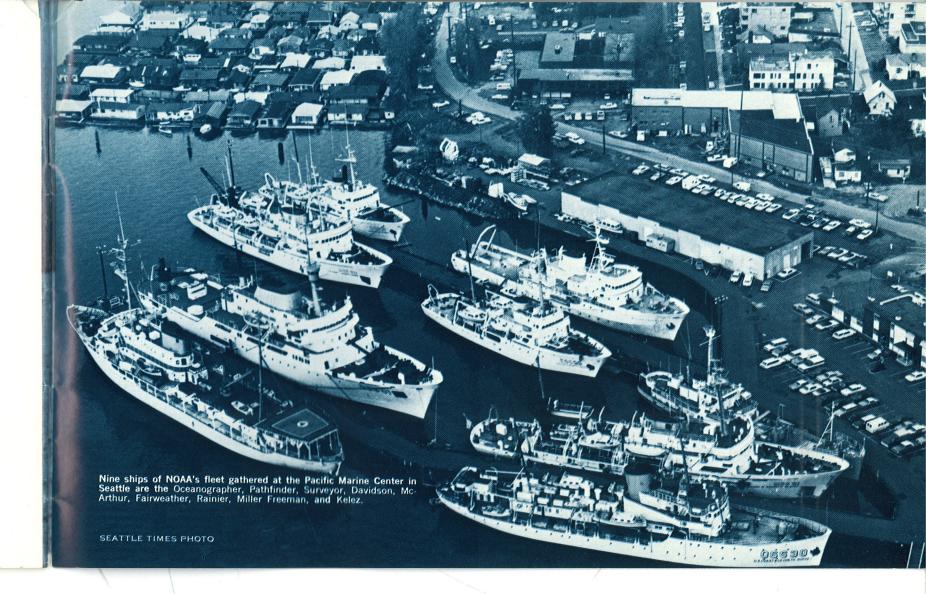






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