sea grant

A Report on the
Oregon State University
Sea Grant Program
for 1973-1974

'Wouldst thou' so the helmsman answered,—
'Learn the secret of the sea?

Only those who brave its dangers
Comprehend its mystery!'

HENRY WADSWORTH LONGFELLOW,
THE SECRET OF THE SEA

introduction

Oregon State University completed its sixth granting year showing signs of maturing as a Sea Grant College. Both continuity and responsive evolution were major program goals during the year—as they still are.

Several benchmarks—involvement of Oregon marine industries, increasing support from state and local sources, cooperation with state and federal marine resource agencies, rigorous program review by advisory councils, peers, agencies and industries, and recognized achievements from projects—all point to a coming of age.

At the same time, other indicators—insufficient funding, increasing requests for services, emerging technical areas that should be involved in the Sea Grant College Program, and the need to conduct more fundamental research—point to the long-term planning and performance necessary before Sea Grant reaches full efficiency and maturity.

Our orientation is people and their linkage to the sea. We are concerned with helping people use ocean resources for economic gain, recreation, and aesthetics. We are concerned with developing an understanding and appreciation of how to live with the ocean and how to manage the coastal zone.

Although our emphasis is on the ocean off Oregon and the Oregon coastal zone, we are an active partner in the Pacific Ocean rim community and recognize and respond to regional, national, and international obligations and opportunities.

The Sea Grant College Program began by emphasizing the historic strengths of Oregon State University in oceanography, fisheries and aquaculture, food technology, marine economics, marine biology, and marine extension programs. In a sense, Oregon State University, with more than 100 years of Land Grant experience, was a Sea Grant College in philosophy before the Sea Grant concept was formalized.

Designation as a Sea Grant Institution in 1968, however, provided the crucial impetus which directed relatively uncoordinated interest and activity in the marine areas toward development of a systematic, broad-ranging marine university. With the coming of Sea Grant, ocean engineering became a major focus of activity; marine law programs at the University of Oregon were started; technician training projects at Clatsop Community College were augmented; and program areas in pharmacy and anthropology were initiated.

Participants in the OSU Sea Grant College program are: the Colleges of Liberal Arts and Science, the Schools of Agriculture, Engineering, Forestry, Oceanography, and Pharmacy at Oregon State University; the University of Oregon Law School; Clatsop Community College; and numerous local, regional, state and federal agencies, and marine industries.

The people in these entities and agencies carry out their work in three major divisions:

Food from the Sea, which provides information needed to maximize and enhance the sustained yield and utilization of marine products for man and animal derived from estuaries and the sea.

Coastal Zone Environments, which enhances the orderly multiple use of the coastal zone, including the estuarine and near shore oceanic water masses and the associated land masses.

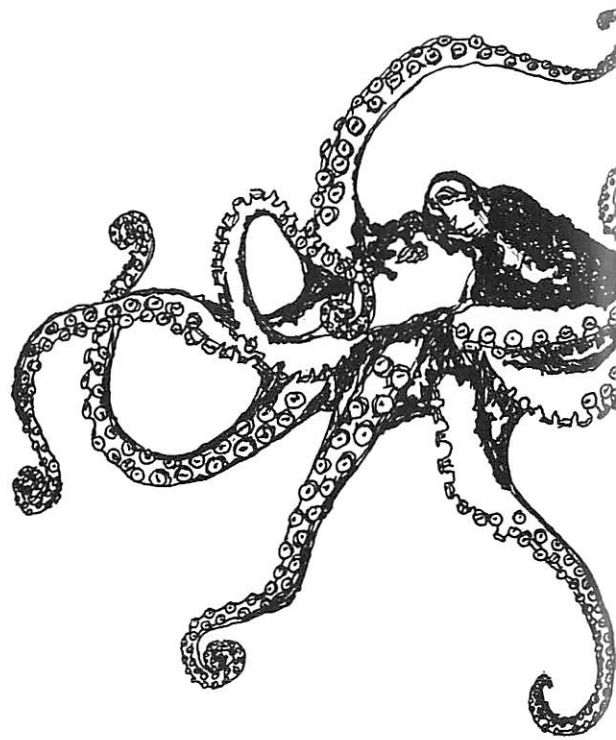
Human Resources, which provides information needed by public bodies to plan for and resolve conflicts pertaining to the development of human, land, and water resources; to give educational assistance to citizens concerned with policy problems and group decisions related to the human and natural resources of the coastal zone; and to offer educational experiences for marine scientists which will permit them to be responsive to social policy needs as they relate to their fields of specialization.

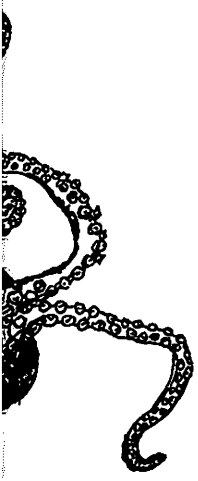
Major portions of OSU Sea Grant's research, education and training, and Marine Advisory Program activities are carried on from the main campuses in Corvallis (Oregon State University), Eugene (University of Oregon), and Astoria (Clatsop Community College).

Several research centers on the coast also provide facilities. The OSU Seafoods Laboratory in Astoria is one of the few university seafood research facilities in the country. The Fisheries Culture Station on Netarts Bay is the site of salmon aquaculture projects.

The OSU Marine Science Center on Yaquina Bay is the coastal hub of marine-related research, however. Beginning as a small oyster laboratory in the late 1930's, the Center was opened in 1965 to serve the expanding programs of oceanography, fisheries, marine biology, and ocean resource public education. It is the homeport of OSU's five vessel fleet and the base of operations for the Sea Grant Marine Advisory Program which operates the length of the coast and throughout the state. Other specialized facilities, such as the 342-foot long wave basin on the OSU campus, provide support for the many intricate ocean research projects.

Facilities are important, but they are meaningless if they are not staffed by good people—competent teachers, able research teams, committed students, and dedicated advisory agents and specialists.





These are the kinds of people that spell success or failure for the Sea Grant idea.

The Sea Grant idea at Oregon State University is a catalyst with an effect far beyond Sea Grant funding. A spirit is emerging which makes it possible to involve some of our best people.

An effective Sea Grant College Program must be attuned to the needs of the region it serves, on trusted terms with the agencies and industries that manage and utilize marine resources, and able to provide the research, education, and advisory services required to focus on top priority problems and opportunities.

We have found that these goals are not easy to achieve. But progress is being made. During the past year, the Oregon State University Sea Grant College Program has been undergoing a fundamental transition in organization. It is now administered by a Director and Assistant Director who serve with guidance from the Vice President for Research and Graduate Studies.

A Sea Grant Advisory Council, external to the university, provides continuing review, planning, and policy development functions. Although council members represent some of the major client areas served by the Sea Grant College, they were chosen principally for their demonstrated public service leadership capabilities.

A Coordinating Committee has functioned within the university since 1967 to guide the Sea Grant College Program. In January 1974, this committee was replaced by two groups: a Sea Grant Executive Committee serves the same purpose internally as the external Advisory Council providing advice to Sea Grant administration on policy and program philosophy; and the Program Chairmen's Committee which works on a day-to-day basis aiding the administrative team with operations and planning in the three divisions and ten program and sub-program areas of the OSU Sea Grant College Program. Chairmen are responsible for developing a systematic approach to planning within program areas and serve as a program management committee to help in program integration.

Based on OSU Sea Grant College Program experience and interaction with the users of Oregon's marine resources, we have developed a philosophy of operation and a structure which includes the three major divisions already mentioned, and programs and projects within the divisions. This framework provides a focus for the research, education, and advisory activities of Sea Grant. Emphasis may change from year to year based on emerging needs and technological developments.

The major divisions are structured to exist on a longer term basis but are expected to vary over time. Program areas may be added, dropped, or reoriented. Projects within program areas have specific tasks and objectives whose accomplishments can be documented on a regular basis. Projects are of limited duration and are terminated as tasks and objectives reach completion.

This annual report marks the end of a year of OSU Sea Grant work which began with the preparation of the proposal. That process is not a casual one. New projects are actively solicited and generated in response to emerging needs and opportunities. Continuing projects are evaluated for progress. Unproductive work is either terminated or redirected.

Both new and continuing projects are subjected to internal and external review by representatives from peer groups, industry, local, state, regional and federal agencies, and the Sea Grant Advisory Council. This review is not a token process. Projects included in any proposal are subjected to rigorous review to narrow the number included. These reviews also help focus and tighten accepted projects and weed out weak or untimely projects. Reviews also serve another significant role: as a form of horizontal communication which implies and means a true sense of cooperation with marine industries and agencies.

All aspects of the OSU Sea Grant College Program face a continual process of evaluation. This is made

possible by the cooperation of a number of people inside and outside the program. Indeed, the growth of this cooperation with the people, industries, agencies, and governments forms one of the main milestones of Sea Grant's short history at Oregon State University.

This cooperation begins after the proposal has been accepted with funding, first from Office of Sea Grant, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. Of equal importance is a line-item Sea Grant appropriation from the State of Oregon as partial match. Other matching funds come from local governments—counties and port commissions—and from industrial sources. We believe this increasing local support indicates that the OSU Sea Grant College Program is useful to the people of Oregon.

But the cooperation goes much deeper than just the provision of program funds. In one aspect or another, the program is in daily contact with government agencies on all levels. We work actively with county governments, port commissions, and local task forces involved with planning and managing estuaries and other coastal areas.

On the state level, the Fish Commission of Oregon, Wildlife Commission, Department of Environmental Quality, Land Board, Water Resources Board, Department of Agriculture, Department of Economic Development, and Oregon State Board of Health are involved in OSU Sea Grant planning and development. Of special significance because of critical timing, the Oregon Coastal Conservation and Development Commission has requested continuous interaction to help its members prepare a plan for managing the Oregon coastal zone by 1975.

On the Federal level, the OSU Sea Grant College Program has close ties with the National Marine Fisheries Service (NMFS) through personal contact with its director, working relationships with the Northwest Region on a continual basis, and with the Alaska and Pacific Southwest regions through mutual membership in the Pacific Sea Grant Advisory Program (PASGAP). Through the National Marine Advisory Service (NMAS) and projects of mutual interest, we are developing participation relationships with other NOAA agencies, especially the National Ocean Survey and the National Weather Service.

In coastal zone studies, we work with the NOAA Office of Coastal Zone Management and cooperate with the Department of Interior's Fish and Wildlife Service and with the Environmental Protection Agency.

The U.S. Army Corps of Engineers is involved with the OSU Sea Grant

College Program in estuarine research and management. The U.S. Coast Guard works closely on surf and bar forecasting and marine safety programs. The Food and Drug Administration participates in workshops on seafood processing. The Internal Revenue Service is a partner in teaching fishing business management.

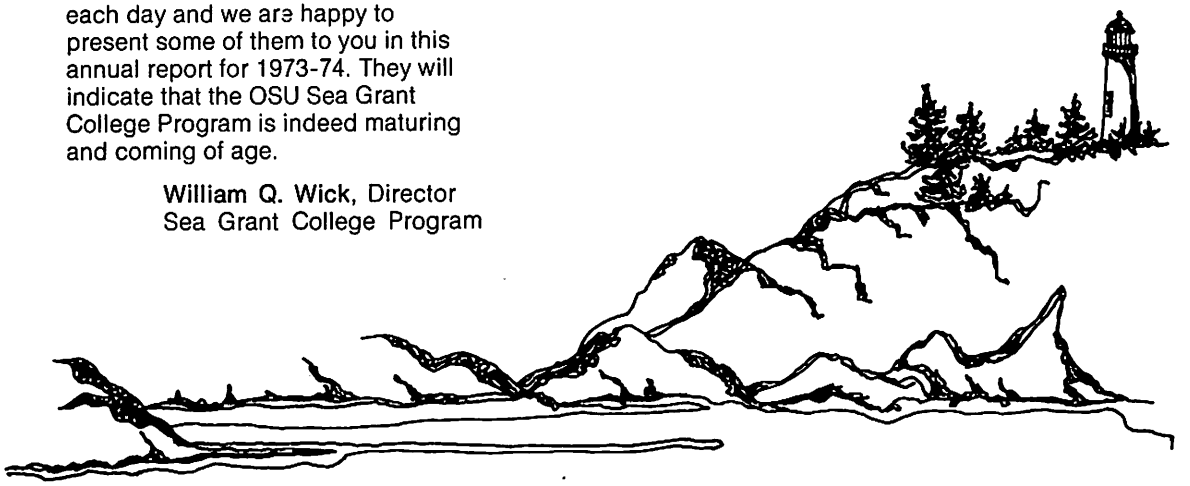
Since 1969, the OSU Sea Grant College Program has coordinated PASGAP, a regional grouping of eight marine universities and the Alaska, Northwest and Southwest regions of the National Marine Fisheries Service. PASGAP provides a mechanism for cooperative response to marine resources questions on the Pacific rim through talent sharing, problem identification, cooperative publication, and traveling technical workshops. Equally important is the trust developed through this cooperation. It provides impetus toward joint research activities and has already been pursued in specific projects with the University of Washington and Humboldt State University.

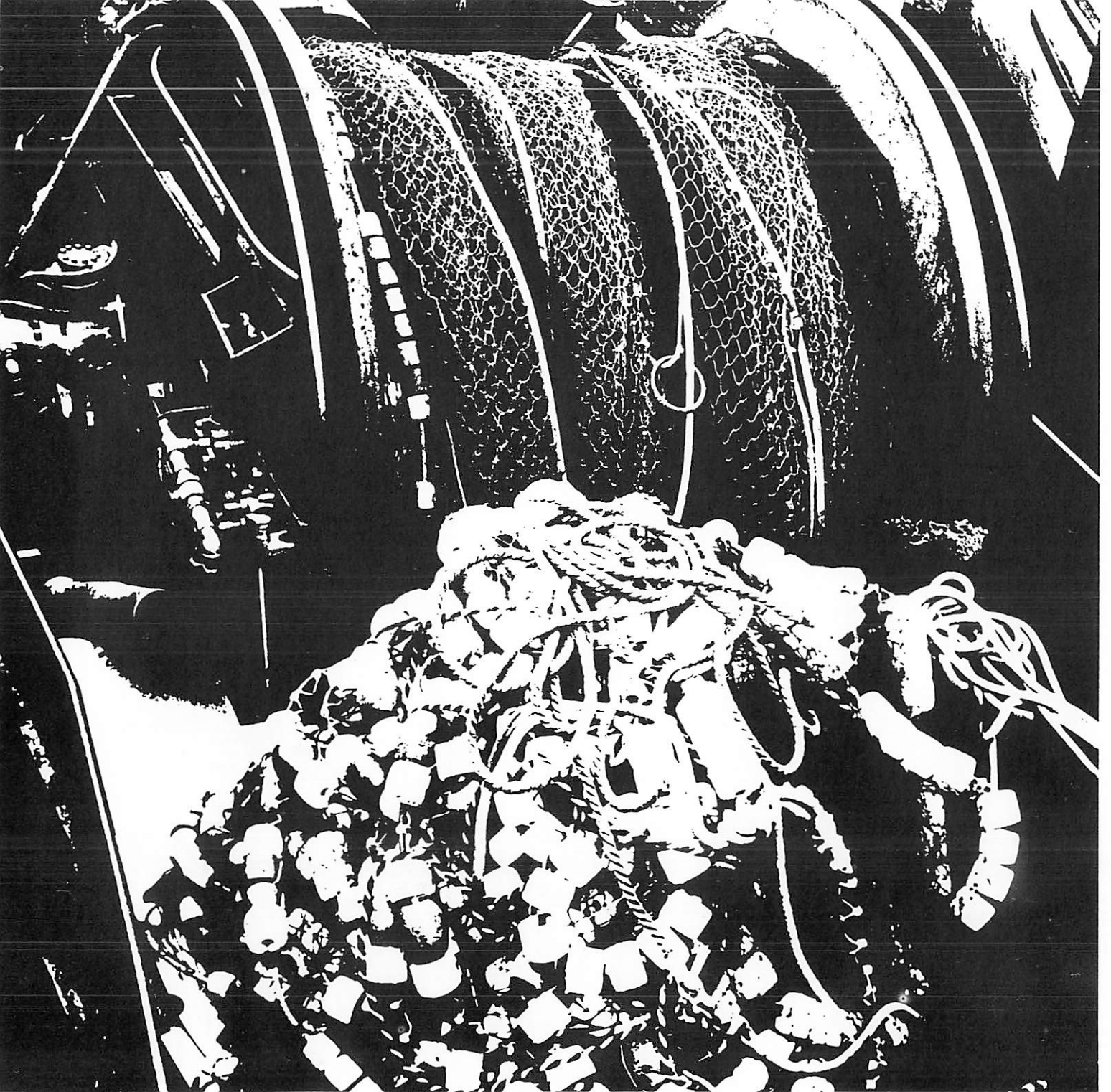
A unique project involving two geographically separated Sea Grant Institutions began in 1973, when three Oregon charter sports fishing boat skippers visited Michigan for a week-long study of Great Lakes sport fishing methods. Last June, Michigan boat captains visited the Oregon coast to continue the exchange of methods. Cooperation between the Sea Grant Programs of Oregon and Michigan and funds from tackle manufacturing companies made this exchange possible.

Along with this valued official local, state, regional, and federal support and cooperation has come an increased involvement with marine industry in Oregon and elsewhere. This effort began slowly—a process of developing acquaintanceship to the point of trust. The process continues as marine extension agents carry knowledge from the laboratory to those who can use it. They also gain feedback from those who work with marine resources and problems for their livelihood and carry this information to the managers and researchers of the OSU Sea Grant College Program.

It's a big job and the complicated tasks and interdisciplinary nature of it means that success must be measured in years rather than weeks or months. Successes are achieved each day and we are happy to present some of them to you in this annual report for 1973-74. They will indicate that the OSU Sea Grant College Program is indeed maturing and coming of age.

William Q. Wick, Director
Sea Grant College Program





Disease Detection

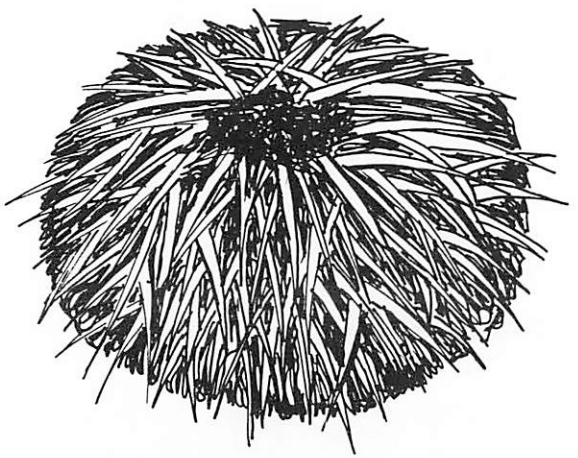
The same phenomena used in preventing polio in humans seems to be successful in preventing infectious diseases like vibriosis in fish and shellfish. Sea Grant microbiologists have discovered a similarity in approach that may eliminate heavy losses in hatchery reared fish that could threaten the existence of aquaculture, or fish farming, if not stopped. The Salk polio vaccine is a suspension of killed virus, the causative agent of polio. The virus is incapable of causing disease. But the human immune system learns to recognize the virus as a foreign agent and develops substances called antibodies that will attack the live virus. The result is immunity to polio. The newer, oral Sabin polio vaccine is based on a live polio virus altered so that it no longer produces clinical symptoms of the disease. Like the killed-type vaccine, it causes an individual to form antibodies against the virus. These antibodies then provide a level of protection or immunity against the disease.

Experiments adapting both these techniques to fish have revealed that an orally administered killed-type vaccine for *Vibrio anguillarum,* an infectious disease of salt water fish, produces immunization for up to 60 days after the vaccination period. The vaccine is added to the fish diet. Injectable vaccine gets better results (reducing fish losses from 90 per cent to less than 10 per cent) but is harder to administer because each of the several million fish in a hatchery must be individually injected. The work of the microbiologists goes a long way toward achieving hatcheries and fish farms that are disease free or where potentially dangerous problems can at least be diagnosed quickly. If aquaculture is to continue as a productive program, diseases like vibriosis must be controlled in ways like this.

food from the sea

Salmon Marketing

Can the changes affecting the salmon industry be better understood and the economic impact predicted by looking at a similar situation in Canada? An OSU marine economist thinks so and has been studying the situation for Sea Grant. Government programs in limiting entry of fishermen to the salmon industry are being considered at the same time products are being marketed in different forms. For example, salmon formerly canned is being sold fresh in both domestic and foreign markets. All this worries people in the industry and increases the need for the marketing study. In Canada, the government has reduced the number of its commercial salmon fishermen by a limited entry program and supported a 200 mile limit to control the fishing by foreign fleets. If such programs result in increased catches of salmon and other species they will have an impact on price and other factors all over the world. The marine economist has been examining this question as well as those raised by more hatchery rearing of fish to determine the ultimate impact on the industry. He has constructed a model of the Canadian processed salmon market which represents that market in enough detail to indicate similarities and areas of applicability to the Oregon situation. The model has been checked with policymakers in the Canadian Fisheries Service and presented to a workshop at OSU. With that basic tool now ready, the economist and others can begin to make the needed applications of it to the Oregon salmon industry that may help avoid disruption in the future.



Sea Urchin Gonads

Sea Urchin roe, like caviar, is a high-priced seafood in many countries, particularly Japan, where it is considered such a delicacy that the supply has been all but exploited in recent years. Except for a fresh roe industry in California and British Columbia, sea urchin development has been slow in the U.S., particularly in Oregon where they have been raised only for more traditional educational and research purposes. That was before this year, however, and the work of an OSU oceanographer who has discovered a means to produce marketable roe out of season. In laboratory experiments, he has shown that the annual cycle of gonad growth in a typical sea urchin species is easily controllable by manipulating food and temperature. This is a crucial discovery because sea urchins are slow growing. Large animals with large roe yields quickly become scarce when harvested. Their natural gonad growth is also seasonal in harvest areas, resulting in a season of about five months. The oceanographer's finding would make it possible to take "spawned out" animals from the field during the period when prime roe is not obtainable and, in about 40 days, fatten up the gonad to prime market quality and maximum size. Because sea urchins eat almost anything and have a high conversion of food to gonad, these findings have obvious implications to Oregon. Such methods to produce marketable roe out of season could add an important secondary product to Oregon marine aquaculture systems in the future, using wastes or other unused local marine resources as food. Reportedly up to a million urchins per day are being harvested in California and a substantial number in British Columbia and Washington. With good quality urchins bringing $3 to $4 each when delivered on the Tokyo market, it wouldn't take long for a well-paying industry to develop.

Many other projects have been underway in the Food from the Sea Division this year:

• privately-owned commercial Chum salmon hatcheries were provided surplus eggs and sperm and 761,000 pathogen-free Chum salmon fry propagated in streamside incubators at Netarts Bay were released.

• two Sea Grant-designed commercial streamside incubation hatcheries owned by Keta Corp. and Siuslaw Fisheries, also released a total of 400,000 Chum salmon fry.

• researchers also found that growth rate, pond conversion efficiency, and survival decreased with increases in temperature beyond about 14°C, information needed to operate a Chum salmon aquaculture facility.

• the same study revealed that higher water temperature and, in one case, decreased size, caused an increase in the salmon's susceptibility to vibrio disease.

• the scientists also found differences between various related groups of salmon in mortality rates caused by Vibrio disease.

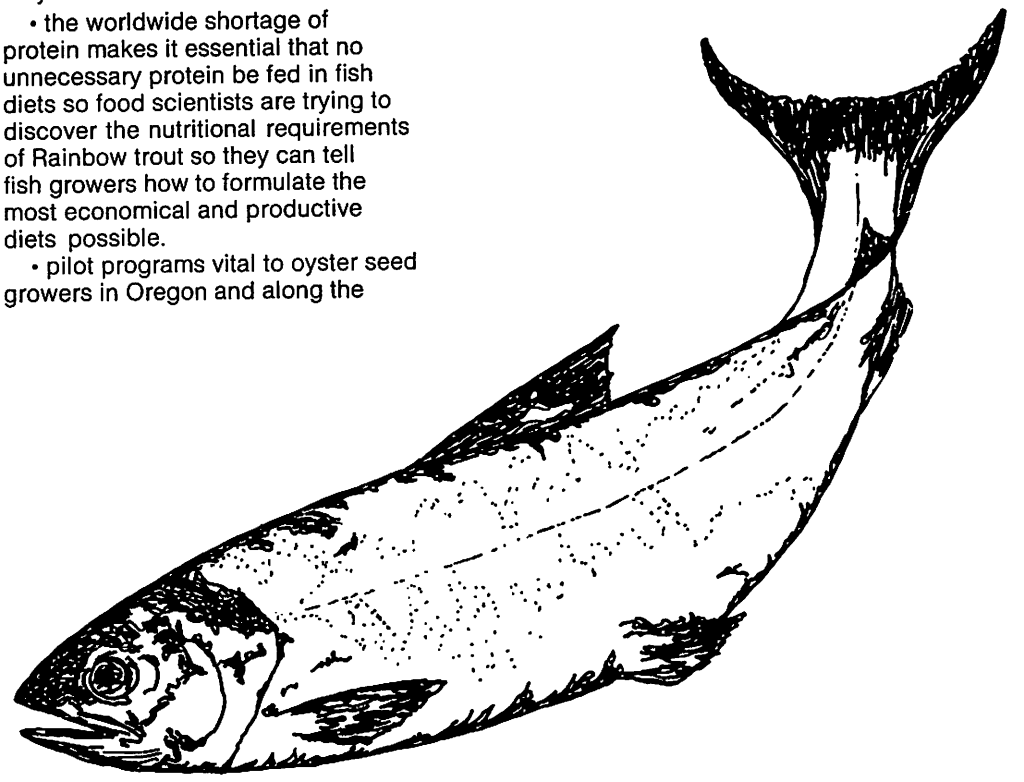
• food scientists discovered that silver salmon required ω3 fatty acid for growth and that a dietary ω6 fatty acid greater than one per cent retarded fish growth, both important findings in the search to identify the type of fatty acids essential to the aquaculture of silver salmon.

• early revelations about the importance of ω3 fatty acid in fish diets and its availability in marine oil have caused fish culturists and feed manufacturers to use fish oils as a diet additive when available.

• fish feed manufacturers have changed their rations following a discovery by Sea Grant food scientists that ω6 fatty acid is not essential to the fertility, development, or growth of Rainbow trout and ω3 fatty acid can be substituted.

• the worldwide shortage of protein makes it essential that no unnecessary protein be fed in fish diets so food scientists are trying to discover the nutritional requirements of Rainbow trout so they can tell fish growers how to formulate the most economical and productive diets possible.

• pilot programs vital to oyster seed growers in Oregon and along the



West Coast have been designed and constructed by Sea Grant fisheries specialists; the growers need the programs because they rely heavily on artificial seed production from hatcheries to supply their industry.

• algal cultures were provided to commercial hatcheries in Washington and California.

• a study of water flow requirements for oysters at various temperatures and an experiment with seed oysters using flow rate and water temperature will help Sea Grant scientists determine if oysters can be raised in the hot water resulting from the possible location of nuclear plants along the Oregon coast.

• non-living particulate organic matter is important in the nutrition of oysters and may make it possible to grow and store algae independently of the oysters, a discovery by a Sea Grant botanist who perfected techniques to produce large amounts of labeled dissolved organic matter and particulate matter used in the feeding of oysters.

• a significant variation exists in the performance of genetic lines of oysters in different environments, a finding that may make it difficult to provide oyster growers with selected lines of seed oysters with superior performance in growing areas unless lines and areas are matched.

• 82 per cent of juvenile English sole in the upper estuary of Yaquina Bay, Oregon, had Glugea disease, a finding that came at the same time a zoologist was infecting the fish with the disease experimentally in the laboratory using brine shrimp and amphipods to transmit it in an effort to cure it; this laboratory work discovered that temperature is of prime importance in establishing infection and in subsequent parasite development.

• the zoologist discovered no Glugea infections at 10°-11°C, a slow parasite development at 15°C, and a rapid development at 17°-18°C; since temperatures above 15°C occur more frequently and for the greatest duration in the upper estuary, that explains the high incidence of infected fish there.

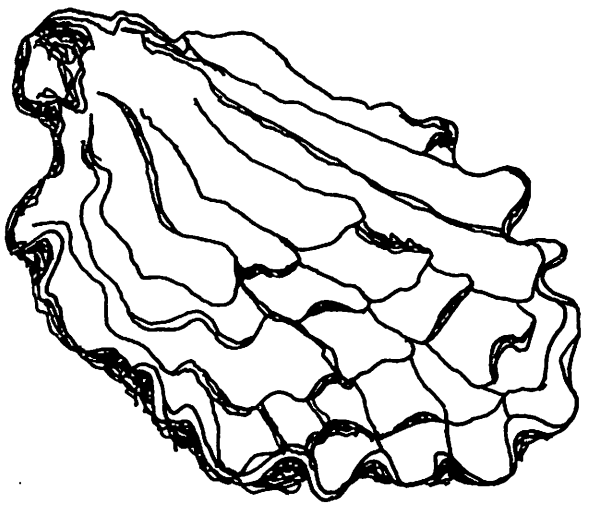
• the same scientist has found a new oyster disease organism, tentatively identified as a haplosporidian, and distributed details to appropriate state and federal agencies.

• oceanographers made progress in their development of an environmental profiling system to measure various characteristics of the ocean to find out how it produces fish.

• successful crab catches and upwelling can be correlated and fishing effort adjusted accordingly because of samples taken off Newport, Oregon, and studied by oceanographers.

• pollution of Oregon coastal waters could have serious effects on future populations of English sole, Pacific tomcod, smelt, and butter sole and help explain why these fish were more abundant during 1970-71 than in the 1969-70 or 1971-72 periods, according to Sea Grant oceanographers.

• more powerful boats can achieve higher production without damaging nets of gill net fishermen because of the improved propeller guard being developed by Sea Grant mechanical engineers.



• a new fishing industry for Oregon is the object of a study by oceanographers of the distribution and abundance of the Tanner crab from Coos Bay, Oregon, southward to Cape Blanco; they have been collecting preliminary samples on cruises to the area and analyzing them in the laboratory.

• food scientists have developed a chemical test and a colorimetric method to distinguish tuna muscle discolored to orange and green from normal-appearing tuna after precooking; this test may enable processors to screen tuna and thus reduce handling and processing costs.

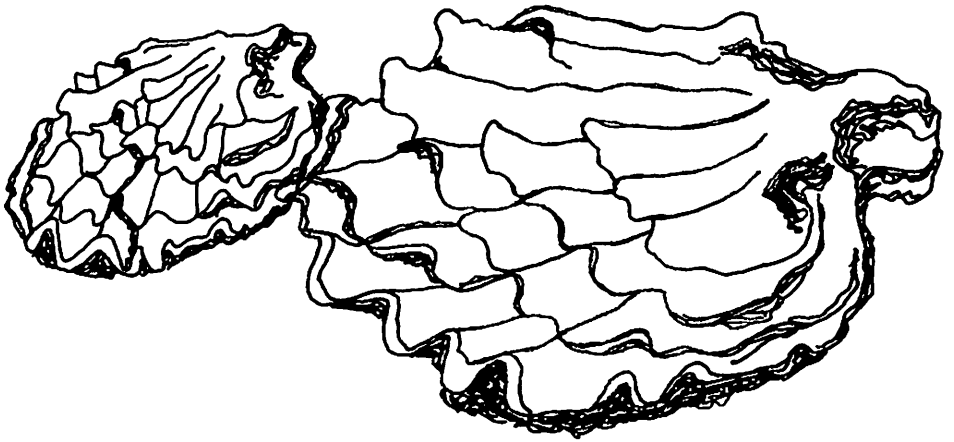
• other food scientists have developed the basic technological information needed to begin using fish muscle process products like loaves, sausages, and extruded portions.

• they have also developed a simple quality control method so that both processor and buyer can determine frozen fish quality.

• potatoes, rice, and yellow and white corn grits extender can now be precooked and mixed with minced fish flesh thanks to Sea Grant food scientists.

• improved decisions affecting a fisherman's profitability were the result of a survey of fishermen conducted by a marine economist.

• the same marine economist updated, revised, and republished all port costs and returns data to make them more useful as a guide to profitability.



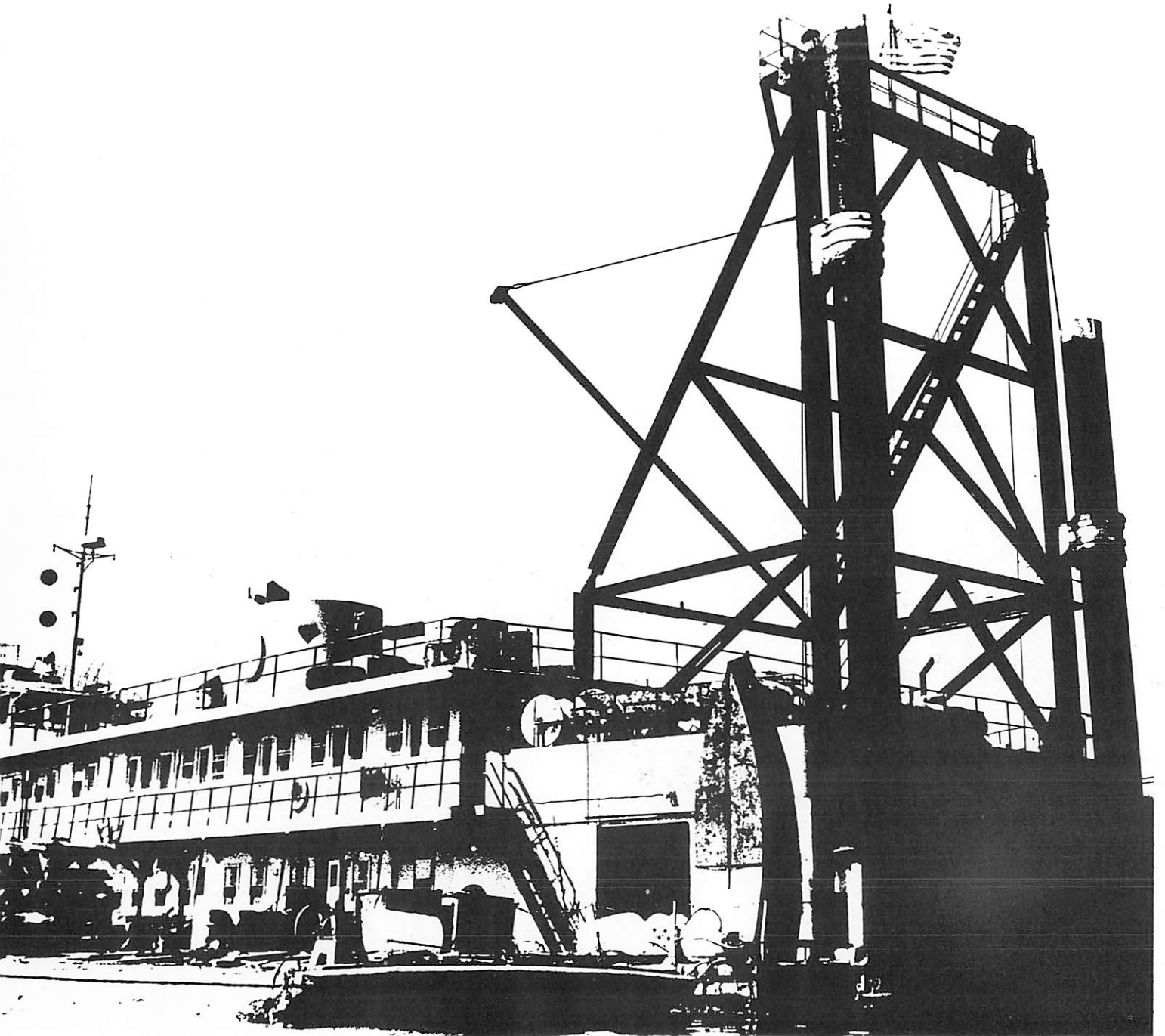
• a study of solid fish waste from Oregon seafood processing plants was completed and published and it provided information on the nature and quantity of solid seafood waste and alternatives for disposal.

• Tanner crab processing was speeded thanks to the use of direct digital electronic timing by industrial engineers to accelerate the analysis, design, and control of handling techniques.

• fisheries specialists continued to develop innovative fishing gear and new methods for Oregon's commercial fishermen; they held net mending workshops on the coast, helping the Oregon drag fleet convert to Atlantic Western Trawls for round fish, and disseminated results from research into pairtrawling.

• samples of 2,000 sub-legal size Dungeness crab caught in 30 experimental crab pots off Newport and Astoria will be used to predict the commercial harvest of crab next season.

• fish health management was the subject of a five-day short course for aquaculturalists on the OSU campus which detailed disease prevention diagnosis and control.



coastal zone environments

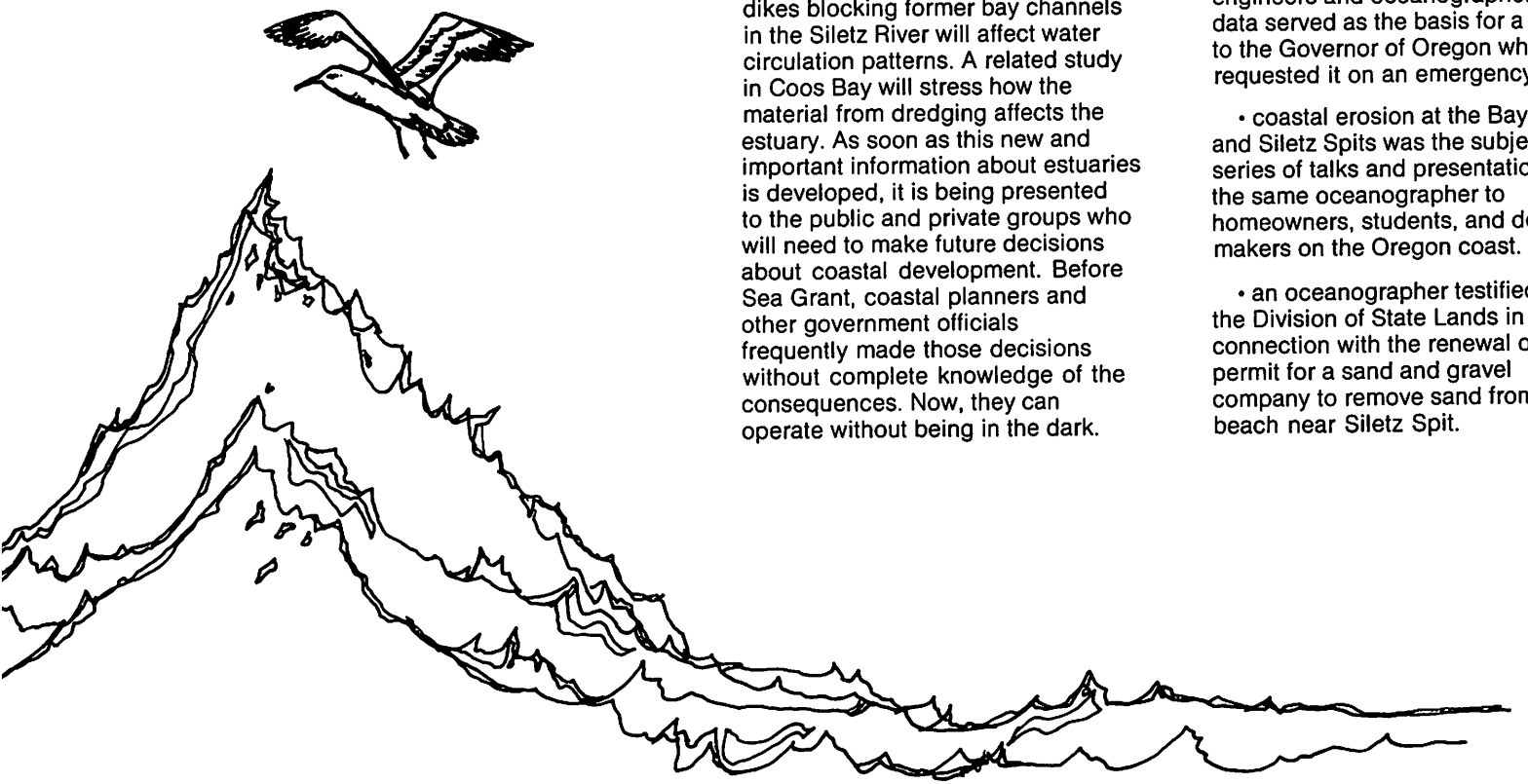
Sea and Surf Forecasting

Waves. Whether you go to sea on a regular basis as a commercial or sports fisherman, as the captain of your own boat on Sunday pleasure cruise, or as the supervising engineer of an off-shore construction project, waves make the difference between your success or failure. The National Weather Service has issued forecasts of wave conditions for years but they have not always accurately predicted the special and unpredictable ocean conditions that exist off Oregon's coast, as illustrated by the 30 boats a week now requiring assistance or rescue by the U.S. Coast Guard. This potentially dangerous situation is now being reversed, thanks to Sea Grant oceanographers who have devised a new system for measuring wave conditions using a small vertical seismometer in much the same way that instrument detects earthquakes: by measuring their vibrations. Waves cause vibrations depending on their period or length and their height. This oscillation of pressure on the sea floor is picked

up by the seismometer as a microseism, of a much lower magniture than an earthquake. The 24 hour seismometer wave sensing system can be set up and maintained for about one-tenth the cost of a sea-based bottom sensor or pressure transducer system which also may get covered with shifting sand or have its cable broken. It also works better than a visual method which must be limited to daylight hours and clearer days. The land based seismometers are located at three spots along Oregon's coast: Astoria in the north, Newport in the center, and Reedsport in the south. The information from the seismometers is fed into a computer where wave calculations are predicted and the information given to the National Weather Service for distribution more accurately and rapidly than before. In the future, this system which already prevents boating accidents and saves lives, may aid in predicting storms and preventing oil spills by rerouting Alaska oil tankers when ocean waters are threatened by dangerously high waves.

Estuarine Hydraulics

Land use planners have long ignored a lot of the things that go on in estuaries, those complicated and beneficial areas at the mouths of rivers where river currents meet the ocean tide. They had no source of information. Gradually, however, the public has become aware of the importance of the interacting physical, chemical, and biological processes going on in estuaries and the damage that might result if they are upset. As a result, they have put pressure on governmenal agencies for more information about estuaries. This, in turn, has led those agencies to turn to Sea Grant for help. Agencies have funded a number of projects for OSU Sea Grant's ocean engineering group. Two years ago, their research caused the relocation of discharge of a sewage treatment plant in Waldport, Oregon, on the Alsea estuary, away from a salmon rearing installation. This year, the engineers are completing work in the Alsea as well as the Siletz and



Siuslaw estuaries. This work has revealed how tides affect water quality and sedimentation at various times of the year. Armed with this basic information, the engineers are now working with the Army Corps of Engineers to find out how propwash dredging affects Tillamook Bay. These engineers are trying to determine how proposed removal of dikes blocking former bay channels in the Siletz River will affect water circulation patterns. A related study in Coos Bay will stress how the material from dredging affects the estuary. As soon as this new and important information about estuaries is developed, it is being presented to the public and private groups who will need to make future decisions about coastal development. Before Sea Grant, coastal planners and other government officials frequently made those decisions without complete knowledge of the consequences. Now, they can operate without being in the dark.

In the Coastal Zone Environments Division, Sea Grant scientists and engineers accomplished a number of other important tasks during the past twelve months:

- the evidence needed to evaluate the causes, extent of damage and probability of spit breaching at Siletz Spit, Oregon, was gathered by engineers and oceanographers; this data served as the basis for a report to the Governor of Oregon who had requested it on an emergency basis.

- coastal erosion at the Bayocean and Siletz Spits was the subject of a series of talks and presentations by the same oceanographer to homeowners, students, and decision-makers on the Oregon coast.

- an oceanographer testified before the Division of State Lands in connection with the renewal of a permit for a sand and gravel company to remove sand from the beach near Siletz Spit.

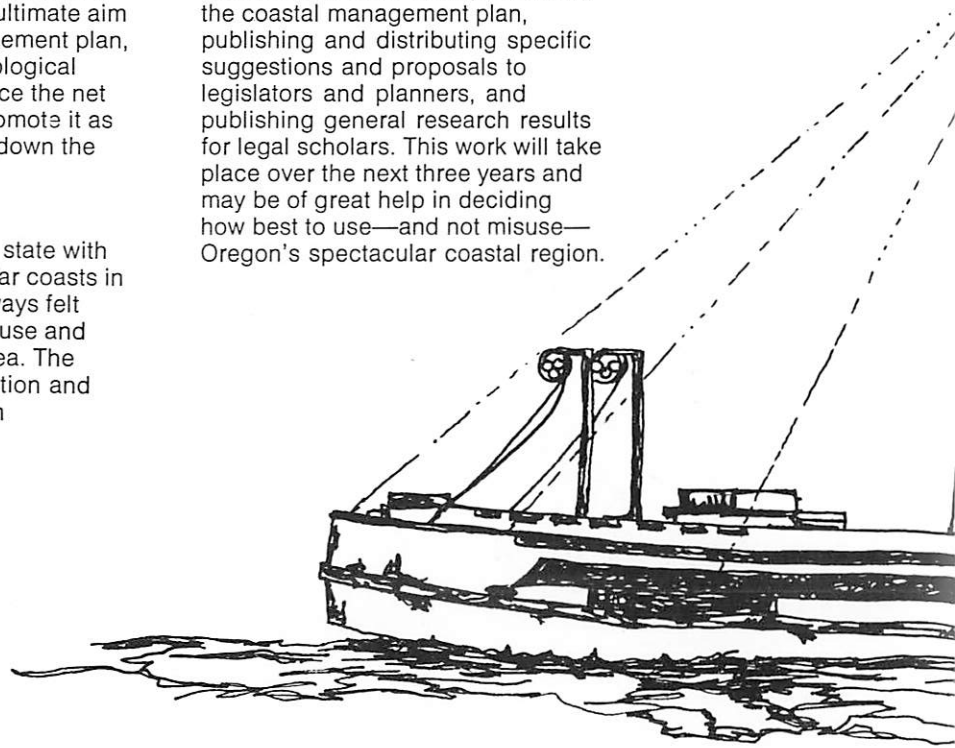
human resources

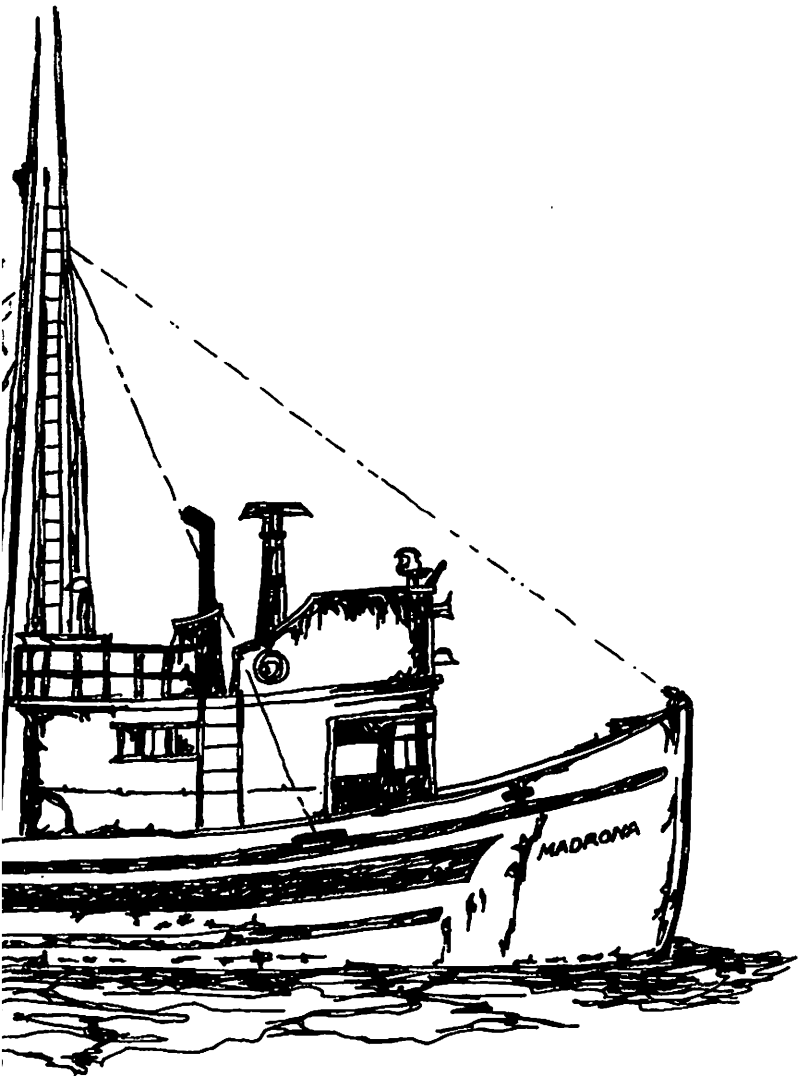
Crab Moratorium

What would happen if fishing effort for Dungeness crab were cut back as a means of resource management? Sea Grant marine economists are trying to find out by conducting interviews with 240 fishermen. They were asked about their work history, non-fishing employment and profitability as fishermen. Tentative conclusions to date indicate the finding that only about 20 per cent of fishing businesses were profitable in 1972. Also profitable fishing enterprises are primarily year-around combination vessels that could also harvest Dungeness crab as well as tuna and salmon. Exit from the Dungeness crab fishery depends more on the losses fishermen sustain than on the attraction of high profits in other fisheries. More information will emerge as the survey results are analyzed. When complete, these findings will help determine if a moratorium on fishing for Dungeness crab is a necessary and practical management alternative. Although a moratorium isn't the only possible management strategy, it may be tried before other policies. OSU Sea Grant is cooperating with its counterparts in California and Washington via Pacific Marine Fisheries Commission, and the National Marine Fisheries Service in this work as a pilot project to help develop a management plan for Dungeness crab. The ultimate aim is the creation of a management plan, consistent with sound biological principles, that will enhance the net benefits from crab and promote it as an orderly fishery up and down the Pacific Coast.

Coastal Zone Law

As an ocean-bordering state with one of the most spectacular coasts in the world, Oregon has always felt a general concern for the use and misuse of this valuable area. The Oregon Coastal Conservation and Development Commission (OCC&DC) was set up by the Oregon Legislature in 1971 to develop a plan to manage the coast. That agency turned to Sea Grant's Ocean Resources Law Program for help in implementing the plan. To this end, the lawyers are now conducting a survey of the present system of governing the Oregon coast, the legal obstacles and problems in implementing a new management plan, and the legal methods available to implement the new management scheme. They will also be formulating specific proposals for implementing the coastal management plan, publishing and distributing specific suggestions and proposals to legislators and planners, and publishing general research results for legal scholars. This work will take place over the next three years and may be of great help in deciding how best to use—and not misuse—Oregon's spectacular coastal region.





OSU Sea Grant has also been working with OCC&DC in the areas of geography, economics, political science, and oceanography. For example, the geography project is looking at changing patterns of ownership, parcel size, land value, and use of Oregon coastal zone land. An economics project is determining the various effects of alternate pricing systems on the distribution of costs of expanded public facilities along the coast. The basic objectives of the political science project are to examine the factors that are associated with participation by citizens in coastal zone planning and analyze the implications of these findings on the design of citizen participation programs. One oceanography input has been the preparation of a thorough study of Oregon estuaries. It details physical, chemical, and biological characteristics of the estuaries and the natural resources found within them in a complete form not available before.

The past year has seen progress made on a number of other projects in the Human Resources Division of Sea Grant's work:

- how harvesting of Oregon salmon may affect overall world fishing policies may be understood because of a study of pertinent historical examples and changes through the years by an OSU anthropologist.
- a nine session film and lecture series, "Fishermen and Fishing Communities," was presented last spring for a large university and community audience.
- a credit course, "Man in the Marine Environment," was also offered last spring term at OSU.
- a conference on the future impact of aquaculture on fish management laws was held under the Ocean Law Program to prepare fishermen to operate under new regulations as they are passed.
- a Sea Grant lawyer attended the United Nations Law of the Sea Conference in Caracas; he and other lawyers are helping to interpret how the results of that meeting will affect Northwest fishermen.
- research has also continued on Northwest Indian fishing rights and controlling ocean pollution.
- a card catalogue and shelving system for a new kind of Ocean Law Library was nearly completed.
- a conference on "Steinbeck and the Sea" held for OSU students and faculty and the general public explored John Steinbeck's interest in and knowledge of marine biology through a series of lectures on literature and marine biology.

WIN

The plant superintendent for a fish processor in Garibaldi had a problem: he thought it would cost too much to train women to fillet fish. When a MAP agent heard about this, he put the superintendent in touch with an official of the Oregon State Employment Work Incentive Program (WIN) in Astoria. When they had finished talking, the superintendent had found out that WIN draws members from a pool of employment applicants on welfare, that it carefully screens applicants, and pays 50 per cent of new employee salaries during a 17-week training period. That was enough for the plant superintendent: he hired two women on the spot and hopes eventually to hire 10 or 12 more through the program.

Fishermen Assistance

Oregon has about 6,000 commercial fishermen. The majority of them earn less than $5,000 a year and have relatively limited information on new technology, business management skills, and information on policies relating to their field. Limited information, that is, until MAP agents came along. By putting on a series of workshops, publishing a newsletter, and making personal contacts with the fishermen this year, a group of MAP agents started the long process of informing the fishermen about matters of vital concern to their future survival. There is no guarantee that their problems are over, but because of Sea Grant, they have more knowledge than they did before.

marine advisory program

Marine Advisory Program agents carried out a number of other projects this past year:

• an average 4.2 boats per week were lost in the Northeastern Pacific Ocean last year, a problem that caused a MAP oceanographer to present a workshop on accident prevention to the West Coast Trollers Association in Pacific City, Oregon; the program was so well-received that it may be presented in Garibaldi, Oregon, to another group.

• fish processors, fishermen, extension people and the general public found out all about how to export fish at a one-day MAP-sponsored seminar in February; the balance of trade deficit, foreign marketing opportunities, and the agencies that help businessmen enter the export business were discussed.

• a better way to preserve the wire rope used in various marine work was investigated by a MAP oceanographer; the search, which turned up grease and crankcase oil as possibilities, will continue, until the best possible approach is found.

• the Federal Water Pollution Control Act makes it necessary for the food processing industry to become more aware of waste utilization and pollution control regulations and several MAP agents saw to it this year that people in that industry found out what they needed to know about the new rules.

• fishermen's wives in Garibaldi are now organized in a club that will help them discuss common problems thanks to a MAP agent and the vice-president of a similar wives organization in Newport.

• a MAP agent helped organize the Tillamook Bay Task Force, a body of local citizens appointed by the county commission to develop and implement a comprehensive plan for the Tillamook estuary and surrounding land areas.

• the docks in Coos Bay have deteriorated to the extent that some commercial fishing there is threatened; a MAP agent testified before the city council about the value of that industry when that body was considering what to do and suggested that OSU oceanographers come to town and evaluate various dock proposals to improve the situation, and the council agreed.

• a MAP workshop and publication on spray-brine refrigeration systems helped tuna boat owners learn how to operate those systems and repair them when they break down; this solves a big problem because the systems frequently malfunction, causing lost fishing time and costly repair bills.

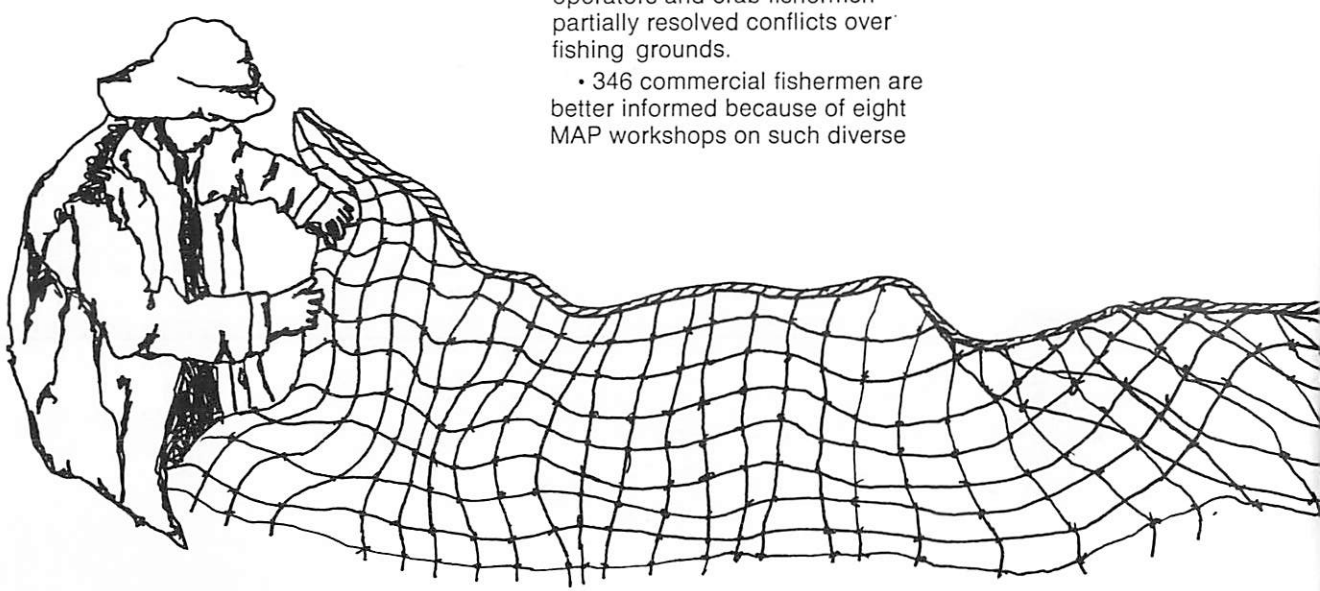
• a MAP education specialist worked out a pilot Marine Science 4-H Project and has been instrumental in organizing clubs in Oregon, California, and Washington, the first such groups ever set up.

• "Oregon at Work" television programs on conflicts over Columbia River salmon and shrimp fishing were produced and shown throughout the state to acquaint the public with both subjects.

• agents taught commercial fishermen how to mend nets, fish for black cod and bottom fish, and about refrigeration, hydraulics, and bookkeeping.

• because they got together in a MAP-sponsored workshop, towboat operators and crab fishermen partially resolved conflicts over fishing grounds.

• 346 commercial fishermen are better informed because of eight MAP workshops on such diverse



subjects as limited entry, salmon regulations and management, hatchery programs and habitat enhancement, state political structure, fishermen's organizations, and the care of fish on board vessels.

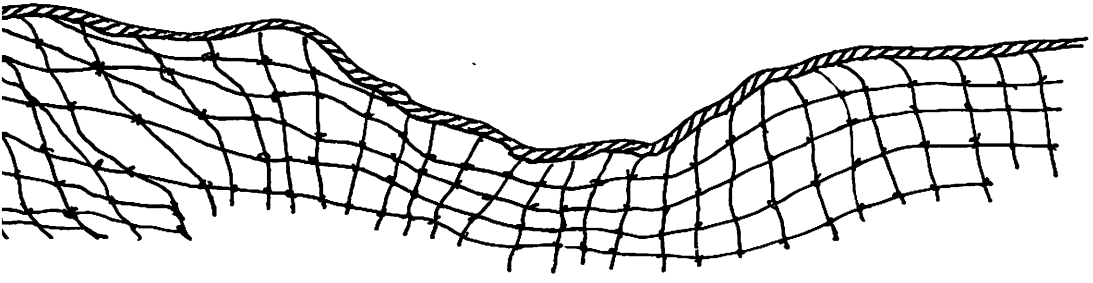
• a MAP seafood specialist provided the Oregon State Department of Agriculture information about practical aspects of using microbial standards for fresh and processed seafood.

• the specialist also prepared a publication for the general public about preserving and using seafood that also detailed its nutritional value and new product potential.

• he also helped processors file water discharge permit applications with the Environmental Protection Agency and worked with Sea Grant researchers to find markets for hake in fish and chip restaurants.

• retail supermarket managers learned about sanitation from a MAP agent, who also organized instruction in sanitation for employees in four processing plants.

• a trawl fishing movie made by MAP helped new shrimp fishermen better understand the industry they are entering.



• the seafood specialist also worked with the Sea Grant research staff on a study of the economic considerations of supermarket sanitation.

• marine extension agents presented workshops on boating safety and damage control for recreational boaters and commercial fishermen and planned short courses on navigation and recreational diving to be presented in the summer.

• extension oceanographers also worked with technical staff members of the Oregon Coastal Conservation and Development Commission to plan workshops on coastal zone planning, resource inventory, and estuarine sanctuary matters.

• a MAP ocean law specialist published reports on managing the Oregon coast, and three *Oregon Law Memos* for commercial fishermen.

• he conducted a conference on "Northwest Mariculture Laws" for aquaculturalists

• the ocean law specialist also testified before the U.S. Senate Commerce Committee on the 200 mile fishing zone in June.

• more than 250,000 visitors participated in marine science education programs at the OSU Marine Science Center; 17,000 students, their teachers, and 4-H and other Youth groups took part in more programmed learning.

• residents of several coastal and inland communities took MAP background courses in marine sciences and another group studied the same subject at the OSU Marine Science Center.

• the Columbia River, an artery of the sea, was the basis for a conference on "The Future of Oregon Maritime Industries" in Portland, three educational films on Columbia salmon resources, and several meetings between Sea Grant personnel and officials from resource management agencies on subjects like dredge spoil use and/or disposal.

• MAP communication specialists produced a 10-minute motion picture on rigging and operating an Oregon trawler for commercial fishermen, vocational teachers, and the general public.

• they also prepared public service announcements on the program and a television news release on the OSU-Michigan Sea Grant charter operator exchange.

education and training

EDUCATION AND TRAINING

		Degree Sought	Department
Aquaculture			
Pilot Chum Salmon Production	Jerome Stefferud	MS	Fisheries & Wildlife
Sea Water Culture of Salmonids	Jerry Rowan	MS	Fisheries & Wildlife
Detection, Prevention & Control of Infectious Diseases in Fish	David Ransom	PhD	Microbiology
The Effects of Temperature & Ration on the Growth & Survival of English sole *(Parophrys vetulus)* Larvae & Juveniles	Steven Williams	PhD	Fisheries & Wildlife
Culture of Algae for Molluscs	James De Boer	PhD	Botany
Biological Resources			
Assessment of the Tanner Crab (*Chionoecetes tanneri* Rathbun) as a Potential Fisheries Resource on the Oregon Continental Slope	Patricia McAllister	MS	Oceanography (Biological)
	Brian Oliver	MS	Oceanography (Biological)
	Robert Carney	PhD	Oceanography (Biological)
Ecology of Shrimp & Crab Early Life History	Robert Lough	PhD	Oceanography (Biological)
	Peter Rothlisberg	PhD	Zoology
Pelagic Fisheries Environment off Oregon	Donald Keene	MS	Oceanography (Biological)
	Ellen Deason	MS	Oceanography (Biological)
Pelagic Food Chain Processes of the Oregon Coastal Zone	John Johnson	MS	Oceanography (Biological)
	Archie Vanderhart	MS	Oceanography (Biological)
Rockfish Populations Identification	Eugene Burreson	PhD	Zoology
Study of a "Neoplastic Disease" of Bivalve Molluscs in Yaquina Bay	Ronald Riley	PhD	General Science
Virus Diseases of Fish	John McMichael	PhD	Microbiology
Harvest of Stocks			
Gill Net Boat Propeller Shroud	Daniel Ladd	MS	Mechanical Engineering
Marine Product Development			
Factors Involved in the "Green" and "Orange" Discoloration of Albacore Tuna (*Thunnus alaunga*)	Carl Decker	PhD	Food Science & Technology
	Alan Boyko	MS	Food Science & Technology
The Processed Salmon Market: U.S. & Canada	Christopher Carter	PhD	Agricultural Economics
	Der-Hsiung Wang	PhD	Agricultural Economics
Economics of Marine Firms	Kee Chong	PhD	Agricultural Economics
	Donald Ford	MS	Agricultural Economics
Industrial Engineering System Study: Shrimp, Crab, Fillets & Other Product-Mix Standards	Randal Conrads	MS	Industrial Engineering
	William Mercer	MS	Industrial Engineering
	Jyotirnoy Chakrauarty	MS	Industrial Engineering

Coastal Management			
Coastal Sand Transport	Michael Gaughan	MS	Oceanography (Physical)
	Martin Miller	PhD	Oceanography (Geological)
	Campbell Rea	MS	Oceanography (Geological)
Forces & Resources for Ocean & Nearshore Structures	Don Tavolacci	MS	Civil Engineering
Economics of Coastal Areas	Stephen Reiling	PhD	Agricultural Economics
Estuarine Management			
Estuarine Hydraulics	David McKenzie	MS	Civil Engineering
	Robert Arneson	MS	Civil Engineering
	Charles Rauw	MSOE	Mechanical Engineering
	Michael Utt	MSOE	Civil Engineering
Hydraulic Dredge Spoil Fate	Marvin Pyles	MS	Civil Engineering
	Ying Tseng	MS	Civil Engineering
Public Policy Analysis			
Research & Publication in Ocean Law	Richard Benner	JD	University of Oregon Law School
	Jo Pickford	JD	University of Oregon Law School
	Hollis McMilan	JD	University of Oregon Law School
Innovations and the Oregon Fish Harvest System: Fishermen's Organizations & Communications Patterns	Dean Yates	MS	Anthropology
Professional and Technical Education			
Commercial Fishing Technician Training	18 students		Clatsop Community College
Marine Technician Training	65 students		Clatsop Community College

STATUS OF PROJECTS

PROJECT NUMBER	PROJECT TITLE	STATUS AND RESULTS
Program:	Aquaculture	
R/AQ-6	Pilot Chum Salmon Production	Continuing
R/AQ-7	Sea Water Culture of Salmonids	Continuing
R/AQ-8	Essential Fatty Acid Requirements of Salmon	Continuing
R/AQ-9	Detection, Prevention and Control of Infectious Diseases in Fish	Continuing—transferred to Fish & Shellfish Diseases Subprogram Aquaculture
R/AQ-10	Essential Fatty Acid Requirement of Rainbow Trout	Continuing
R/AQ-11	Protein-energy Relationships and Mineral Requirements of Rainbow Trout	Continuing — extension requested to 31 December 1975
R/AQ-12	The Effects of Temperature and Ration on the Growth and Survival of English Sole (*Parophrys vetulus*) Larvae and Juveniles	Completed
R/AQ-13	Glugea Disease of Fish in Oregon Estuaries	Continuing—transferred to Fish & Shellfish Diseases Subprogram Aquaculture
R/AQ-15	Development and Evaluation of Hatchery Techniques for Producing Oyster Seed	Continuing
R/AQ-16	Development and Evaluation of "Factory" Systems for Raising Oysters in Heated Water	Continuing
R/AQ-18	Culture of Algae for Molluscs	Continuing — extension requested to 30 June 1975
R/AQ-19	Selective Breeding of Oysters	Continuing
Program:	Biological Resources	
R/BR-1	Preliminary Assessment of the Tanner Crab (*Chionoecetes tanneri* Rathbun) as a Fisheries Resource off Oregon	Continuing—transferred to Exploitation of Stocks Program
R/BR-2	Ecology of Shrimp and Crab Early Life	Completed; 5 publications
R/BR-4	Pelagic Fisheries Environment off Oregon	Continuing
R/BR-5	Pelagic Food Chain Processes of the Oregon Coastal Zone	Continuing — extension requested to 30 June 1975
R/BR-6	Early Life of Boreal Food Fish	Continuing — extension requested to 30 June 1975
R/BR-7	Population Assessment of Fishing Stocks	Terminated—P. I. not yet hired
R/BR-8	Rockfish Populations Identification	Completed; 1 publication

R/BR-9	Study of a Neoplastic Disease of Bivalve Molluscs in Yaquina Bay	Continuing—transferred to Fish & Shellfish Diseases Subprogram Aquaculture
R/BR-10	Virus Diseases of Fish	Completed; 1 publication
Program:	Exploitation of Stocks	
R/ES-2	Gill Net Boat, Propeller Shroud	Continuing
R/ES-3	Pair Trawling	Completed—report in preparation
Program:	Marine Product Development	
R/PD-1	Seafoods and Heavy Metals	Terminated—P. I. resigned; 4 publications
R/PD-2	Marine Biomedicinals and Other Bioorganic Substances	Terminated; 5 publications
R/PD-3	Improve Microbial Quality of Seafoods. I. Dungeness Crab	Completed; 1 publication
R/PD-4	Control of *Vibrio parahaemolyticus* in Shellfish Processing Operations	Completed; 1 publication
R/PD-8	Factors Involved in the "Green" and "Orange" Discoloration of Albacore Tuna (*Thunnus alalunga*)	Continuing — extension requested to 30 June 1975
R/PD-9	Whitening of Rockfish Portions	Completed; 1 publication
R/PD-10	Parameters Influencing Utility of Fish Muscle in Frozen Portions and Further Processed Items	Continuing
R/PD-12	New Seafood Product Concepts. II. Extension of Minced Fish Flesh with Vegetable and Cereal Products	Continuing
R/PD-13	Quality of Minced Fish Flesh Recovered by Machine Separation	Completed; 1 publication
R/PD-14	Whole Smelt (*Thaleichthys pacificus)* as a Hot-process Smoked Fish	Completed—method developed
R/PD-15	Intermediate-moisture Kippered Salmon Products	Terminated—P. I. resigned
R/PD-16	The Processed Salmon Market: U.S. and Canada	Continuing
R/PD-17	Economics of Marine Firms	Continuing — extension requested to 30 June 1975
R/PD-18	Industrial Engineering System Study—Shrimp, Crab, Fillets and Other Product-mix Standards	Continuing
Program:	Coastal Management	
R/CM-1	Coastal Sand Transport	Continuing
R/CM-4	Sea and Surf Forecasting	Completed; 1 publication

R/CM-6	Forces and Response for Ocean and Nearshore Structures	Completed; 1 publication
R/CM-7	Economics of Coastal Areas	Completed early; 1 publication
Program:	Estuarine Management	
R/EM-1	Estuarine Hydraulics	Continuing
R/EM-2	Hydraulic Dredge Spoil Fate	Completed; two manuscripts submitted
Program:	Professional and Technical Education	
T/T-2	Commercial Fishing Technician Training	Continuing — earlier completion date of 30 June 1977 proposed
T/T-3	Marine Technician Training	Continuing — earlier completion date of 30 June 1977 proposed
T/T-4	Marine Engineering Technician Training	Completed early
E/Ec-1	Marine Economics—Education and Training	Completed; completed course syllabus
E/L-1	Professional Training in Ocean Law	Continuing
Program:	Public Policy Analysis	
R/PPA-1	Research and Publication in Ocean Law	Continuing
R/PPA-2	Advisory Services in Ocean Law	Continuing—transferred to Marine Advisory Program
R/PPA-3	Innovations and the Oregon Fish Harvest System: Fishermen's Organizations and Communications Patterns	Completed; 4 publications
R/PPA-4	Economic Impact of a Moratorium on Entry Oregon's Dungeness Crab Fishery	Continuing — extension requested to 30 June 1975

BUDGET SUMMARY*
By Type of Activity
July 1, 1973-June 30, 1974
Expenditures

	NOAA	University
Research		
Aquaculture	197,338	137,988
Living Resources other	341,950	89,454
Marine Biomedicinals	15,600	9,669
Marine Law & Socio	112,468	63,310
Ocean Engineering	143,249	80,963
Resources Recovery	155,810	49,460
Applied Oceanography	74,148	0
Education		
College Level	9,332	8,631
Voc. Marine Tech. Training	49,900	30,000
Advisory Services		
Extension Programs	174,681	75,344
Other Advisory	23,700	53,153
Program Management		
Program Administration	31,824	93,322
Program Development	0	14,837
Total	$1,330,000	$726,156

* *This budget summary is not a final fiscal report. Expenditure figures are only approximate.*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This Annual Report is published once a year by the OSU Sea Grant College Program, Corvallis, Oregon.

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