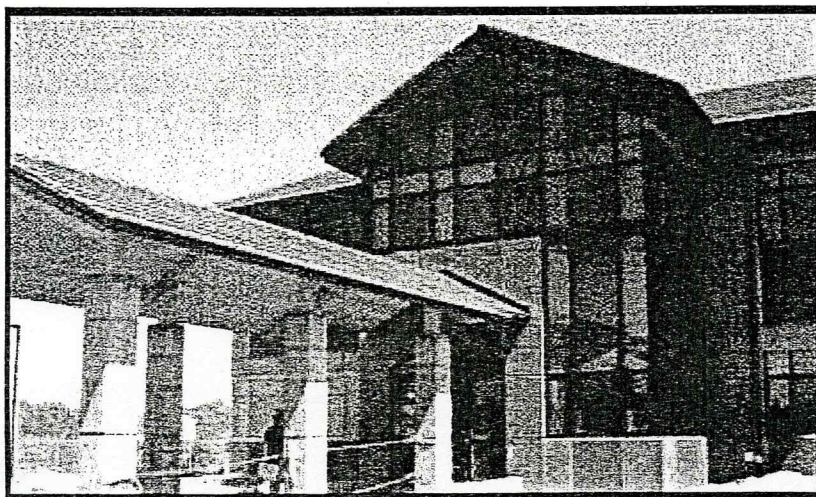


2001-2002 Annual Report

Oregon State University Hatfield Marine Science Center July 2002



NMFS Barry Fisher Building approaches completion

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2001-2002 Annual Report Oregon State University Hatfield Marine Science Center

Director's Message

George W. Boehlert, Director

This annual report describes the accomplishments of 2001-2002, the last of 25 years of Lavern J. Weber's leadership as director of the Hatfield Marine Science Center. A hallmark of his tenure has been growth – of facilities, programs, and scientific capabilities. One of the earliest responsibilities as the first resident director of the Center was to dedicate the new Education Building in 1977; one of his last was to attend the groundbreaking of the Barry Fisher Building for the National Oceanic and Atmospheric Administration (NOAA) in 2001. In between, expansion of the HMSC's facilities has included NOAA's Newport Aquaculture Laboratory, the Research Support Facility, a new building for the Environmental Protection Agency's Western Ecology Division, the Guin Library, the 800,000 gallon seawater storage tank, two new Ship Operations buildings and expanded docking facilities for coastal and oceangoing research vessels, the U.S. Fish and Wildlife Service building, the expanded and renovated Visitor Center, and new facilities allowing a two-fold increase in the capacity to house students and visiting scientists on-site.

Along with the buildings, Lavern worked to develop programs in research, education, and outreach. He brought the Marine and Freshwater Biomedical Center grant to the HMSC in 1978-1982. Knowing the need for long-term, dedicated research programs, he worked diligently with local legislators and campus administration to create the Coastal Oregon Marine Experiment Station in 1989 and



Lavern J. Weber, Director, 1977-2002

served as its first superintendent until 1997. During this time he revitalized the Astoria Seafood Laboratory and brought in new researchers as well as their new buildings. He also served as Director of the Cooperative Institute for Marine Resources Studies (CIMRS) from 1991-1999, emphasizing collaboration and cooperation with the growing number of federal agencies at the Center. His leadership was recognized nationally when he was elected President of the National Association of Marine Laboratories (2000-2001).



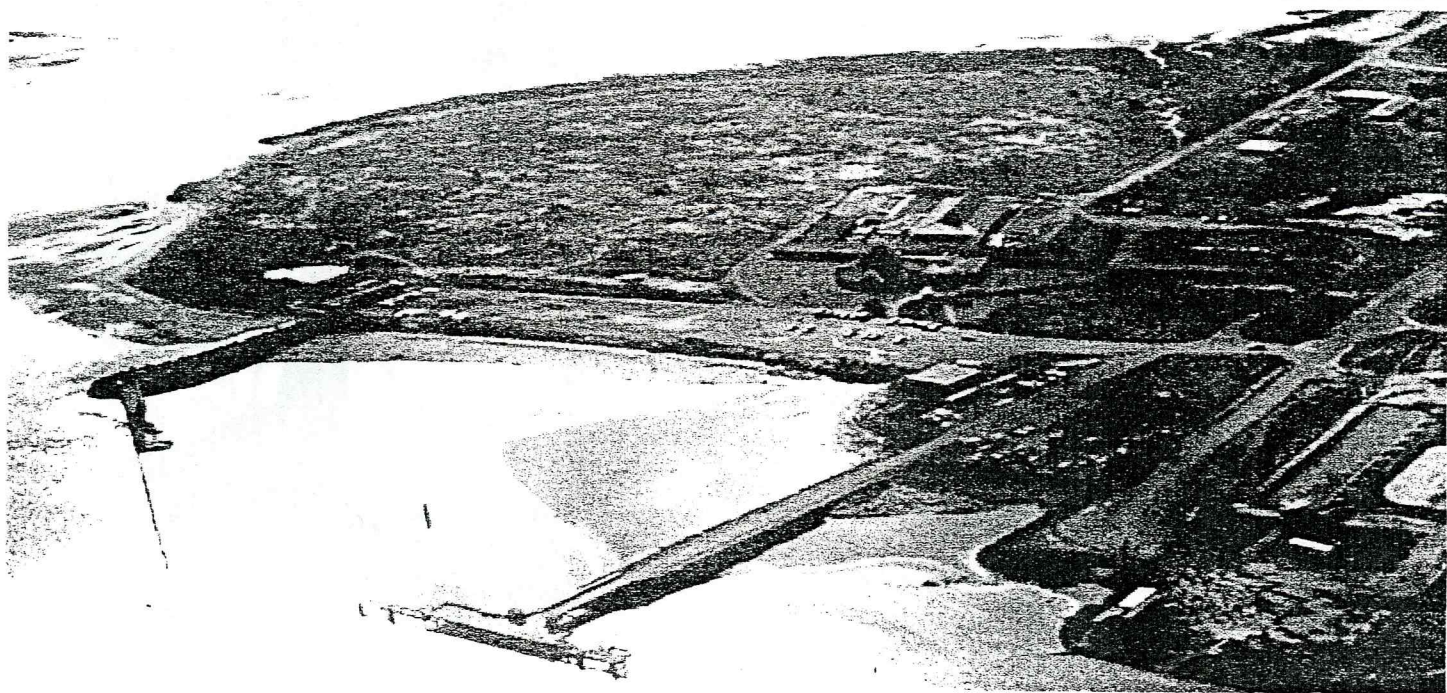
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Graduate and undergraduate education have evolved into impressive programs during the Weber years. The spring term 16-credit Marine Biology class began in 1980 and the first Fisheries term was started in 1981. He encouraged the summer term program for the Master of Science Education with an emphasis in Marine Education. To help minimize any sense of isolation at the HMSC, he invested heavily in cutting edge distance education technology, creating the only Lincoln County satellite uplink facility and adding PictureTel videoconferencing equipment. He also guided donor generosity to establish the Markham Endowment, providing grants for graduate students to conduct their research at the Center. He successfully advised his own graduate students, demonstrating his mentoring and research skills. Finally, he helped develop the Oregon Coast Community College's new Aquarium Technology Program, collaborative with the HMSC and adding a new dimension to the educational programs of the HMSC.



The HMSC as it looked in 1977

Public education and outreach has also grown. In 1988, Lavern took responsibility for the Public Wing, which had had no major improvements since opening in 1965. He successfully sought NASA funding to plan its renovation, leading to a \$4.5 million HUD economic development grant for renovation. The new Visitor Center, with its theme of "searching for patterns in a complex world," serves as a showcase for Oregon State University, bringing the HMSC's research to the public.

Starting with a few buildings, a poor seawater system, a few scattered researchers and a few miscellaneous classes, Lavern Weber has left a fine research institution with a state-of-the-art seawater system, a first-class library, advanced communications technology, a diverse and active group of researchers and students, the goodwill of the community and the state, and thousands of people whose lives have been enriched by his efforts. All are the beneficiaries of Lavern Weber's legacy.



Aerial of HMSC in 2002 with new Fisher Building and tank building drawn in

Background of New Director

George W. Boehlert, director of one of the National Oceanic and Atmospheric Administration's research laboratories, has been named director of the OSU Hatfield Marine Science Center. Boehlert, who will begin his duties July 1, succeeds Lavern Weber, who retired after 25 years as center director.

For the last eight years, Boehlert has directed NOAA's Pacific Fisheries Environmental Laboratory in Monterey, California. The lab plays a key role in helping scientists better understand the role of the environment in fluctuations of marine resources and changes in marine ecosystems. Boehlert has published more than 80 scientific papers. His research has focused on fisheries oceanography, impacts of fishing on marine ecosystems, ocean survival of Pacific salmon, fish reproduction and larval fish ecology.

"The Hatfield Marine Science Center is one of the best marine laboratories in the nation to lead and develop cooperative research and education programs involving academic, state and federal groups," said Boehlert.

He said that along with its state and federal partners in Newport, the Center is poised to help find solutions to pressing problems in the marine environment, as well as to train students to continue this work in the future.

A 1972 graduate of the University of California at Santa Barbara, Boehlert went on to earn his doctorate in marine biology from the Scripps Institution of Oceanography at the University of California at San Diego. He joined the OSU faculty as an assistant professor in 1979, where he remained for four years before joining NOAA's National Marine Fisheries Service in Honolulu, Hawaii.

He spent ten years in Hawaii, the last five as director of the laboratory, and served on the graduate faculty of the University of Hawaii. In 1993, he moved to his current position in Monterey.

Extension Sea Grant Visitor Center

Jay Rasmussen, Extension Sea Grant Program Leader

The goal of the National Sea Grant Program to enhance appropriate use of ocean and coastal resources is carried out in our state by Oregon Sea Grant. The outreach education called for in Federal Sea Grant legislation is conducted through the Extension Sea Grant program (ESG) in Oregon.

The mission of ESG's program is to educate Oregonians by delivering research-based, objective information to help them solve problems, develop leadership, and manage resources wisely. To carry out this role with coastal and marine clientele, the Extension Sea Grant program (one of five extension program areas at Oregon State University) has a team of marine agents and specialists affiliated with the OSU Extension Service and located in coastal communities, at the Hatfield Marine Science Center and on campus, whose goals are to:

- Identify and prioritize emerging community education issues and information needs of the industry
- Transfer knowledge to individuals and groups who can use it to solve problems or capitalize on opportunities
- Teach and encourage people to apply this knowledge to their situation
- Develop working relationships with other organizations so that the educational program impact is maximized
- Increase the proficiency of Extension faculty to develop and deliver relevant issue-based education
- Encourage the adoption and implementation of coastal education programs by other Extension professionals throughout the state and nation
- Stimulate researchers to generate knowledge needed to resolve coastal and marine challenges
- Gather relevant research-based information about coastal and marine resources and issues

Some of the areas of focus include commercial fisheries, seafood technology, sustainable aquaculture, business and community development, coastal ecosystems and habitats, coastal natural hazards, fishing vessel safety, and marine and cultural education. Many agents and specialists conduct their own research projects and collaborate with Sea Grant funded researchers, the Coastal Oregon Marine Experiment Station, and the Agriculture, Forestry, 4-H, and Family & Community Development program areas of the OSU Extension Service. In 2001, the following faculty members have appointments ranging from full-time to quarter-time with Oregon State University: Susan Hanna (main office is on campus), Bill Hanshumaker, Ken Hilderbrand, Jon Luke, Bruce Mate, Vicki Osis, Jay Rasmussen, and Lynne Wright.

Each year Extension Sea Grant effectively reaches thousands of people—from fishing industry leaders to school children—through workshops, classes, conferences and other educational delivery mechanisms. In November 1997, Oregon Sea Grant assumed management of the Visitor Center at the Hatfield Marine Science Center.

New Program Begins. The goal of the "ornamental aquatic animal health extension" program is to improve the quality of ornamental aquatic animal health and husbandry in Oregon. The primary focus will be to provide educational programming and service to the aquarium industry in Oregon that will help wholesalers, retailers and hobbyists to succeed in the rearing, husbandry, and health care of ornamental aquatic animals in the aquarium or pond environment.

Located at the HMSC effective June 1, 2002, Dr. Tim Miller-Morgan is an assistant professor in the Department of Biomedical Sciences at the College of Veterinary Medicine at Oregon State University. Prior to accepting this position Dr. Miller-Morgan was the senior aquarist and veterinarian at the Hatfield Marine Science Center aquarium and a consulting veterinarian at the Oregon Coast Aquarium.

Jon Luke: Visitor Center Manager

The Visitor Center ended the year strong with an 8 percent increase in attendance and a 6 percent increase in donations. In early December, oceanographer Bob Ballard and NOAA Vents director Steve Hammond spoke to a standing-room-only audience about the future of oceanography. We estimated that nearly 200 people attended.

During the Winter Whale Watch Week, the Visitor Center unveiled a new killer whale skull display. The skull was collected and rendered by Sea Grant marine education specialist Bill Hanshumaker. The display demonstrates the size of an orca's head and shows how teeth rings can be identified to age the whale. The display was funded by the Rudy Mate Memorial Fund. Rudy Mate, the father of Bruce Mate, was a dedicated volunteer at the Visitor Center for many years. The exhibit was fabricated by Interpretive Design of Salem.

A new exhibit coming this summer will convey the excitement of underwater discovery by simulating the control panel of the Remotely Operated Platform for Ocean Science (ROPOS) as it investigates an undersea volcano. The exhibit uses actual video taken by NOAA researchers on the "NeMO" (New Millennium Observatory) Project as they explore the seafloor near the Axial volcano in the Juan de Fuca Ridge that erupted in 1998.

The final design has been completed for a new exhibit on aquatic invasive species called "Invasion of the Habitat Snatchers." This will be the first major exhibit to be installed in the Visitor Center since the remodel in 1997. The exhibit will introduce visitors to this global issue and will illustrate, through various visual and interactive methods, the pathways and characteristics of aquatic invasive species. The display will convey actions that people can take to prevent the spread of unwanted species.

We are fortunate to have the generous support of so many volunteers who help make this place function. There are over 90 volunteers who logged nearly 6750 hours for this year, which is the equivalent of almost 4 full-time employees. Volunteers have also logged nearly 39,000 hours since we reopened in 1997. They also make a considerable travel commitment just to get here to do the valuable work and service they provide to visitors. Several volunteers come from Lincoln City, Corvallis, and as

far away as Salem! The miles that our volunteers have logged this year alone are 52,925 and over 320,795 miles since 1997. The volunteers greeted over 120,000 visitors this year, introduced films to more than 35,000 viewers, and provided hour-long guided interpretive tours of the Yaquina Bay Estuary and the Newport fishing fleet to over 1200 people. Our volunteers have enriched the lives of many HMSC visitors as well as staff.

The Visitor Center is committed to providing a variety of informal education programs. This year we hosted Salmon Saturday, Fossil Festival, Coastal Hazards, and Ocean Quest, in which over 3500 visitors heard nearly real-time reports from scientists at sea. Our Whale Watch Week programs introduced over 9000 visitors to the natural biology of marine mammal research OSU scientists are conducting to track whale migration.

Ken Hilderbrand: Seafood Processing Specialist

On May 31, Ken Hilderbrand retired from Oregon State University's faculty after 33 years of service as OSU Extension Sea Grant's Seafood Processing Specialist. His food industry career spans almost 45 years and he feels "it is now time to move on." "Besides," says Hilderbrand, "I need to stop my unauthorized parking in the official vehicle lot!"

Hilderbrand is most proud of his internet publication downloads record in the past year. In the 12 months prior to April 1st, over 25,000 of his publications were downloaded from the OSU Sea Grant web site. The requests came from locations all over the world. These downloads were from 14 of his seafood processing and safety publications which were accessed often enough to make the "top 20" list of downloaded Sea Grant publications.

Ken and his wife Linda will be touring Canada and Alaska by motor home until settling for the winter in Yuma, Arizona.





Vicki Osis: Marine Education Specialist

The marine education program delivers marine science programs to teachers and youth. The programs are based at the Hatfield Marine Science Center and offer teacher workshops and graduate level courses that may be applied to an MS in Science Education. Youth programs include day camps and school field trip programs to the center.

National Science foundation Geosciences division NSF funded a \$53,000.00 15-month project to develop high school web based curricula materials that present the new discoveries on the Juan De Fuca Plate and the current deep-sea research projects. This is a joint project between Sea Grant and the NOAA Vents program.

The curriculum is completed and posted on the web at <http://www.pmel.noaa.gov/vents/nemo/education.html>

The project also funded an interactive display for the Visitor Center. The animation is completed for the virtual visit to AXIAL volcano. The display unit is nearing completion. It will be a simulated ROPOS control panel from the RV Ron Brown. The display is under the direction of Bill Hanshumaker and will be tested this summer.

The HMSC Youth field trip program grew again this year from 10,500 students to over 10,900 students served in 2002. These programs provide 2-3 hours of hands-on instruction for each visiting student. The girl scout program served 300 scouts in 2000-2001 and is still growing.

The Jackson Hole Community funded a Pathfinder Workshop for teachers. Pathfinder is a nationwide Sea Grant program that focuses on oceanography and marine biology for the classroom grades 7-12. Fifteen teachers attended this work-

shop in Summer 2001. Instructors for the workshop were Mike Goodrich, retired geosciences high school teacher from Portland, and Dr. Cynthia Trowbridge.

The Stannard Family Foundation gave \$20,000.00 to support the HMSC Day Camp program. This money was used to reduce the fees for campers and scholarships for needy students. The money enabled us to purchase field equipment for the stream, sandy beach and estuary investigations parts of the camps. The camps served 80 students in 2001 and the demand was so great we have added two new camps for summer 2002.

Ten teachers received stream ecology training, and protocols to take water quality samples in their local streams. Each teacher received a kit of equipment valued at \$3000 from the Howard Hughes Medical Institute funded RIVERNET program. The workshop was held in March and the new teachers have begun sampling while others are preparing their classes for next year's monitoring.

Summer graduate courses and workshops declined in participation in 2001. Only 5-7 teachers registered for each class. Extra effort has been directed at advertising. Summer 2002 has 10 teacher in each class and more are registering.

The second GLOBE partnership workshop at the Hatfield Marine Science Center was held at HMSC in 2001. Instructors included, Vicki Osis, Fawn Custer, GLOBE Teacher from Northern California and GLOBE Scientist from Florida State. Twenty teachers attended from Washington, California, the United Arab Emirates, Chicago and Arizona. Project GLOBE is an international program that encourages students to learn about their environment through environmental monitoring.

The National Geographic Society through Coastal America funded a Student Ocean Conference. The focus was *Marine Reserves: Here Today Here Tomorrow*. The fifty-five students attending were drawn from the National Ocean Sciences Bowl Teams who were to compete the next day in Corvallis. These knowledgeable students heard talks from state and national officials about Marine Reserves, then adjourned to conduct an activity where they were to select and designate a marine reserve for the state of Oregon. Each team gave a presentation on its marine reserve and the regulations it recommended for its reserve.

College of Oceanic and Atmospheric Sciences - Ship Operations

Frederick J. Jones, Marine Superintendent

Oregon State University's (OSU) College of Oceanic and Atmospheric Sciences (COAS) operates the 185-foot Research Vessel (R/V) *Wecoma* and the 54-foot R/V *Elakha*. OSU is one of 20 vessel-operating institutions in the University-National Oceanographic Laboratory System. The COAS Ship Operations office and pier facility are located at the Hatfield Marine Science Center in Newport, OR.

The R/V *Wecoma* is owned by the National Science Foundation (NSF) and operated by OSU under a cooperative agreement. She carries a crew of 12 and a science complement of up to 18. In 2002 her 185 days of scheduled operations are funded by the NSF and include work by researchers from Oregon State University, the University of Washington, the University of Hawaii, and NOAA. Major projects this year include GLOBEC (GLOBal ocean ECosystems dynamics), H.O.M.E. (Hawaii Ocean Mixing Experiment), and H.O.T. (Hawaii Ocean Time-series.) In addition to the usual work areas off the West Coast, this year WECOMA will be operating out of Honolulu for the months of August through November.

R/V *Elakha* is owned by OSU and funded largely by user charges. The vessel is designated by the USCG as an Oceanographic Research Vessel and is capable of supporting research and education in coastal waters, bays and estuaries from Southern

Washington to Northern California. *Elakha* supports a variety of research programs including those of COAS, Zoology, Ocean Engineering, Microbiology, the OSU/NOAA Cooperative Institute for Marine Resources Studies (CIMRS) and the Oregon Department of Fish & Wildlife at HMSC. The vessel also supports the HMSC Marine Education program as well as education activities for OSU and Linfield College.

The COAS Ship Operations Pier in Newport serves a variety of visiting oceanographic research ships and U.S. government vessels. Visiting vessels for 2002 include: R/Vs *Roger Revelle* & *New Horizon* (Scripps Institution of Oceanography), *Western Flyer* (Monterey Bay Aquarium Research Institute), *Maurice Ewing* (Lamont-Doherty Earth Observatory) and *Atlantis* (Woods Hole Oceanographic Institution) as well as the USCGC *Steadfast* and *Cowslip*.

Additional information on OSU's Research Vessels and the College of Oceanic & Atmospheric Sciences can be found at www.coas.oregonstate.edu.



Independent Researchers

John Chapman: Invasive Species

Work continues on the gammaridean amphipod chapter for the upcoming *Smith and Lights Manual: Guide to Intertidal Invertebrates of Central California and Oregon* to be published by U.C. Press. Production of the chapter has become a four-year synthesis of all eastern Pacific gammaridean amphipod taxonomy. He was beginning to wonder if he would ever finish, but sections on three major families—Ampeliscidae, Ampithoidae and Phoxocephalidae (or approximately 70 of 400 species)—are nearly complete. The final production is

beginning to move much faster. There is no financial award for this activity, but it has cost thousands of dollars of personal funds.

Other highlights of the year were participation in surveys of the Olympic National Seashore, which will continue this summer, a survey of the nonindigenous species of the Panama Canal, Panama; an amphipod identification workshop that he attended at the Los Angeles County Museum of Natural History; and another amphipod identification workshop that John led at the California Academy of Sciences in San Francisco. Several papers were accepted for publication this year, but none has seen the light of day.

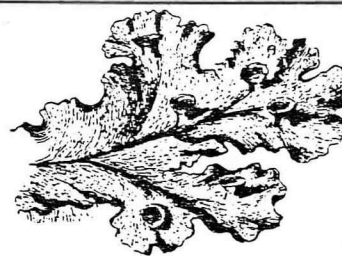
His work on the geography of marine biological invasions was greatly aided by the trip to

Panama and by a grant through the U.S. Coast Guard and the National Marine Fisheries Service to survey the nonindigenous species of the Columbia River. As a member of the executive committee of the Western Regional Panel, National Aquatic Nuisance Species Task Force, he has been appointed to the coastal committee and will be responsible for promoting efforts to limit invasions of aquatic nuisance species.

Jill Grover: Larval Ecology

As publication in a peer-reviewed journal is the culmination of careful scientific study, during 2001-2002, efforts were focused on turning five years worth of work into print. To this end, a manuscript was submitted to *Marine Ecology Progress Series*, revisions were made, age and growth data were re-analyzed, new figures were generated, and the new "improved" version was accepted for publication. The revision was entitled "Effects of the 1997-1998 El Niño event on early-juvenile Pacific hake *Merluccius productus*: age, growth, abundance and diet in coastal nursery habitats." Jill was senior author, with two co-authors: Troy Buckley of the Alaska Fisheries Science Center, NMFS, and David Woodbury of the Southwest Fisheries Science Center, NMFS.

Prior to this study, warm ocean conditions had been loosely correlated with stronger year classes of Pacific hake. All strong year-classes occurred in warmer than average years, although not all warm years produced strong year-classes. Warm years have resulted in higher variability in the survival of larval hake than cold years, due to the compounding effects of many environmental factors. In the present study, survival from early spawns appeared to be very different in the two years of El Niño conditions. In late winter and early spring of the 1998 El Niño, warm ocean temperatures occurred in conjunction with reduced upwelling and record low levels of plankton production. Recruitment of the 1998 hake year-class was negatively impacted, principally as a result of reduced growth and survival from early spawns.



Gayle I. Hansen: Marine Algology

Over the last few years, concern over the decline of species diversity worldwide has led Gayle Hansen, our marine algal taxonomist, to study the biodiversity of marine algae in Oregon and in Alaska, her areas of taxonomic focus. In order to detect changes in biodiversity, she is developing databases of current diversity that can be used as a baseline of comparison for future change. To be certain that the databases are reliable, she is using only verifiable records of species occurrences. Conveniently, herbarium specimens of marine algae provide this resource. For several hundred years now, pressed voucher specimens of marine algae, labeled with their collection data, have been deposited in herbaria throughout the world. By borrowing these specimens and correcting and updating their identifications, she has been able to database the information on over 8,000 specimens from Oregon and over 20,000 specimens from Alaska. Her records for Oregon begin in the 1870's while those for Alaska begin in the 1820's. The databases are all in MS Access and are currently in various stages of completion.

The Oregon algal database is now complete and is waiting for posting by a Web facilitator. When available for use, there will be a queriable feature making it possible to obtain distribution maps of the species as well as site lists that can be filtered by taxonomic group, year of collection, and collector. The initial database will contain only 8,000 specimen records, but eventually funding may become available to curate and add to the database the information contained in 12,000 additional Oregon algal specimens that are housed in the herbarium on the main campus.

The Alaskan algal database project has developed in 2 overlapping parts. The first part was completed this year. After checking, updating and fine-tuning the 10,000 record database of voucher

specimens collected during impact studies of the Exxon Valdez Oil Spill (1989-1998), Gayle has been able to provide checklists and biogeographic analyses of the seaweeds of south-central Alaska. In addition to revealing the areas of high and low biodiversity, her analyses demonstrate that wave exposure is the most critical feature regulating algal distributions in this area and that low salinity deters algal biodiversity only in the areas of low exposure. The second part of the Alaskan algal database project combines the information derived from the oil spill collections with the label data from 40,000 additional specimens held at numerous herbaria around the world. The goal of this part of the project is to Web post the finalized database in a queriable format and complete a biogeographic analysis of the marine algae of all of Alaska. Funded through the National Science Foundation, this part of the project is being completed with a collaborator from the University of British Columbia. To date, we have identified and entered 3/4 of the specimens into the database and hope to finish the project by the Spring of 2003.

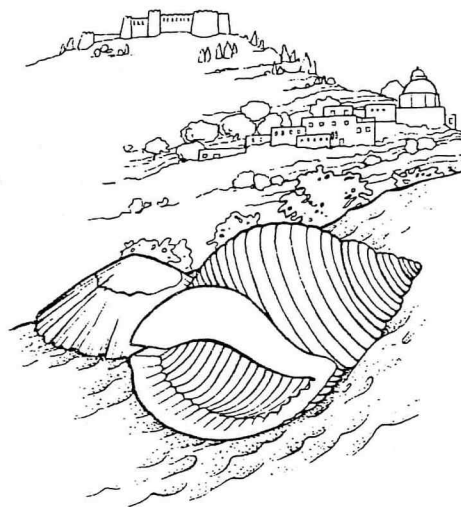
Since all of these databases will be Web posted, they will be easily accessible to anyone who is interested. Gayle anticipates that marine scientists will initially use these databases to determine species distributions and seasonality. As time progresses, they will become resources for determining changes in species diversity over time and help to determine if they are caused by natural cycles or by anthropogenic factors such as pollution, alien species introductions, and global warming.

Cynthia D. Trowbridge: Marine Ecology

The ongoing focus of Cynthia's research is the invasion ecology of green macroalgal pests. Cynthia was an invited speaker at the International *Caulerpa taxifolia* Conference in San Diego and a member of the Special Review Panel that assessed eradication efforts of *C. taxifolia* in California. Cynthia is now a leading authority on another algal pest, *Codium fragile* ssp. *tomentosoides* (common name "oyster thief" or "dead man's fingers"), on Scottish, Irish, Australian, and New Zealand rocky shores. She is focusing her current research on N.E. Pacific shores (Oregon & California), N.W. Pacific shores (Japan), and N.E. Atlantic shores (Ireland, UK, France).

In terms of European research activities, Cynthia is collaborating with (1) Dr. Colin Little (retired *Senior Lecturer, Univ. Bristol*) at Lough Hyne Marine Reserve, Co. Cork, Ireland; (2) Dr. William Farnham (*Associate Senior Lecturer, Univ. Portsmouth*) in the Solent Region of England; (3) Dr. Alan Critchley (*Head, Degussa Texturant Systems*) in France. Cynthia was also recently received a WISC (AAAS/NSF) to continue her Japanese research with Dr. Yoshiaki J. Hirano (*Associate Professor, Chiba University*) and Dr. Yayoi Hirano (*Chiba University*) on the sacoglossan sea slugs of Japan. Finally, Cynthia is collaborating with molecular ecologist Dr. Liz Walsh (*Associate Professor, Univ. Texas – El Paso*) on the population genetics of sea slugs on introduced vs. native algal host-plants.

Other professional activities include research talks for the *Western Society of Malacologists*, *World Congress of Malacology*, and *Northwest Algal Symposium*. Cynthia is the executive treasurer of the *Western Society of Malacologists* and the organizer of a *Molluscan Ecology Symposium* at the annual meeting in Asilomar, CA. She continues to teach university field courses at HMSC: FW 599 Marine Invertebrates, BI 451/551 Marine Biology (seaweed & invertebrate sections), and COAST/Pathfinders. Not only does Cynthia have affiliations with three departments at OSU, she also has an adjunct faculty appointment at *Univ. Texas – El Paso*. Cynthia joins other UTEP faculty supervising undergraduate research projects during the *Field Biology* course at CEDO (Center for the Study of Deserts and Oceans) in Puerto Peñasco, Sonora, Mexico.



Coastal Oregon Marine Experiment Station

Gilbert Sylvia, Superintendent

The Coastal Oregon Marine Experiment Station (COMES) encompasses faculty, students, and facilities at the Hatfield Marine Science Center and the Astoria Seafood Laboratory. The year 2001-2002 was successful and marked continued growth of the Station. COMES began in 1988 as a counterpart to the inland agricultural experiment stations — its mission — to conduct applied research on coastal and marine issues beneficial to the citizens of Oregon and the nation. Under the leadership of Lavern Weber and an advisory board chaired by Captain Barry Fisher, the Station began with three faculty and a handful of graduate students. Twelve years later the Marine Experiment Station has grown to include 14 faculty, 15 staff and research associates, 60 graduate students, and over \$2 million annually in external grants and funds.

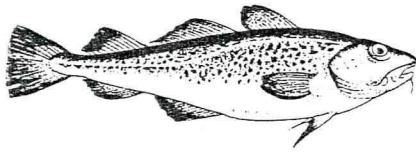
The research programs of COMES encompass seven primary areas: *Aquaculture* (Chris Langdon and Anja Robinson), *Fish Disease* (Robert Olson and Paul Reno), *Fisheries Science* (David Sampson), *Fishery Management* (Susan Hanna), *Marine Mammals* (Bruce Mate), *Marine Economics and Marketing* (Gilbert Sylvia), *Salmon and Marine Fisheries Ecology/Genetics* (Ian Fleming and Michael Banks), and *Seafood Science and Engineering* (Ed Kolbe, Michael Morrissey, Jae Park, and Yi-Cheng Su). Approximately half of the COMES faculty have joint positions within their academic homes, Oregon Sea Grant, and/or the Oregon Department of Fisheries and Wildlife. Much of the research involves diverse cooperators including OSU faculty, other national and international research institutes, and industry, state, and federal government including National Marine Fisheries Service and Oregon Department of Fish and Wildlife. COMES also helps sponsor workshops and conferences which further the mission of the Station in supporting wise use of marine resources. Over the past three years COMES has hired four new faculty, is presently searching for a new faculty member in Seafood Microbiology (on hold), and is proposing additional positions in biology and ecology.

Michael Banks, Marine Fisheries Genetics

Primary effort this year has been directed towards the founding of our program in Marine Fisheries Genetics. HMSC now hosts a facility equipped with state-of-the-arts thermo-regulator and genotyper/DNA sequencer equipment for the application of molecular genetics in the study of Marine Fisheries. Three primary programs are now funded:

- 1) Characterizing the genetic basis of stream and ocean type life history differences expressed in chinook salmon, including the study of two populations with Federal endangered species listing.
- 2) Genetic characterization of the range and limits of gene flow among four species of rockfish as representatives of four major life history types expressed in this species-complex as a means of providing information for sustainable management of groundfish fisheries.
- 3) Characterization of the genetic relationships among native oyster populations from estuaries sampled in California, Oregon, Washington and Alaska as a preliminary for the use of native oysters for the restoration of estuarine habitat quality.

Five graduate students and a research staff member perform research on these programs, as well as another project in collaboration with Dr. Greswell, studying the population genetics of coastal cutthroat. Two summer interns will also be hosted in the Marine Fisheries Genetics program for research on salmonid-pinniped interactions and another project quantifying the disease resistance and MHC haplotype diversity in chinook salmon. Dr. Banks is happy to announce that he was awarded the 2001 Stevan R. Phelps award for co-authoring the best paper in Fisheries Genetics published by the American Fisheries Society in the year 2000. We're also very enthusiastic about a new lab-based course in Coastal Population Genetics that will be offered from our program beginning in fall 2002.



Ian A. Fleming: Fish Ecology

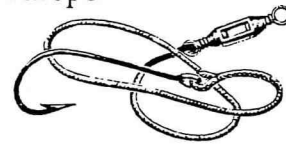
Dr. Ian A. Fleming arrived in February 2001 and spent much of last year establishing his research program on the marine and anadromous fish ecology. Construction of his aquarium and dry laboratory facilities are ongoing, though should be completed by late summer. The research program focuses on marine and diadromous fish ecology, with a particular focus on Pacific salmon. It encompasses both fundamental and applied aspects of fish ecology, integrating perspectives from ecology and evolution with fisheries management and conservation.

One of the issues the research is addressing is the role of estuaries in the life history, population biology and resilience of salmonid populations. A related issue being studied is the potential impacts of molluscan shellfish culture in estuaries on salmonid fish populations, several of which have been listed as endangered under the ESA in the Pacific Northwest. The problem of interactions between cultured (hatchery and farm) and wild salmonids is also being addressed. A further aspect of the program examines the life history, ecology and behavior of exploited marine fishes (dogfish sharks and rockfish) to improve sustainable management. Dr. Fleming is also continuing several collaborative projects with researchers in Norway, Canada, the Netherlands, United Kingdom, Ireland and Italy. This work involves studies quantifying long-term ecological and genetic effects of interactions between wild and escaped farm salmon, including impacts on immune response genes, and studies examining the reproductive ecology of fishes and their evolution during captive rearing.

During the past year, three students have joined the research group: Jacki Richards, who is studying the life history and demography of dogfish sharks (Fall 2001); Marion Mann, who is developing a project on juvenile rockfish habitat associations (Winter 2002); and Lisa Krentz, who is studying the estuarine life history and behavior of cutthroat trout (co-supervision, Winter 2002). Dr. Sigurd Einum, a postdoctoral scientist from Norway, joined the laboratory for several months in 2001 to work

collaboratively on a number of projects focusing on the evolution egg size and recruitment in fishes. Two new students will join the laboratory in Fall 2002, both of which will be working on projects related to estuarine behavior/life history of chinook and other salmonids (Columbia R & coastal Oregon estuaries). Dr. Yusuke Koseki from Hokkaido University will be joining the laboratory in June 2002 for a year of postdoctoral studies; he will be extending his work on salmon breeding and life history tactics.

In terms of other activity, Dr. Fleming continues to seat on the National Research Council committee examining the status of Atlantic salmon populations in Maine; the Northwest Power Planning Council, Artificial Production Advisory Committee; and the steering committees for the Quantitative/ Experimental Genetics Workshop of the European Union (EU) funded Atlantic salmon genetics (SALGEN) project and the American Fisheries Society symposium on *Propagated aquatic organisms in and for aquatic resource management*. This past year he co-hosted the 4th *European Telemetry Conference* held in Norway and is now co-editing the proceedings to be published in *Hydrobiologia*. Together with Dr. Michael Banks, Dr. Fleming also co-hosted the *Salmon Ecology and Genetics Symposium* at HMSC. He served as an external PhD examiner at the University of British Columbia, Canada, and gave several invited and contributed presentations at universities, workshops, symposia and conferences in the US, Canada and Europe.



Susan Hanna: Marine Fisheries Management and Policy

Activities in the past year have focused on three themes: research on improving fishery management, education/outreach on science and policy, and professional service.

Research on Improving Fishery Management

Research on improving fishery management concentrated on developing incentives for improving the performance of fishery management, understanding economic aspects of institutional design for fisheries, and integrating economics and biology in performance indicators for fishery management.

Developing incentives for improving fishery management was approached through a Sea Grant funded project that involves the synthesis of infor-

mation on market-based incentives for natural resource management and the application of this knowledge to fisheries. Effort during the past year has concentrated on writing a report analyzing the use of incentive programs in agriculture and natural resources. Additionally, she prepared a proposal to investigate the use of incentive-based tools to the reduction of bycatch and discards in the west coast groundfish fishery. Work in incentives resulted in two publications: a chapter on the economics of co-management in a book to be published in 2002, and a chapter on the behavioral incentives and management costs published in a fishery management report of the Pew Oceans Commission.

Understanding the economic aspects of institutional design was approached through the investigation of changes affecting U.S. fishery management. A book chapter on design challenges of the transition in the American fishing commons will be published in 2002. The institutional costs of extensive litigation of federal fishery regulation was addressed in a talk at an American Fisheries Society symposium that resulted in a paper to be published in *Ocean and Coastal Law Journal*.

Integrating economics and biology in performance indicators for fishery management was approached through a journal publication on the management of the ecological/human interface and through international coordination on improving fishery management education. She participated in the steering committee for a COMES/New Zealand sponsored International Workshop on Training Fishery Managers. The workshop will be followed by a special session on fishery management education at the 2002 conference of IIFET, and by educational efforts targeted at the education of U.S. fishery managers. A research proposal to Oregon Sea Grant Program on the development of performance indicators and best management practices for exploited marine ecosystems was funded.

Scientific and Policy Outreach

Outreach education on marine science and policy involved the provision of general science advice to agencies, specific advice to two national commissions reviewing U.S. ocean policy and lectures on current fishery management issues.

General scientific advice was provided to regional and federal agencies through service on

four advisory committees: the Science Advisory Panel of the U.S. Commission on Ocean Policy, the Science Advisory Board of the National Oceanic and Atmospheric Administration (Executive Committee); the Marine Fisheries Advisory Committee of the National Marine Fisheries Service (Steering Committee; Chair, Capacity Subcommittee); the Independent Scientific Review Panel of the Northwest Power Planning Council (Vice Chair). She chaired a national panel reviewing the conduct of social science within the five NOAA line offices and made recommendations for its improvement. The panel has completed its review and is now writing its report.

Two national commissions are reviewing U.S. ocean policy and developing recommendations for change: The Pew Oceans Commission and the U.S. Commission on Ocean Policy. She gave a presentation at a fishery management workshop of the Pew Commission on improvements needed to improve the cost-effectiveness of management and prepared a chapter for the ensuing workshop report. She agreed to meet with the Stewardship Working Group of the U.S. Ocean Commission and prepare testimony on the science/policy interface in fishery management.

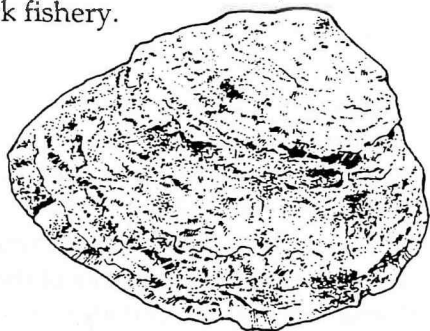
At the state level, the Oregon Ocean Policy Advisory Council (OPAC) continued its consideration of marine protected areas in Oregon waters. She participated in a panel of scientists answering questions from OPAC on economic aspects related to MPA design.

Lectures on current issues in fishery management focused on various challenges facing fishery management and attempts to achieve fishery sustainability. She gave three seminars at the Hatfield Marine Science Center: one on why fishery management is not biology, a second on the changes facing west coast groundfish management and a third on the future of Oregon's fisheries and possibilities of achieving sustainability. She gave a lecture to MRM 507, Graduate Seminar in Fisheries Management, on the transition facing American fishery governance.

Professional Service

Professional service has been directed toward contributing to the performance of research organizations, professional associations and jour-

nals. Service has continued on the Board of Trustees, Fishery Management Institute, North Sea Centre in Denmark; the Executive Committee of the International Institute for Fisheries Economics and Trade (IIFET); and as President of the International Association for the Study of Common Property (IASCP). Service was also provided as a member of the Editorial Boards of *Ecological Economics* and *Ecosystems*. As President of IASCP, Hanna inaugurated the Pacific Regional Chapter in Brisbane, Australia with a keynote speech on tradition and globalization, and its relation to common property in theory and practice. She served on the review panel of the National Fisheries Conservation Center's report on the Bering Sea Ecosystem, to be submitted as a major background document to the Marine Stewardship Council's certification process of the Bering Sea Pollock fishery.



Chris Langdon: Molluscan Aquaculture

In 2001, the main focus of the COMES Aquaculture Program at HMSC was the USDA-funded Molluscan Broodstock Program (MBP). The purpose of this program is to develop superior Pacific oyster broodstock for the West Coast shellfish industry through genetic selection. About 500 families of Pacific oysters have been produced. Research assistants Sean Matson, John Brake, Ebru Önal and crew have planted these families at commercial test sites along the West Coast, from Prince William Sound, Alaska, to Tomales Bay, California.

On average we have observed that families from selected MBP broodstock produced yields that were 9.5% greater than those of families from wild oysters, indicating that yield is a heritable trait. Selected MBP families were used in several commercial hatcheries in 2001 to produce millions of seed for large-scale evaluation. It is important to be able to identify MBP families that perform well across a wide range of environments so that they can be used by commercial hatcheries for seed production. Graduate student Ford Evans is addressing this

question by studying interactions between environment and yields of Pacific oysters. This year, graduate student Paul Lang joined the program to continue MBP research.

Abalone aquaculture has great commercial potential in Oregon, as long as an alternative to kelp can be found as a suitable abalone food because harvested wild kelp is in short supply. Graduate student Carl Demetropoulos has focused on optimizing the culture of dulse (*Palmaria mollis*) as a food for abalone. This OSU-developed technology has been adopted by a multi-million dollar abalone farm in Hawaii. A joint patent application between OSU and the Hawaiian farm for a fast-growing strain of dulse was issued by the U.S. Patent Office in 2001. Carl is planning to defend his Ph.D in spring 2002 and is presently teaching at the new Channel Islands Cal State University.

Graduate student Blaine Griffen has worked on a joint project with Ted DeWitt, EPA, to study the feeding physiology of mud shrimp and their impact on phytoplankton abundance in Yaquina Bay. Mud shrimp are very abundant in Oregon's estuaries and Blaine has shown that they have a major impact on phytoplankton concentrations due to their suspension-feeding activities. Their burrowing activities are also responsible for huge losses of shellfish habitat in Oregon's estuaries because mud shrimp soften the substrate and bury oysters and clams. Blaine successfully defended his Masters thesis in winter 2002 and will be continuing with a Ph.D at the University of New Hampshire.

On the West Coast, rearing commercially important marine species, such as sable fish, may become increasingly important in meeting our food demands as natural fish stocks decline and fishing becomes more limited. Development of techniques for rearing marine fish larvae will be important in the development of marine fish aquaculture on the West Coast, U.S. As part of this effort, graduate student Umur Önal has developed various novel microparticulate feeds for marine fish larvae, using clown fish larvae as a model species. As part of this project, Umur has established a breeding population of clown fish at HMSC that is capable of producing several hundred larvae each week, ensuring a reliable supply of larvae for diet development.

Bruce Mate: Marine Mammals

Dr. Bruce Mate and his staff use state-of-the-art satellite-monitored radio tags to study the migratory pathways, critical habitats and behaviors of endangered great whales. This year's studies resulted in discoveries that dramatically increased the current level of knowledge about several species.

In March 2001, tags were applied to fin whales and blue whales in the Sea of Cortez. The main purpose of the fin whale study was to gather any data that would help determine whether these animals are resident in the Sea of Cortez, or whether they migrate in and out of the Pacific. The tags on the fin whales transmitted for up to five months, allowing us to track these animals for a total of 11,185 miles. During that time, none of the fin whales in the study left the Sea of Cortez.

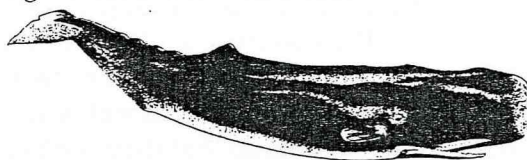
A female blue whale with a calf was tagged during this same study; her tag allowed them to track her for 213 days and 7,305 miles. She did not migrate to the known summer feeding area off California as was expected, but instead spent the summer feeding west of Baja California and in particular off Punta Eugenia. Since it was thought that the Eastern North Pacific stock of blue whales spent the summer feeding season off California, this discovery may mean that the population and calving rates of this stock, which is counted by ship and aerial surveys off the California coast, have been underestimated.

In August 2001 Dr. Bruce Mate and his staff successfully tagged a Gulf of Mexico sperm whale and eventually compiled the world's first detailed data on a sperm whale's movements. These data showed that 1) the whale stayed near the 1,000-meter contour; 2) it never left the Gulf of Mexico during 165 days and 5,116 miles of tracking; and 3) after months of staying in the area off the mouth of the Mississippi, it eventually migrated in a counter-clockwise direction around the Gulf of Mexico into the Gulf of Campeche. When presented at an informational transfer meeting, these data caught the attention of the gas and oil industry, which has a vested interest in establishing whether marine mammals change their movements or behaviors in

response to the acoustics used to detect seafloor oil and gas resources. Until now, the industry has found no objective means of measuring possible effects of acoustical surveys on normal whale movements. As a result, the International Association of Geophysical Contractors (IAGC) has entered into a collaborative study with OSU, Woods Hole Oceanographic Institute, and Texas A&M University to tag and track up to 20 sperm whales in the Gulf of Mexico during July 2002, and to monitor possible changes in their movements during acoustic tests run by an IAGC survey ship.

In September 2001, the group tagged 21 southern right whales in two separate locations off the south and east coasts of South Africa. The tags transmitted for up to 137 days, with the longest whale track being 4,362 miles. Before this study began, the only record of a southern right whale anywhere other than the coast of South Africa was a single photograph taken near Bouvet Island in 1995—now we have detailed tracklines for thousands of miles. In the first few weeks, five of the whales migrated south in parallel corridors away from South Africa. Four animals appeared to go to the edge of Antarctic sea ice; three went north to an area associated with old whaling grounds. Juxtaposition of tracklines over seafloor topography revealed that the whales are moving over undersea ridges and that three of the whales crossed the exact same ridge at different times.

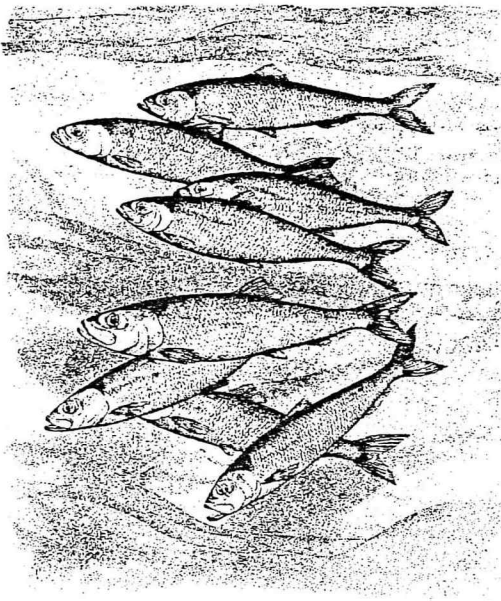
Two things that this study proved immediately were: 1) the animals from the two tagging locations are not different stocks as was previously surmised (some of the tagged animals moved from one tagging area to the other); and 2) some animals never left the coastal area, staying throughout the summer feeding season. This means that South Africa is now the first known location for studying feeding right whales in the southern hemisphere, and is also an example of animals moving back into an area where they were once abundant before whaling reduced their numbers.



Paul Reno: Fish Disease

Diseases of finfish: Dr. Reno has completed initial studies into the mechanism that is operative for the initial transmission of furunculosis in chinook salmon, and is in the process of expanding these studies to evaluate other parameters such as flow rates, fish age, etc. on the progress of disease. With Michael Banks, he is also evaluating the role of the genotype of the major histocompatibility complexes on furunculosis infection and disease. The other central focus on the dynamics of disease in populations has been on whirling disease (*Myxobolus cerebralis*) in rivers. He has constructed a stochastic model of the persistence of parasite infection in a river system in Nevada and is in the process of doing the same for the Lostine River system in northeastern Oregon. He is also initiating experiments to emulate the complex life cycle of the parasite in the laboratory.

Seafood Safety: In conjunction with Michael Morrissey in Astoria, he has been involved in experiments to evaluate the potential for inactivating bacterial pathogens in shellfish using high hydrostatic pressure. He has found that at moderate pressures for several minutes, a million-fold decrease in bacterial numbers can be achieved. These findings are currently being fine-tuned by commercial laboratories and will likely be used on a commercial scale soon.



David Sampson: Population Dynamics

Dr. Sampson's research on Oregon's marine fisheries for groundfish is focussed on two general areas: (1) stock assessment and fisheries management issues, and (2) fishermen's behavior, particularly fishing strategies and choice of fishing locations. During the summer 2001 he completed, on behalf of the Oregon Department of Fish and Wildlife, a stock assessment for the stock of Dover sole off California, Oregon, and Washington. In July the assessment was formally reviewed for the Pacific Fishery Management Council by a stock assessment review panel. During autumn 2001 he participated in the Peer Review Panel for California's Nearshore Fishery Management Plan. During winter 2002 he completed an analysis for the Oregon Trawl Commission of data from at-sea observers and fisher logbooks on groundfish discards.

During autumn 2001 Dr. Sampson taught the upper division course "Marine Fisheries" to 26 students, and during spring 2002 he taught a new graduate course "Fishery Stock Assessment Methods" to 6 students. Both courses were broadcast to Corvallis from the Science Center using a two-way television system, with the classes being split about equally between students in Corvallis and ones at the HMSC.

During autumn 2001 Yanshui Yin, one of Dr. Sampson's students, successfully defended his Fisheries Ph.D. thesis "Sensitivity of the Stock Synthesis Assessment Model: a Simulation Approach." Dr. Sampson's current graduate students are conducting research on the following topics: oceanographic influences on the survival of Columbia River salmon; dynamics of anchovy and sardine populations; rockfish food habits and feeding ecology; and a bioenergetic model of Steller sea lion growth and survival. Two of these students are scheduled to defend their theses during June 2002.

Gilbert Sylvia: Marine Resource Economics and Marketing

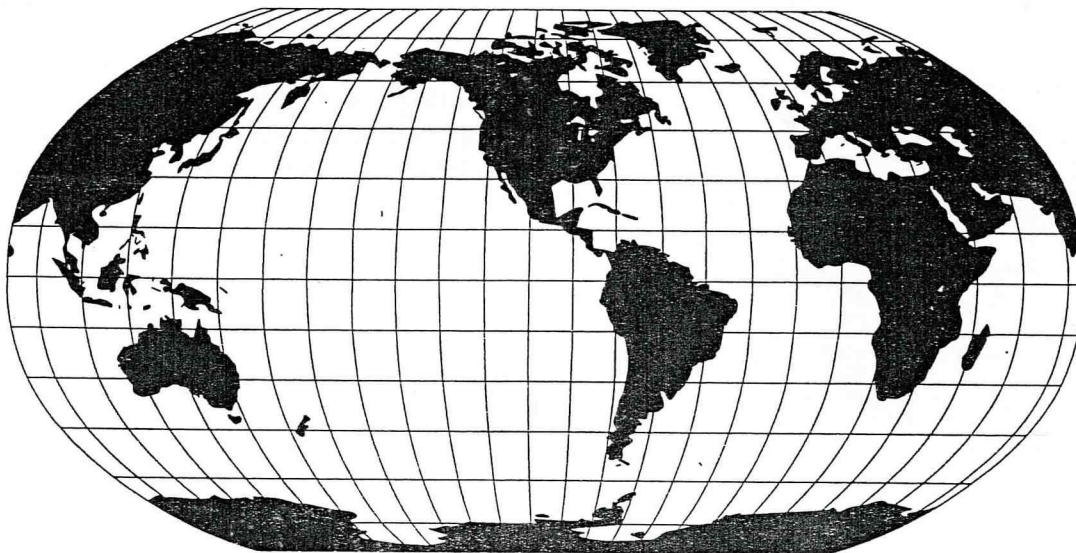
Research during the past year has concentrated on seafood marketing and fisheries management and policy. Outreach and public service has been directed at improving fisheries management, publishing and presenting marketing and management research for industry, and assisting west coast industry and agencies in developing cooperative and cost-effective fisheries research. Many of these interdisciplinary projects include close cooperation with the Astoria Seafood Laboratory, the OSU Department of Bioresource Engineering, Oregon Department of Fish and Wildlife, Cooperative Institute of Marine Resource Studies, and economists and biologists of the National Marine Fisheries Service.

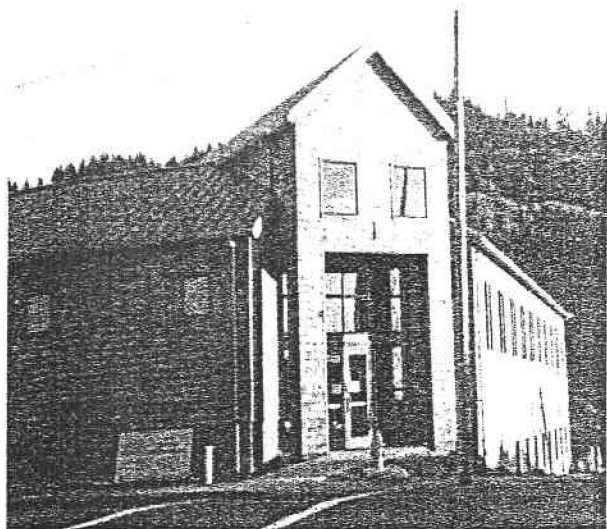
Research projects include: 1) bioeconomic modeling of the pink shrimp fishery; 2) evaluating the role of intrinsic seafood quality for improving fishery management; 3) determining incentives for successful scientists/fishermen research cooperation; 4) developing education programs for fishery managers, and 4) developing product quality and marketing strategies for the albacore tuna industry.

He is completing and publishing work from two Sea Grant-sponsored projects. The first study is a cooperative project with the Oregon Department of Fish and Wildlife and the Astoria Seafood Laboratory focusing on the economics of the Pacific pink

shrimp industry. This research includes an evaluation of the costs and benefits of finfish excluder devices, the relationship of shrimp quality, fishing, and processing strategies, and development of a bioeconomic model of the fishery. The second project is being conducted in cooperation with the Astoria Seafood Laboratory and evaluates the economic and marketing potentials for using 1) HACCP-based quality systems, 2) super chilling storage and transportation systems, and 3) time-temperature monitoring devices for value-added harvesting and processing of Pacific whiting and albacore tuna. They have begun a new USDA project focusing on integrating community development, market and product quality research, and sustainable harvesting practices. Primary focus is shellfish and albacore tuna. They have also initiated a study looking at the costs, benefits, and risks associated with developing cold storage along the Oregon coast. Finally, we are conducting two projects with the New Zealand Seafood Industry focusing on developing bioeconomic management models for the Challenger scallop fishery, and organizing a conference on follow-up projects for educating fishery managers for 21st century fisheries.

These research projects have generated over \$900,000 of extramural funding and are supporting six graduate students (2 Ph.D. and 4 Masters' candidates) from the Departments of Agricultural and Resource Economics, Marine Resource Management, and Fisheries and Wildlife.





Astoria Seafood Laboratory
Michael Morrissey, Director

The OSU Seafood Research laboratory is part of the Coastal Oregon Marine Experiment Station (COMES) and is involved in seafood research, graduate student training at the M.S. and Ph.D. level and is charged with transferring information to the seafood industry through publications, workshops and meetings.

Research activities over the past year have included:

Value-added products. Research continues in the area of value-added products from albacore tuna. A new methodology termed 'Culinology' using research chefs to help develop new products has been utilized to develop several products. Ingredient technology research with surimi has led to potential use of new compounds in the manufacture of surimi.

Seafood Safety. The use of high-pressure processing for the reduction of *Vibrio parahaemolyticus* in Pacific oysters has shown the efficacy of this process. The use of e-beam irradiation has proven to be an effective method for pasteurization of surimi. The elimination of *Listeria* in smoked fish was determined through the use of e-beam irradiation as well as acidified sodium chlorite dips.

Seafood Processing/Quality. New processing methods for the recovery and utilization of fish proteins through manipulation of pH have shown the potential of this method. The determination of lipid content in albacore was accomplished and can be potentially used for marketing purposes.

Outreach

The 10th Annual Surimi School was held April 16-18. It was co-sponsored by 21 companies and had over 100 attendees. The 2nd annual Surimi Forum was held on April 15. An Oregon Pacific Whiting Seminar sponsored by Oregon Department of Agriculture was held in Korea May 14 and 16. The second Scales and Shells seafood information workshop was held May 7-8 and attended by the Portland Culinary Alliance.

Staff and Students

Dr. Myeong Choi from You University (Korea) continues as a visiting professor here at the Seafood Lab. Graduate students that completed their degree over the past year were Jacek Jaczynski, PhD (Food Science), Hakan Calik, MS (Food Science), Jenny Hansen, MS (Food Science). Both Jacek and Hakan won first and second place in the Seafood Division student paper competition at the annual meetings of the Institute of Food Technologists. Julia Mabry joined the staff as a part-time lab technician working with Dr. Park.



Cooperative Institute for Marine Resources Studies

Clare Reimers, Director

Jessica L. Waddell, Fiscal and Faculty Personnel Administrator

Established in 1982 under a Cooperative Agreement, the OSU/NOAA Cooperative Institute for Marine Resources Studies (CIMRS) brings together university and agency expertise to address science and management issues relating to fisheries, ecosystem health, aquaculture, oceanography, marine-technology and related fields. The Institute is governed by an Executive Board and meets quarterly with its Science Advisory Council. Membership in the Institute includes university Faculty Research Assistants, Research Associates, Post-doctoral Fellows, Professors and agency principal investigators who collaborate with research projects funded through the Institute.

In January 2002, CIMRS announced a request for proposals on U.S. West Coast groundfish and their habitats with research priorities in the area of stock assessment, socioeconomic factors relating to groundfish harvesting, ecological impacts of fishing, ecosystem and climate effects on stock productivity, technological innovations for surveys and trawling, and management strategies. Three proposals were funded after competitive review, all of which have some component of support for OSU students and faculty in Oceanography, Fisheries and Wildlife, and COMES. Similar funding opportunities are anticipated in the coming year.

Investigators from a wide range of OSU departments and divisions of the NMFS Northwest Fisheries Science Center met at the Hatfield Marine Science Center for a one-day intensive workshop on aquaculture and fish health. Scientists from both organizations benefited from the exchange of information on the status of current research and areas of future concern.

In April, CIMRS hosted its first speaker as part of the Distinguished Lecturer Series—Dr. David Marcogliese, Environment Canada, "Applications of Parasitology to Environmental and Ecological Research".

Six graduate students in the College of Oceanic and Atmospheric Sciences and the Dept. of Fish and Wildlife received partial support from CIMRS both at the Masters and Doctorate level. Throughout the year, CIMRS also hosts short visits from graduate students attending universities around the U.S. who are involved in similar research efforts. This year, graduate students visited from Woods Hole Oceanographic Institute, Lamont Doherty Earth Observatory and Universidad de Azores.

The cooperative research projects supported in FY 01-02 totaled over \$3M and were from two NOAA research offices. Highlights are presented below.

Oceanic and Atmospheric Research Office/Pacific Marine Environmental Laboratory

Ocean Environment Research Division/VENTS PROGRAM

Acoustic Monitoring (Dr. Robert Dziak, Matt Fowler, Joe Haxel, Andy T.K. Lau, Dr. Haru Matsumoto)

In February 1999, a consortium of U.S. investigators began long-term monitoring of Mid-Atlantic Ridge (MAR) seismicity between 15°N and 35°N. The experiment uses six autonomous hydrophones moored within the SOFAR channel on the MAR flanks. The hydrophones record the hydroacoustic tertiary phase or T-wave of oceanic earthquakes from throughout the Atlantic basin. A surprising result of the waveform analysis was the identification of P- arrivals from earthquakes outside the Atlantic Ocean basin. The hydrophones detected P-waves from global earthquakes with magnitudes from 5.8 to 8.3 at epicentral distances ranging from 29.6 to 167.2 degrees.

A new compilation of multibeam bathymetry data and preliminary structural analysis for the Gorda plate reveals pervasive, and in places recently active, dip-slip and strike-slip faulting, which appears to be accommodating internal deformation of this small plate fragment. Based on the fault orientations and styles of faulting, the plate appears to be segmented into three structural domains, with the central, highly deformed segments accommodating the largest amount of deformation through sinistral

strike-slip and reactivated dip-slip motion faulting. Whereas previous deformation models suggest a structurally segmented or broken plate, our results suggest a significantly more, but not totally coherent style of internal deformation.

Sounds in the Sea, a new project developed this year, features an autonomous hydrophone at Pioneer Seamount. This continuous exploration of sound has been made available in near real-time on the World Wide Web for the general public as well as scientists from other universities and agencies. In conjunction with this project, CIMRS provided support for a hands-on workshop for middle-school and high-school students sponsored by OSU's Saturday Academy, a non-profit, pre-college education program. Sound in the Sea was a unique two-session hands-on engineering workshop that emphasized marine biology and acoustics. Students explored the world of underwater sound and actually made a simple underwater hydrophone.

Marine Mammal Acoustics (Dr. David Mellinger, Sharon Nieukirk, Sarah Heimlich)

In order to acoustically monitor areas of the world ocean not covered by existing fixed hydrophone arrays, CIMRS and PMEL scientists have developed autonomous moored hydrophones to record acoustic energy from both underwater seismic activity as well as that from whale calls. These instruments are capable of recording frequencies from 1 - 20,000 Hz, and depending on the sampling rate, can record data for over a year before servicing is required. The hydrophones are designed to be deployed as an array of independent instruments whose geometry can be determined by the needs of the experimenter in order to localize acoustic sources of interest.

Six autonomous moored hydrophones were placed in the Gulf of Alaska in October 1999 with the specific goal of detecting blue, fin, humpback and northern right whales in this region. Data from the hydrophones were recovered in May 2000. Five of the six instruments were re-deployed in the Gulf for another year. Preliminary analysis of the first seven months of data showed that both northeastern and northwestern blue whale calls were recorded on these instruments as were sounds from finback and humpback whales and an unidentified species of whale. Analysis of a full year of data from this region will greatly enhance our knowledge of the presence/absence and seasonality of large whales in the

Gulf of Alaska.

In March 2000, as part of a collaborative effort with investigators from Woods Hole Oceanographic Institution and Lamont Doherty Earth Observatory, six Atlantic portable hydrophones were recovered from along the Mid-Atlantic Ridge and re-deployed for another year of data recording. Preliminary analysis of the data revealed numerous calls from at least four species of whale (blue, fin, minke, and humpback). All calls were detected most often in the winter, and the blue and fin whale calls were detected most often on the northern hydrophones. Man-made sounds from ships, and especially seismic airguns often obscured biological sounds, particularly during the summer months. Whale vocalizations were recorded by this array despite its location in a very remote, oligotrophic part of the Atlantic Ocean. This array will remain in place through 2002, and we plan to increase the sample rate of the hydrophones to clarify the source of sounds we have currently classified as unknown.

Automatic signal detection methods were developed to identify whale calls in large data sets. Dr. David Mellinger's automatic detection program, Ishmael, includes the ability to detect calls by use of matched filters, spectrogram correlation or energy detection. This software program has been used to detect calls of blue and minke whales from these Atlantic Ocean hydrophone records. Analysis of these data continue, with the goal of assessing seasonal distribution of these species.

CIMRS hosted an international undergraduate intern from the Azores to exchange data on whale distributions. Data from the Azores combined with data from the Atlantic hydrophone array will give a more comprehensive picture of whale distributions/seasonality in the area.

Geophysical Monitoring (Andra Bobbitt, Dr. William Chadwick, Susan Merle)

NeMO (New Millennium Observatory) a new multidisciplinary project centered at Axial Volcano is in its fourth year. This project has established several arrays of seafloor and water-column instruments, time-lapse cameras, and sample collection systems for documenting chemical, biological, hydrographic and geologic changes in and around the Axial caldera. One year of data was downloaded from the array of extensometers at South Cleft, and processed and analyzed at sea. The data showed resolution of measurements to be ± 2 cm, and that no

deformation events occurred during the first year. Real-time camera and sensor data from the NeMO Net were transmitted successfully for part of the year. When CIMRS scientists were at sea servicing the observatory in 2001, an interactive Web link to the support ship was featured at the Hatfield Marine Science Center in cooperation with NOAA's new Office of Exploration. This web link provided close to real-time information to educators, students, and researchers on the results of each day's activities during the cruise, and also provided answers to specific questions from a land-based audience.

Hydrothermal Emissions (Leigh Evans, Ron Greene)

On Sept. 7, 2001 an eruption was detected and located in the Middle Valley of the Endeavour segment of the Juan de Fuca Ridge. Water-column samples from Middle Valley taken aboard the R.V. Tully were analyzed to determine the nature of the seismic activity in October 2001. The 21-day swarm produced no detectable chemical enrichment of the water column however.

An improved sampling method design was created for vent fluid sampling using the ROV ROPOS. Testing of the sampling unit during the 2001 field season proved the unit to be highly successful; minor modifications will be made to improve performance for next field season. Numerous water-column samples collected from the last three years of NeMO cruises were analyzed. In particular samples from a new anhydrite vent, Vixen, near the south end of Axial caldera, showed a much lower concentration of helium than other vents in the immediate vicinity.



National Marine Fisheries Service/Northwest Fisheries Science Center

Fish Ecology (Becky Baldwin, Leah Feinberg, Julie Keister, Greg Krutzikowsky, Todd Miller - GRA, Cheryl Morgan, Suzan Pool, Anders Røestad, Todd Sandell, Dr. Robert Schabetsberger, Tracy Shaw, Mitch Vance; Dr. Charles Miller and Dr. William Pearcy, Joe Fisher, Doug Reese-GRA, COAS)

The U.S. GLOBEC Program continued its funding of a multiyear monitoring project of long-term observations, mesoscale surveys, process studies of euphausiids and retrospective analysis of zooplankton species of the central Oregon shelf ecosystem. This project studies two species of euphausiids in order to correlate population density and distribution with ocean temperature and phytoplankton biomass. Euphausiids are key forage species for Pacific whiting, rockfish, and salmon. CIMRS scientific staff participated in several short-duration survey cruises covering the region from Newport to Crescent City; analysis of the MOCNESS net samples and additional experimental studies on the targeted species are being conducted by CIMRS research assistants. A high frequency acoustics instrument is towed on these cruises to study spatial variations in biomass of euphausiids and other large zooplankton in relation to hydrographic features. Researchers found high correlations between volume backscattering of zooplankton and total volume of zooplankton captured in MOCNESS nets. Thus, they are now able to convert acoustics data into zooplankton biomass data. In a related project, CIMRS research on the distribution and trophic interactions of juvenile salmonids and associated taxa off the northern California and Oregon Coasts addresses questions about (1) the current and historical relationship between marine fish predator/prey field communities during the summer period (2) the relationship between changing ocean conditions and the marine predator/prey field community and how these factors affect juvenile salmon survival. CIMRS is providing support for a graduate student in Fisheries and Wildlife to participate in this research, concentrating on the diet of forage fish, i.e., sardines, smelt, herring. CIMRS scientists studying the patho-

gens and parasites of both juvenile salmon and their competitors and predators help determine trophic linkages not easily identified through gut content analysis. During the coming year a postdoctoral fellow will integrate the multiyear field and laboratory data into a comprehensive ecosystem model that incorporates data results of the physical environment and trophic dynamics of these fish.

CIMRS scientists made good progress on all aspects of the cooperative study on the feeding and growth of juvenile salmonids off the Washington and Oregon coasts. Analysis of stomach contents

from juvenile salmonids collected in 2000 and 2001 revealed spatial and temporal variability in the diet and relation of diet to available prey. Stomach contents of predators of juvenile salmonids were also analyzed. Physical oceanographic data were collected to monitor the habitat of these fish as well and growth rates were analyzed and compared for tagged and untagged salmon. An integrated, multiyear database will help fishery scientists determine which physical and biological processes influence salmon growth and survival and possibly what species and stocks would be most affected.

**Environmental Protection Agency
Office of Research and Development
National Health and Environmental Effects
Laboratory
Pacific Coastal Ecology Branch**

Walt Nelson, Branch Chief

The Newport EPA research laboratory is part of the Western Ecology Division, located in Corvallis, Oregon. The research mission of the Pacific Coastal Ecology Branch is to develop procedures to assess the cumulative and interactive effects of human activities on the ecological resources of estuaries of the Pacific Northwest.

The high rate of human population growth in the Pacific Northwest is subjecting estuaries and coastal watersheds to many anthropogenic stresses. The amount of this stress will continue to increase as population growth continues and the Northwest further develops economically. Stressors which jeopardize the ecological sustainability of estuarine and coastal watershed resources include watershed alterations (e.g., urbanization, land use alteration, road construction, agriculture and forestry practices) such as increased nutrient and sedimentation loads, habitat loss and alteration (e.g., landfill and dredging), planned and unplanned biotic introductions, pollution, anthropogenic-caused algal blooms, and extreme natural events such as floods, droughts, and disease outbreaks. Determining the effect of stressors is complicated by the fact that they have differ-

ent ecological effects and act at various, often overlapping, spatial and temporal scales.

The specific research focus for the Coastal Ecology Branch is to define ecological processes and to develop and evaluate models to predict stress-response relationships for Pacific Northwest estuaries at a range of spatial and temporal scales. The research seeks to evaluate how specific estuarine habitats, and particularly seagrasses and burrowing shrimp, respond to a range of potential stressors which may lead to habitat alteration. Additionally, the research effort seeks to understand the influences of these stress factors at spatial scales from local to regional, and seeks to develop indicators of ecological condition which may be used to evaluate estuarine status across multiple spatial scales. Current projects include research on:

- Estuarine biota-habitat relationships
- Responses of estuarine ecological engineering species (seagrasses, burrowing shrimp) to multiple abiotic stressors
- Factors controlling distribution of native and exotic seagrass species
- Effects of the nonindigenous seagrass *Zostera japonica* on inorganic nutrient flux in the Yaquina Bay estuary
- Range expansion and reproductive ecology of *Zostera japonica*, a non-native eelgrass in Yaquina Bay
- The impact of sediment sulfides on seagrasses and associated fauna

- Evaluation of watershed versus oceanic nutrient inputs to Pacific Northwest estuaries
- Assessment of distribution of non-indigenous species in west coast estuaries

Research activities include large-scale (within and among estuaries) field studies and laboratory investigations of relationships between stressors and effects. PCEB administers the Western Coastal Environmental Monitoring and Assessment Program, which is part of the National Coastal Assess-

ment being conducted by EPA. The program is a five-year research effort to determine the condition of estuarine and near coastal resources of Washington, Oregon and California, with preliminary efforts of two-year duration in Alaska and Hawaii. Research staff is currently 13 federal employees, 2 EPA postdoctoral fellows, 1 National Research Council postdoctoral fellow, and 14 technical and clerical contract support staff.

Oregon Department of Fish and Wildlife

Marine Resources Program Patricia M. Burke, Program Director

Staff members of the Department of Fish and Wildlife's Marine Resources Program are located in the Newport headquarters and at Astoria, Charleston, Tillamook, and Brookings field offices with seasonal staff at all ports along the Oregon coast. Staff includes about 45 year-round full-time employees and up to 60 seasonal employees.

Marine Resources Program (MRP) is organized into four sub-programs including: Administration, Resource Assessment and Analysis, Resource Monitoring and Sampling, and Data Services. Administration has experienced the biggest change in staffing this past year. Jim Golden, acting Marine Resources Program Director retired in Fall of 2001 and Rod Kaiser became acting director. A new director, Patty Burke, has been hired and began on June 3, 2002.

The Pacific Fishery Management Council (PFMC) increased restrictions on groundfish fisheries in 2001 in response to the continuing groundfish crisis. Additional groundfish stocks were listed as overfished under the Magnuson-Stevens Fishery Conservation and Enhancement Act. The following stocks are now listed as overfished under the Act: canary rockfish, cowcod, bocaccio, Pacific Ocean perch, lingcod, widow rockfish, darkblotched rockfish, and yelloweye rockfish. In addition, ODFW began regulatory changes that would place new limitations on the nearshore live fish fishery. These changes

include placing nearshore rockfish under the umbrella of the state's Developmental Fisheries Program and beginning work on developing an interim nearshore management plan and a limited entry program to control the number of participants in the fishery. In September 2001, the Oregon Fish and Wildlife Commission took the first step toward developing the limited entry program by adopting a control date defining when fishers needed to be in the fishery in order to qualify for future participation. Work is continuing on the program with an anticipated adoption date in fall 2002.

To respond to the growing groundfish crisis, the Marine Resources Program continued and expanded several research initiatives beginning in 2000. These included: 1) studies of modified trawl gear designed to safely eliminate unwanted bycatch or restricted species; 2) a study designed to collect and validate length and age at maturity of several rockfish species and petrale sole - information needed to improve stock assessments; 3) a nearshore fixed gear survey to compare three different reef areas on the south coast; 4) a lingcod handling mortality study; 5) ROV surveys of fish populations on nearshore reefs, focusing on developing survey methods; 6) hook and line surveys of black rockfish on the southern Oregon coast; 7) a study to determine the pit tag retention and tagging logistics for black rockfish, in preparation for a tagging study initiated in 2002; 8) observer trips on vessels participating in Oregon's growing sardine fishery. Research cooperators have included OSU, National Marine Fisheries Service, and commercial fishermen.

In addition to work with groundfish fisheries, the Marine Program undertook management initia-

tives with the Dungeness crab and pink shrimp fisheries, the two highest value (by species) commercial fisheries in the state. Staff began work on developing a pot limitation program for the Dungeness crab fishery. The fishery already limits the number of participants; this program would limit the total number of pots that participants can use while executing the fishery. The shrimp fishery saw major changes in the use of bycatch-reduction devices. These were required for the first time in the history of the fishery on August 1, 2001. The primary concern was reducing the amount of canary rockfish bycatch in the shrimp fishery.

The MRP's salmon activities are directed towards two areas of study. The Ocean Boat Sampling Project monitors and samples the ocean recreational, ocean boat fishery and the commercial troll salmon fishery. The project has recently expanded coverage to most Oregon coastal ports and time periods (March-October) to assess the recreational ocean fishery, improve sampling efficiency, accommodate increased data needs, and manage affected stocks. The project integrates its activities with MRP's marine recreational non-salmonid finfish project to

meet coastwide biological sampling objectives for lingcod, black rockfish, and a variety of other species. In addition, the project has implemented an intense charter vessel "ride-along" at-sea observer program, since 1999, to directly assess the new Oregon ocean selective (hatchery fin clipped only) recreational coho fishery.

A second salmon project conducts management and stock assessment activities to evaluate coastal wild Chinook populations as required under the Pacific Salmon Treaty (PST) and the Coastal Chinook Management Plan. In 2001, the Coastal Chinook Research and Monitoring Project continues to build on field work that directs activities in critical stock research and development of field techniques to more closely determine actual ocean and spawning escapement, forecasting of adult abundance, and exploitation rates for these stocks. Oregon's coastal Chinook stocks from the Elk River, north to the Columbia River are heavy contributors to ocean fisheries off Canada and SE Alaska as well as off Oregon. Pacific Salmon Treaty (Pacific Salmon Commission) funding has increased substantially since 1999 to support this work.

National Marine Fisheries Service

Fisheries Behavioral Ecology Program,

Alaska Fisheries Science Center

Allan W. Stoner, Program Manager

The Fisheries Behavioral Ecology Program conducts experimental research directed toward understanding the role that behavior plays in regulating distribution, abundance growth, and survival of fish species and their interactions with fishing methods and gear. The goal of the Program is to provide the critical information needed to improve survey techniques, to improve predictions of population abundance and survival, and to conserve populations of economically significant marine resource species and their habitats. Investigations conducted during the last year continued under two long-term research themes: bycatch stress and fish ecology.

Experimental Analysis of Capture Stress

Investigation of the key principles which control mortality in fish when they are discarded from fishing operations continues to be a primary research focus for Michael Davis, in collaboration with

Bori Olla (OSU) and Carl Schreck (OSU). Recent work with walleye pollock, sablefish, lingcod and halibut has shown that 1) environmental factors, such as light, temperature and air can interact with gear stressors to magnify mortality; 2) susceptibility to stress and mortality is species- and size-specific; and 3) mortality may be delayed, such that it is difficult to estimate through traditional "capture and hold" approaches conducted aboard vessels or with net pens in the field. Cliff Ryer, assisted by Michele Ottmar and Erick Sturm, is conducting research on the fate of fish which escape trawl gear through codend meshes. Experiments that simulated entrainment and escape from a trawl demonstrated that juvenile walleye pollock and sablefish suffered significant behavioral impairment, which ultimately rendered them more vulnerable to predation. This suggests that there may be a large and unobserved source of fishing mortality associated with bycatch escape devices in towed gear.

Vision and Fish Behavior

The role of vision in fish foraging continues to be an important research topic under investigation

by Cliff Ryer. Infrared monitoring systems developed for this research have allowed experimentation with fish under the full range of light levels which they encounter at various depths in the ocean, day or night. Recent research demonstrated that juvenile halibut, like juvenile walleye pollock and sablefish, while being highly visual foragers, are capable of capturing planktonic prey in complete darkness. This may play a vital role in feeding, growth and survival during periods of prolonged darkness at depth or in winter at high latitudes.

Growth Studies

Growth studies were conducted by Sue Sogard and Mara Spencer during the last year to look at the trade-off between growth and energy storage mechanisms in age-0 sablefish. Lipid allocation was highly dependent upon fish size, but was also modified by trade-offs with growth capacity under different environmental conditions. New experiments have been initiated to examine the role that temperature plays in the feeding, growth, and recruitment of Pacific halibut, with emphasis on low temperatures encountered in the Bering Sea nursery grounds.

Habitat Studies with Flatfishes

Al Stoner and Michele Ottmar completed experiments during the last year to examine relationships between sediments and juvenile rock sole and Pacific halibut. Both species demonstrated strong size-dependent changes in sediment choices during the first year of life. Laboratory studies combined with survey work in Kodiak, Alaska, are being used to define the habitat requirements for newly-settled flatfishes. The presence of structures provided by sessile organisms may also influence habitat suitability for young fishes. Mesocosm experiments showed that juvenile rock sole and halibut have a strong preference for structured habitats created by sponges, bryozoans, bivalve shells, and sand waves. Subsequent experiments conducted by Al Stoner, Cliff Ryer, and Rich Titgen show that habitat structure mediates the survivorship of age-0 flatfishes in the presence of their natural predators. These are structures potentially removed or modified by fishing gear.

Staff changes

Dr. Susan Sogard departed HMSC for the Santa Cruz Laboratory of NMFS in October 2001, after nearly 10 years with the Fisheries Behavioral Ecology Program. During that time she authored many papers on walleye pollock and sablefish, spanning the topics of feeding, growth, mortality, and habitat utilization. Dr. Thomas Hurst joined the program in March 2002, to lead studies on the behavior and ecology of walleye pollock, sablefish, and flatfishes. He received his Ph.D. from The State University of New York at Stony Brook in 2000, and is an expert on temperature-related ecology of fishes. Scott Haines joined the technical staff in March 2002.



National Marine Fisheries Service

Northwest Fisheries Science Center
Newport Research Station (NRS)

I. Administration (Bruce McCain, NRS Facilities Manager)

The new Captain R. Barry Fisher Building should be completed by the end of August, 2002. This two-story building and adjoining warehouse, located on the northeast corner of the HMSC campus, will house some of the staff of the NWFSC who will move in during September and October, 2002. The two-story building has 23 offices, two workrooms, an information technology support room, conference room, and lunchroom. The warehouse includes a workroom, a restroom facility with showers and dive lockers, a necropsy facility, a staging room, a walk-in freezer, and extensive dry storage space. A groundbreaking and dedication ceremony was held on October 7, 2001, and was attended by U.S. Senator Ron Wyden, senior administrators of NOAA Fisheries, officials from OSU and over 100 community members, including Captain Fisher's widow, Carol.

An emergency response plan was prepared this year for the NRS, and an emergency response team was formed. The team consists of building captains, floor wardens, and an emergency coordinator.

II. Environmental Conservation Division (EC) (NWFSC: Mary Arkoosh, Ethan Clemons, and Anna Kagley; and CIMRS Fellow: Coral Stafford)

Research conducted by the staff of the EC at the HMSC continues to focus on interrelationships among host resistance, environmental stressors (e.g. pollution), and infectious pathogens. Previous research showed that exposure to pollutants can lead to defects of the immune system and to an increase in disease susceptibility in juvenile chinook salmon (*O. tshawytscha*). Whether pollution influences natural disease outbreaks in host populations, including salmon, is currently unknown. However, recent studies of natural fish populations by other researchers have demonstrated that infectious disease-induced mortality can significantly affect the structure of a host population by reducing its numbers.

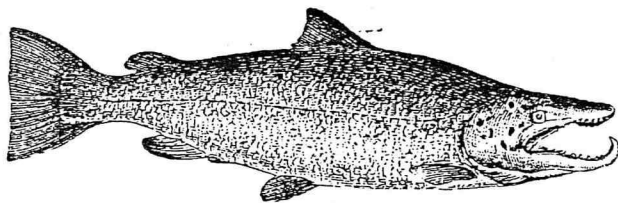
To understand the impact of disease in salmon populations, we have evaluated the prevalence of

pathogens in various populations of juvenile salmonids. Our studies of juvenile fall chinook salmon from several Oregon and Washington coastal estuaries reveal that selected bacterial, parasitic, and viral agents are integral components in all systems studied, although their intensities and prevalences varied.

Since we found that pathogens are integral components of all systems studied, we are currently using mathematical and spatially explicit modeling techniques to examine the relationships among environmental stressors and parasite burden and infection rates in wild host populations.

We are conducting laboratory studies to estimate the efficiency of the transfer of a microparasite from an infectious individual to a susceptible individual. These laboratory studies will allow us to measure the transmission coefficient, Beta (B) in salmon independent of in situ intra- and inter-species population dynamics. Susceptible salmon of varying densities will be exposed to *V. anguillarum* from a single infected individual under controlled conditions. The population will be monitored for pathogen infection over time. Future laboratory studies will examine how environmental stressors may alter Beta. This epidemiological test will be used to gauge the validity of the field study results and may uncover other parameters relevant to the analysis of the field studies.

Other studies include addressing the possible effects of dams on immune function. One hypothesis being tested is that adult return rates of Snake River spring/summer chinook salmon are substantially decreased due to detrimental effects of passage through bypass systems and by transportation of fish collected at Snake River dams. These studies are being performed in conjunction with scientists from NWFSC's Fish Ecology (FE) and Resource Enhancement and Utilization Technologies Division (REUT) divisions, and compare the disease susceptibility of spring chinook salmon smolts that passed through the bypass system on only one dam, with that of



smolts that passed through the bypass systems of several dams. The disease susceptibility of spring chinook salmon smolts barged fish without other salmonids vs. these smolts barged with steelhead juveniles is also being compared.

III. Fish Ecology Division (FE) (NWFSC: Robert Emmett, and Drs. William Peterson, Kym Jacobson, Ric Brodeur, and Dan Bottom; CIMRS Fellows: Cheryl Morgan, Julie Keister, Leah Feinberg, Greg Krutzikowsky, Suzan Pool, Anders Røestad, Robert Schabetsberger, Tracy Shaw, Mitch Vance, Jesse Lamb, Rebecca Baldwin, and Todd Sandell; Post Doctoral: Alex DeRobertis and Patrick Ressler; OSU Graduate Students: Todd Miller and Jaime Gomez-Gutiérrez)

The staff of the Fish Ecology division at the HMSC are all members of the Estuarine and Ocean Ecology Program (EOEP). Several research efforts are described below. They include both monitoring and process studies and all involve extensive collaboration with scientists from Oregon State University (OSU), Oregon Graduate Institute, Department of Fisheries and Oceans/Canada, NOAA/NWFCS/Seattle, Humboldt State University, University of Hawaii, and the University of Maryland.

The EOEP investigates the interactions and ecological linkages within and between the California Current and Columbia River plume. The focus of the research is to determine how the plume and accompanying ocean conditions effect growth and survival of juvenile salmonids. The project studies salmon feeding, the relationships between feeding preferences and prey, and the potential impact of salmonid predators on salmon survival. Interrelationships among salmon, sardines, anchovy and herring are also being studied. An ecosystem-based approach is being used to investigate the biotic and abiotic factors that control growth, distribution, health and survival of important fish species in addition to the processes driving population fluctuations. Ultimately, the ecosystem-based research will be applied to management of fish stocks off the Oregon coast.

Long-Term Coastal Monitoring

Dr. William Peterson led a research program

involving at-sea sampling 2-3 times per month at stations from 1 to 25 miles west of Newport. Temperature and salinity profiles were measured at each station, and samples were taken for later analysis of nutrients, phytoplankton and zooplankton. From 1996-1998, zooplankton biomass was low and there was a high incidence of subtropical species in coastal waters. Euphausiids, a key forage item for rockfish, salmon, and Pacific whiting were in low numbers and spawned only once per year, in late summer. Beginning in 1999, commensurate with cool ocean conditions, zooplankton biomass began to increase and the euphausiid spawning season was expanded to include April through September. In 2001 and 2002, spawning was seen in February, the earliest ever recorded. Recent analysis of zooplankton data shows a high correlation between coho salmon survival and zooplankton species composition. When waters off Newport are dominated by zooplankton species with subarctic Pacific (cold water) affinities, salmon growth and survival is high, but when the zooplankton community has an anomalously high concentration of warm water species, coho salmon do poorly.

GLOBEC Investigations

Dr. Peterson and four CIMRS fellows conducted several GLOBEC oceanographic cruises during this past year. The team surveyed hydrography and zooplankton in relation to mesoscale oceanographic features off Central and Southern Oregon. The main purpose of these cruises was to determine if upwelling jets, upwelling fronts, warm core eddies, and cold water streamers associated with topographic structures (e.g., Stonewall Bank, Heceta Bank, Cape Blanco) are hydrographic features that result in higher than normal concentrations of nutrients, phytoplankton and zooplankton. Consistently high concentrations of euphausiid larvae and juveniles were found on the Heceta Bank, as was offshore dispersal of coastal zooplankton at and south of Cape Blanco.

As part of the GLOBEC cruises, a high frequency acoustics package (HTI Inc.), with 38, 120, 200 and 420 kHz transducers, was towed to study spatial variations in biomass of euphausiids and other large zooplankton in relation to hydrographic features. Dr. Peterson and a CIMRS fellow sampled

the zooplankton at 20 stations per cruise to verify the identity of acoustic targets. They determined that there is a high biomass of euphausiids on the continental shelf near the sea floor during daytime hours and that these animals migrate to the sea surface at night. In offshore waters, euphausiids live between depths of 200-300m by day but migrate to the sea surface at night. Copepods were most abundant on the shelf, but showed very little difference in preferred depths by day or night. Researchers found high correlations between volume backscattering of zooplankton and total volume of zooplankton captured in MOCNESS nets. Thus, they are now able to convert acoustics data into zooplankton biomass data.

Companion GLOBEC studies by Dr. Ric Brodeur, Dr. Kym Jacobson, and Robert Emmett continued to investigate the distribution, abundance, growth, food habits, and condition of juvenile salmon off the coasts of Southern Oregon and Northern California. Determination of the associated pelagic nekton, including potential competitors and predators, will provide clues regarding the relationship between oceanographic conditions and the abundance and health of salmon during their first summer at sea. A CIMRS fellow is also examining the distribution and habitat associations of nekton. Todd Miller (a graduate student) is examining the feeding relationships among salmon and other nekton.

Dr. Jacobson, with the assistance of a CIMRS fellow, is conducting an additional study, funded by U.S. GLOBEC, to incorporate macroparasite data of juvenile salmon off the Southern Oregon and Northern California coasts into trophic studies of the juvenile salmon food web. These data on parasite assemblages can provide long-term feeding habit information about juvenile salmon and their predators and competitors, augmenting the group's ecosystem approach to understanding factors that contribute to salmon population fluctuations.

Bonneville Power Administration (BPA) Investigations

The BPA is funding a program to study predator/prey relationships among hake, mackerel and juvenile salmon off the coasts of Oregon and Washington under the leadership of Robert Emmett. During the spring and summer, cruises are being conducted every 10 days off Willapa Bay, the Columbia River, and Cape Falcon. The cruises sample predators and prey with a pelagic trawl at night to

determine if hake and mackerel are significant predators on juvenile salmonids. The hypothesis being tested is that recent increases in the abundance of predators may explain the recent declines in the abundance of juvenile salmonid. A CIMRS fellow analyzes the stomach contents of the predatory fishes.

Another investigation is examining the correlation between salmon growth and survival and the unique physical and biological characteristics of the Columbia River plume. This effort is being performed in collaboration with scientists from the Oregon Graduate Institute in Beaverton. Project scientists are asking a number of questions about the plume:

- Are juvenile salmon more abundant there than elsewhere along the Washington-Oregon coast? (Early sampling indicates they may be. More than half of the juveniles caught in June and September were netted in the plume.)
- Are growth rates and overall weight and length higher in the plume?
- Do higher nutrient concentrations in the plume enhance food availability?

Program scientists are collecting information on the distribution and abundance of salmon and other species in the upper water column, both in the plume and in coastal waters. These data will be correlated to ocean conditions and compared to data collected in the 1980s. Salmonid growth, condition, pathogen load, food habits, and prey fields are being measured and related to ocean conditions in and around the plume. Scientists involved with this work include Drs. Bill Peterson, Ric Brodeur and Kym Jacobson. Also, a CIMRS fellow developed and maintains the extensive Microsoft Access database of physical and biological data and works with Dr. Peterson on analysis of zooplankton samples. A CIMRS fellow analyzes juvenile salmon stomach contents in collaboration with Dr. Brodeur.

In another project funded by the BPA, Dr. Peterson and a CIMRS fellow studied juvenile salmonids in the Washington/Oregon coastal zone. After three years of sampling, they established that coho and chinook salmon juveniles are restricted entirely to coastal waters. Chinook were found at stations with shallower water depths than coho. In fact, through analysis of their data along with historical data collected by Dr. Bill Pearcy of OSU, they established that the two species maintain a constant depth separation — that is, coho juveniles were

found at stations farther offshore than stations where chinook juveniles were found. Juvenile salmonids were found in zones with the highest copepod biomass. Though juvenile salmonids do not feed on copepods, they are living in zones where productivity is highest and, presumably, their preferred prey have high abundance (small juvenile fishes, amphipods, euphausiids, crab larvae, and pteropods).

Dr. Kym Jacobson, with the assistance of a CIMRS fellow, is evaluating the ecology of disease and the importance of disease processes that affect salmon in the estuary and nearshore ocean. With funding from the BPA and the U.S. GLOBEC Program, they are examining ocean juveniles along the Northern California coast to determine the potential contribution of salmon pathogens (viruses, bacteria and macroparasites) to growth and survival of salmon.

Salmon Recovery Planning

Formal recovery planning for salmon populations listed under the Endangered Species Act (ESA) is a complex process involving both scientists and policymakers. NMFS is forming recovery teams to create plans for all listed salmon in several broad geographic areas. (For more information about the process, see <http://www.nwfsc.noaa.gov/cbd/trt/>.) The first step in this process is to establish biological goals for the recovery of salmonid species, a task that is assigned to "Technical Recovery Teams" (TRTs). Dr. Tom Wainwright is co-leader of the Southern Oregon/Northern California TRT, which considers listed salmonids in the Rogue, Klamath, and Trinity River basins and smaller streams in that region. This work involves identifying independent populations in the region using genetic, habitat, and

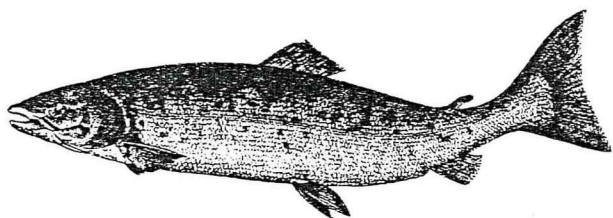
behavior information and assessing conditions for viability of the populations identified. The work is done in collaboration with scientists from the NMFS Northwest and Southwest regions, Oregon Department of Fish and Wildlife, California Department of Fish and Game, U.S. Forest Service, U.S. Department of the Interior, Tribal agencies, and universities.

IV. Fishery Resource Analysis and Monitoring Division (FRAM) (NWFSC: Todd Bridgeman, Michael Schirripa, Jean Rogers, Tonya Builder Ramsey, Keith Bosley, Dan Kamikawa, Waldo Wakefield, Erica Fruh, Jonathan Cusick, Julia Clemons, Jim Bottom, Mary Craig, Carol Ksycinski, Jim Miller, Robin Gintner, and Bruce McCain; Cooperative Ageing Project: Patrick McDonald, Susan Coccetti, Lisa Lysak, Betty Kamikawa, and José Omar Rodriguez; and OSU Graduate Students: Stacey Miller and Curt Whitmire)

FRAM consists of a multi-disciplinary team with expertise in fishery biology and ecology, stock assessment, mathematical modeling, statistics, computer science, and field sampling techniques. Additional members of this program are stationed at the NWFSC in Seattle. Together, they work to develop and provide scientific information necessary for managing West Coast marine fisheries and strive to provide useful and reliable stock assessment data with which fishery managers can set ecologically safe and economically valuable harvest levels. FRAM researchers develop models for managing multispecies fisheries; design programs to provide information on the extent and characteristics of bycatch in commercial fisheries, as they look at methods to reduce fisheries bycatch; characterize essential habitats for key groundfish species; and investigate the design, feasibility, function, and value of marine protected areas.

Stock Assessments

Stock assessments of West Coast sablefish conducted during 2001 were performed by two teams: one team was composed of NMFS scientists, including Dr. Michael Schirripa. The other team consisted of scientists with the Pacific Coast Groundfish Trust. The different models used by each team both estimated that the spawning stock biomass of sablefish are in the "precautionary zone." Projec-



tions by both teams of the possible future condition of the sablefish stock suggested spawning output will decline due to the poor 1996 and 1997 year classes now recruiting into the population. Depending upon which recruitment hypothesis is more correct, recruitment may or may not improve over the short term.

Of the 82 species identified in the Pacific Fishery Management Council's groundfish fishery management plan, formal stock assessments are conducted on only about 20 of these species. Stacey Miller is conducting research to develop a means to evaluate the status of the large number of unassessed groundfish species. The first phase of the project is to compile a database and summarize the available information on slope rockfish. Types of information incorporated into the database for each species include geographic range; types of commercial and sport fisheries that are used to harvest them; essential habitat requirements; important life history characteristics, such as reproductive strategy and age structure; genetic information; survey data; commercial and recreational landings information; and the current status of the stock, if known. Much of this information for over a dozen species was incorporated into the database. During the second phase, the compiled information will be used to determine whether discernible trends exist in the available data that may indicate the status or health of the stocks. It is expected that the analysis of the slope species will be completed by December 2002.

Habitat Investigations

During the summer of 2001, Dr. Waldo Wakefield, Julia Clemons and Keith Bosley worked with a diverse team of marine geologists, fisheries scientists, invertebrate biologists and ecologists, conservation biologists, commercial fishermen and educators, on cruises aboard the *R/V Ronald H. Brown* to Heceta Bank and Astoria Canyon. These studies involved investigators from the Northwest and Southwest Fisheries Science Centers, the Pacific Marine Environmental Laboratory, OSU, Washington State University, and a host of other government, academic, and private institutions.

At Heceta Bank, researchers used a remotely operated vehicle (ROV), and state-of-the-art survey strategies, instrumentation, and data analysis to explore and intensively sample five previously sampled transect sites in addition to extensive transects over new areas. Heceta Bank is the largest

of the heavily fished rocky banks on the outer continental shelf off Oregon. Since the late 1980s this bank has been a primary focus of several groundfish habitat investigations. The most recent studies were designed to evaluate 1) the scales of quantifiable relationships between groundfish populations and bottom morphology and texture, and the factors that control these relationships; 2) the changes that have occurred in the fish populations and habitat over the last decade; and 3) the likelihood of the existence of natural refugia on the bank. These studies were funded in part by the NOAA National Underwater Research Program (NURP) (West Coast and Polar Regions Undersea Research Center).

The Astoria Canyon Project—called “Continuing Lewis and Clark’s Legacy: Exploring the Habitats of Astoria Canyon, Oregon” was conducted as part of NOAA’s new Program in Ocean Exploration. The project initially mapped, explored, and documented the physical, chemical, and biological systems of the canyon using sidescan and multibeam echosounders to create high-resolution, three-dimensional images that clearly depicted features that have never been observed or documented. Immediately following the mapping effort, the team aboard the *R/V Ronald H. Brown* conducted detailed surveys of the canyon using a variety of remote sensing and sampling devices, including an ROV. One preliminary result of the project was the discovery that although the north wall of the upper canyon consisted of a mosaic of jumbled blocks hosting an array of invertebrates, a surprisingly low number and low diversity of bottom-dwelling fishes were observed.

Waldo Wakefield also participated in a joint effort with several OSU investigators, including Chris Goldfinger, Chris Romsos, Randall Milstein, and Suzanne Lovelady from the College of Oceanic and Atmospheric Sciences to initiate a GIS program for West Coast essential fish habitat. Its goal is to create and implement a comprehensive, helpful, and easily accessible, multi-layered GIS database and associated Web-site for groundfish habitat in the Pacific Northwest. The database for Oregon and Washington will be linked to an integrated habitat database that is currently under development for California. It will provide marine researchers ready access to available information to establish and test hypotheses concerning marine habitat and resource distribution and change.

Limited data availability often constrains the questions that can be addressed. This database is a

geologic, geophysical, and bathymetric system of data, metadata, and interpretive and derivative layers created from the raw data. The raw data sources include multi- and single-beam bathymetry, numerous sidescan sonar surveys, academic and oil industry rock, dredge and core samples, and academic and oil industry seismic reflection data. These main data sources are augmented by auxiliary data from submersible observations, cable route surveys, cable burial video, trawl video, and others. These basic layers will be integrated into a bottom type classification, an interactive process that cannot be completely objective, but will include geologic interpretation of the data. Each interpretive layer will be tested against similar layers derived from other sources to interactively converge on the best-fit classification.

Waldo Wakefield was also involved in a joint project with the NMFS's Southwest Fisheries Science Center and Moss Landing Marine Laboratory to evaluate the use of electro-optic imaging (i.e., laser line scanner, LLS) technology to characterize essential groundfish habitats and detect the impacts of fishing on them. The project, which was conducted in and around the Big Creek Ecological Reserve (BCER) off the Central California coast, addressed the characterization and exploration of deep-water habitats and the assessment of potential disturbances to these habitats. Preliminary findings suggest that the LLS system offers the advantage of imaging some of the biogenic components of various seafloor habitats, such as sea anemones, sea pens, kelp and other macro-algae, etc. This type of detail is not possible with acoustic survey techniques such as sidescan and multibeam sonar. The LLS system provided excellent imaging details of the low relief shelf sediments such as sand waves and ripples. Evaluating these features in a broader context from a post-processed mosaic of the seafloor could help scientists to better understand coastal physical processes that influence dynamic benthic habitats. The development of LLS will improve the efficiency and accuracy of the assessment of fish habitats. Funding was provided by NURP and NOAA's Office of Ocean Exploration.

Bruce McCain and Stacey Miller updated the habitat requirements of the 82 groundfish species on the West Coast as previously described in the publi-

cation "Essential Fish Habitat West Coast Groundfish Appendix" prepared by Casillas et al. (1998). This document was included as a congressionally required amendment to the Pacific Fishery Management Council's Fishery Management Plan published in 1998. Regulations require that these habitat descriptions be reviewed and re-evaluated at least once every five years. This most recent update of the "Appendix" was performed by conducting literature searches, and resulted in the identification of additional habitat associations for various life history stages of 40 of the species.

Field Surveys

A number of members of the FRAM Division, including Tonya Builder Ramsey, Keith Bosley, Dan Kamikawa, Erica Fruh, and Dr. Waldo Wakefield, participated in the fourth annual bottom trawl resource survey for Dover sole, sablefish, shortspine and longspine thornyheads, and other groundfish inhabiting the slope zone (100 to 700 fathoms deep) off the coasts of Washington, Oregon, and California. These surveys are designed to provide information to determine the relative abundance of these species in the region and to characterize their distribution. Chartered, commercial fishing vessels were used to conduct independent, replicate surveys. The standard trawl gear used was matched to each boat's characteristics. Fishing vessels *Limit Stalker*, *Excalibur*, *Sea Eagle*, and *Captain Jack* were contracted to survey the area from Cape Flattery, WA to Pt. Conception, CA, from the last week of June through September. Each vessel was chartered for four weeks and they operated in pairs, alternating transects along the coast. The survey followed a stratified random sampling scheme with 15-minute tows, at five stations at randomly selected depths ranging from 100 to 700 fathoms along east-west transects. The transects were spaced 10 minutes of latitude apart. Each vessel occupied a unique set of 20 transects covering the entire north-south extent of the survey.

During 2001, in anticipation of possible future shelf surveys, approximately 50 tows were conducted in the shelf depth (30-100 fathoms) to examine fishing performance of the standard slope survey net and footrope. In a separate experiment, underwater cameras were placed on a trawl net to deter-

mine if the gear was fishing correctly from depths of 100-400 fathoms.

Other FRAM research projects at HMSC during the past year included:

- A re-analysis of information on the historical foreign catch of West Coast groundfish was conducted by Dr. Jean Rogers and is now under final review. The new analysis examined past estimates of total rockfish catch in various fishing strategies, then partitioned this total rockfish catch into individual species according to the composition of samples that best matched the respective species. Once completed, this analysis will provide a consistent approach to evaluating the historical foreign catch for all component species. Notable changes so far observed in the analyses were reductions in the estimated catch of Pacific Ocean perch and increases in the estimated catch of shortspine thornyheads.

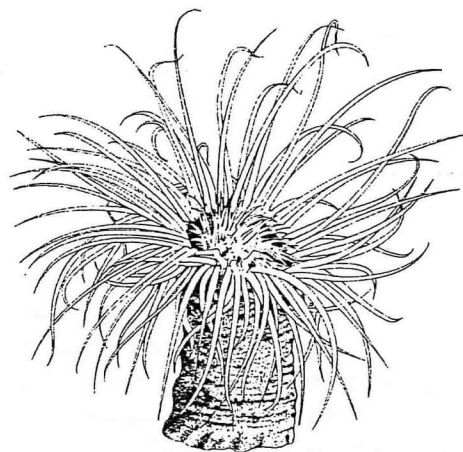
- Drs. Michael Schirripa and Rick Methot investigated the possible causes for the recent upturn in sablefish recruitment on the West Coast. One of the possible causes could be the recent overall climatic "regime shift" that took place in the North Pacific. They used sea level height as a proxy to quantify the southerly and offshore movement of water as a result of the California Current, as well as the coastal upwelling index. They found a significant relationship between mean sea level in July and sablefish year-class strength that same year. Adding estimates of spawning stock biomass to the model added virtually no explanatory power to the model. Their results suggest that environmental processes may play a significantly larger role than spawning stock biomass in determining sablefish year class strength.

- Jonathan Cusick, a recent arrival to Newport, is the Project Lead for a new Pacific Coast Groundfish Observer Program started by the NMFS in 2001. Twenty observers and five alternates were provided by Alaska Observers Inc. The first observers boarded vessels in August. Their goal was to sample the groundfish catch in order to obtain data that can be used to predict discards for the entire fishery. The other goals of the program include: 1) improving management of groundfish by making better estimates of total catch of groundfish species, including prohibited species; 2) collecting better biological information from the groundfish fishery;

and 3) providing a timely and efficient system for collection, storage, analysis and communication of information.

The observers operate out of fishing ports in all three western states. There is a NMFS observer coordinator and a state coordinator in each state to supervise observer logistics, vessel contacts, shoreside sampling, and coverage requirements. Jonathan is also the NMFS coordinator for Oregon. The observers gather data through onboard interviews of vessel captains and crew, observations of fishing operations, measurements of selected portions of the catch and fishing gear, and collecting samples. Data are entered into a computer from paper forms and transferred online to a NMFS-NWFSC database for debriefing, editing, and summarizing.

- The NWFSC continues its collaborative effort with the Oregon Department of Fish and Wildlife and the Pacific States Marine Fisheries Commission to maintain a laboratory dedicated to the ageing of West Coast groundfish. Known as the Cooperative Ageing Project (CAP), it consists of a team of specialists who determine age and other information about groundfish using the ear bones (otoliths) of fish. Researchers use data on the ages of fish for stock assessments and for studies of growth and fish movement. Michael Shirripa is FRAM's liaison with the project. In 2001, the laboratory assumed responsibility for the ageing of Pacific whiting otoliths. Four new staff members joined Pat McDonald on the project, including Susan Coccetti, Lisa Lysak, Betty Kamikawa, and José Omar Rodriguez.



Resource Enhancement and Utilization Technologies Division (REUT) (NWFSC: Dr. Peter Lawson)

Dr. Lawson is the sole representative of the REUT Division at the NRS. His principal research interest focuses on the effects of climate and habitat changes, and fishing efforts on population dynamics of Oregon coastal natural coho salmon. Projects involve collaborations among scientists from the University of Washington, the Environmental Protection Agency, NOAA/NWFSC/Seattle, OSU, and the US Forest Service. Dr. Lawson also provides technical advice to fishery management through his seat on the Scientific and Statistical Committee of the Pacific Fishery Management Council and the Coho

Technical Committee of the Pacific Salmon Commission.

NMFS Enforcement Division

Special Agent Joe Kuczur, Jr. is now located at the Newport Research Station. He is responsible for enforcing 30 federal statutes. Most of his responsibilities derive from the Magnuson-Stevens Fishery Conservation and Management Act, the Marine Mammal Protection Act, and the Endangered Species Act. Groundfish, salmon, and marine mammals are presently his key concerns.

National Oceanic and Atmospheric Administration

Pacific Marine Environmental Laboratory Ocean Environment Research Division

The 2001 fiscal year was a productive one for NOAA's Pacific Marine Environmental Laboratory research staff at the OSU Hatfield Marine Science Center. The Division's team of Principal Investigators, which also includes scientists and technical support staff working through the Oregon State University, Cooperative Institute for Marine Resources Studies, achieved a number of successes in their ongoing research which is focused on submarine volcanic and hydrothermal activity, relationships between groundfish habitat and geology, and the acoustic study of Pacific whales.

A major accomplishment during the year was the successful planning, funding, and execution of two cruises supported by the NOAA Ocean Exploration program. These cruises, one focused on an interdisciplinary exploration of the Astoria Canyon off the mouth of the Columbia River, and the other, which continued a collaborative investigation with scientists from the Northwest Fisheries Science Center, were the first expeditions supported by the Ocean Exploration program. The Astoria Canyon cruise investigated the geology, oceanography, and biology of the canyon—which has not been studied for more than 30 years. The groundfish study integrated the expertise of seafloor

geologists with fisheries biologists in order to discover relationships between the character of the seafloor and the year-to-year varying abundance of commercially important groundfish species. This investigation took place on the Heceta Bank, known to be an important groundfish habitat off the central and southern Oregon coast.

The year also marked continuing success of the unique PMEL T-phase real-time acoustic detection project. Scientists involved in this project use U.S. Navy hydrophones to detect and locate submarine volcanic eruptions. The eruptions are then studied to determine their ocean environmental impacts. The Navy hydrophones are also utilized to detect the calls of whales. This aspect of the hydrophone project continues to detect and track several species of whales in the North and Equatorial Pacific. This work is producing new discoveries about whale migration patterns and the geographic boundaries of some whale populations. During the year, the Navy hydrophones were again supplemented by the deployment of arrays of autonomous hydrophones which both extend and refine the area of the Pacific being acoustically monitored.

Communication of the group's scientific and technical achievements and educational outreach continue to be high priorities. During the year state-of-the-art interactive websites were augmented for several of the projects. They can be viewed at:

<http://www.pmel.noaa.gov/vents/nemo/index.html>
<http://www.pmel.noaa.gov/vents/nemo/explorer.html>

U.S. Fish and Wildlife Service Oregon Coastal Field Office

U.S. Fish and Wildlife Service Oregon Coast Field Office

The Oregon Coastal Field Office supports U.S. Fish and Wildlife Service (Service) employees from the National Wildlife Refuge Division and the Division of Ecological Services. Refuge personnel are responsible for the operations and management of six National Wildlife Refuges (NWR) spanning the Oregon coastline. These refuges include three estuarine refuges (Bandon Marsh, Nestucca Bay, and Siletz Bay), two marine refuges (Three Arch Rocks and Oregon Islands), and a small old-growth forest refuge at Cape Meares. Currently, the Oregon Coast National Wildlife Refuge Complex has six permanent employees and up to 2 temporary employees and 3 AmeriCorp enrollees. Refuge staff focuses on six priorities: 1) land acquisition, 2) habitat management and restoration, 3) biological surveys, 4) monitoring, 5) research, and 6) environmental education and outreach.

The Refuge Complex has an active land acquisition program at Siletz Bay, Nestucca Bay, and Bandon Marsh refuges. At Bandon Marsh NWR, key parcels are being acquired along the lower Coquille River where the refuge is planning to restore over 400 acres of tidal marsh.

Acquisition of land within and around Neskowin Marsh continued this year. The Service now owns over half of the marsh. This unique wetland contains a variety of freshwater wetland types including bogs and fens, some of which are exceedingly rare both on the Oregon coast and throughout the Pacific Northwest.

Annual wildlife surveys included the monitoring of nesting seabirds (e.g. common murre, Brandt's cormorant and pelagic cormorant), peregrine falcons, bald eagles, Aleutian and dusky Canada geese, black brant, and wintering waterfowl. Special studies are continuing on juvenile salmonid use of Siletz Bay wetlands. The study is being done in cooperation with the Confederated Tribe of Siletz Indians and the U.S. Forest Service.

Projects to improve public use or improve habitat and facilities that have been recently accomplished or will be initiated in 2002 include:

- Repair of north stairs at Coquille Point was completed.
- Construction and restoration of the Simpson Reef interpretive overlook at Cape Arago State Park, a project in partnership with Oregon State Parks, Oregon Department of Transportation, and the Federal Highway Administration was completed.
- Reforestation of a sizable tract of coniferous forest at Nestucca Bay NWR continues.
- Planning and preparation for an intertidal wetland restoration project at Siletz Bay, to be constructed August / September 2002.
- Removal of all old barns, houses and structures at Bandon Marsh was completed
- Construction of residence #1 at Bandon Marsh was completed.
- Construction of parking lot, boardwalk and wildlife viewing deck at Bandon Marsh was completed.

Two biologists assigned to the Ecological Services staff in the office are charged with advancing conservation objectives throughout coastal watersheds. Ecological Services' responsibilities include implementing the protection and recovery mandates of the Endangered Species Act, assisting in the implementation of the Northwest Forest Plan, and providing technical assistance to Federal, State, and local conservation and restoration efforts. Ongoing activities include western snowy plover recovery, restoring water quality and habitat function in coastal watersheds, recovery of late successional forest species, and conservation and restoration of sensitive habitats such as estuaries, coastal strand, and wetlands.

List of Awards and Scholarships for 2002

Curtis & Isabella Holt Marine Education Fund

Laurel Hillmann (\$6,000) "Increasing capacity of coastal watershed councils to address aquatic invasive species"

Walter G. Jones Memorial Scholarship

Marlene Bellman (\$1,500) "How new groundfish regulations have changed fishing behavior"

Mamie Markham Research Awards

Marlene Bellman/Ted Hart (\$10,000) "Habitat associations of juvenile rockfish"

Jingyun Duan (\$10,000) "Rapid detection of *Vibrio parahaemolyticus* in seafood"

Daniel Gomez-Uchida (\$9,400) "Genetic diversity in canary rockfish"

Heather Leslie (\$6,598) "Population ecology of intertidal barnacles"

Marion Mann (\$10,000) "Defining micro-habitat for juvenile rockfish"

Todd Miller (\$5,000) "Analysis of ecological systems using stable isotope ratios"

Carrie Newell (\$9,980) "Life history of mysids/swarming behavior of gray whales"

Armando Ubeda (\$4,500) "Influence of body size of adult sea urchins on survival of small urchins"

Roberto Venegas (\$7,000) "Nearshore fish recruitment"

Lylian Brucefield Reynolds Scholarship

Supanwan Thawaornchinsombut (\$600) "Biochemical characteristics and gelation properties of Pacific whiting"

Anja Robinson Fellowship

Ford Evans (\$1,200) "Heritability of individual growth in Pacific oysters"

Wiancko Award

Vicki Osis (\$10,000) Support for summer interns

Bill Wick Marine Fisheries Award

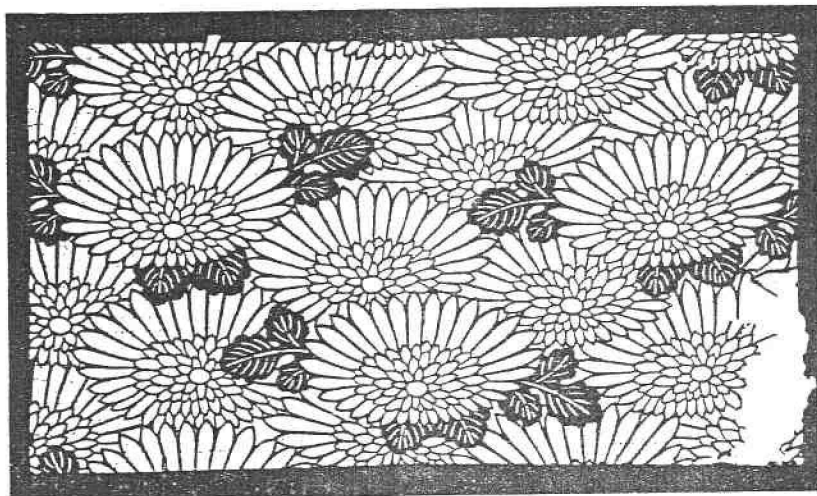
Not given in 2002

Guin Library Janet Webster, Librarian

As one of Oregon State University's libraries, the Guin Library houses a strong collection of marine-related information. In the fiscal year 2001/2002, our book budget was \$9,000 and our periodical budget \$100,000. While this sounds sufficient, it represents a steady decline over the past decade. Given regular inflation and the persistent double-digit inflation of scientific periodical subscriptions, our collection's budget would have to be \$14,000 for books and \$250,000 for periodicals if it had stayed even with the 1991/1992 purchasing level. So, how do we cope with declining budgets and increasing demand? We continue to cut duplication between the Valley Library on the main campus and the Guin Library. This is a double-edge sword as we lose access to a wide variety of journal titles, but it focuses the collection. We also cut print subscriptions and purchase electronic access. The trend to more electronic publications does not save money, but it does increase access for the same money. Balancing the needs of our users with the financial reality will always be challenging. This year was no different except that users are much more interested in electronic access to journals. You can browse a list of the journal titles the OSU Libraries currently get electronically - <http://osulibrary.orst.edu/research/ejournal.htm>

Even during difficult budget times, the library staff continues to provide excellent service to researchers, staff and students located at HMSC as well as those in Astoria at the Seafoods Lab and people on the main campus in Corvallis. Service ranges from tracking down articles from other sources and delivering them electronically to helping find a piece of information for a report. The implementation of the Prospero system allows us to receive an electronic copy of an article and forward it to the requester who then downloads it from a website. Use of the library and its services remains high.

Janet Webster, the Head Librarian, is currently president of the Oregon Library Association. In that capacity, she is developing a scholarship fund for library school students and examining stable funding for the statewide summer reading program. Additionally, she serves on the Senate Interim Task Force on Library Cooperation that is charged with finding creative solutions to better resource sharing throughout the state. Ms. Webster presented a paper with colleague Barbara Butler at the IAMSILIC annual conference and the Oregon Library Association annual conference in Brest, France on scholarly communication in aquatic and marine science. The two are continuing to work on ways to address the spiraling cost of journals in these fields. Ms. Webster is also working on several digital initiatives including the continuing Yaquina Bay Bibliography, the Seafood Wastewater Bibliography, and the Tsunami Digital Library



Statistics

Student Enrollment

<u>Fall</u>	<u>Class</u>	<u>2000</u>	<u>2001</u>
FW 407/507	Seminar	11	6
FW 420x/520x	Ecology/Manage. of Marine Fish	NA	19
FW 431/531	Dynamics of Marine Biological Resources	19	NA
FX 441	Group Problem Solving	NA	2
FX 442	Prob Def. & Analysis/Marine Fish	NA	6
FW 454/554	Fishery Biology	NA	31
FW 465/565	Marine Fisheries	NA	23
FW 494/594	Diseases & Parasites of Marine Fish & Invertebrates	8	4
FW 497/597	Aquaculture	9	6
FW 498/598	Aquaculture Lab	8	4
FW 499	St/Marine Team	NA	10
<u>Spring</u>		<u>2001</u>	<u>2002</u>
Bi 450/451	Marine Biology	19	12
<u>Summer</u>		<u>2001</u>	<u>2002</u>
FW 408/508	Project GLOBE	18	12
FW 508	Operation Pathfinder	14	NA
FW 508	Rocky Intertidal	8	NA
FW 599	Biology of Fishes	5	NA
FW 599	Symbiosis in the Coastal Ecosystem	NA	10
FW 599	Estuarine Ecosystem	NA	11
FW 599	Marine Invertebrates	NA	9
HSTA 499/599	Integrating Science History	12	NA
OC 599	Biological Oceanography	12	NA
OC 599	Geological Oceanography for Teachers	NA	10

Public Wing Visitors

Since opening, June 1965* = 9,796,284

June 1, 2001 through May 31, 2002 = 143,061

Number of students in scheduled school group visits = 11,375

HMSC Visitor Center Volunteers

2001-2002

Myra Austin
Bonnie Bahn
Marlene Bellman
Dawn Bence
Jennifer Berger
Katy Biondo
James Bones
Gerald Boyd
Patricia Brown
Joyce Browning
Philip Carbone
Gert Carey
Jane Carr
Harry Caylor
Ray Clark
Barbara Copfer
Matteo Costamagna
Beryl Czuleger
Tom Czuleger
Irene DeLauney
Stuart Didtel
Terry Dillman
Charlotte Dinolt
Kathleen Dobson
Pat Duggan
Jennifer Duncan
Carl Ehrman
Mildred Ehrman
Gerald Engleman
Doyle Falwell
Elaine Falwell
Theresa Farrell
Terry Fouladpour
Shirley George
Tracy Gesell
Teresa Hartsell
Sara Hodges
Kathleen Holt
Ralph Irvin
Jazmin Iveson

Paula Jones
Thomas Kaminski
Clyde Kellay
Donald Kennedy
Margaret Kennedy
Ruth Kistler
Nancy Kromer-Miller
Patricia Lewis
Frank Lush
Barbara Mate
Curt McCann
Patricia McCann
Patricia McChesney
Donna McCoy
Ed McCoy
Walt McNeal
Patricia Modde
Maxine Moodie
Terry Morse
Rick Nansen
Robin Nelson
Kenneth Nevar
Sue Nevar
Roger Nichols
Brian O'Quin
Kennith Parks
Mary Emma Parks
Bonnie Pazdalski
Walt Pazdalski
Tom Peterson
Isabella Potter
Dolores Reed
Donna Reynolds
Karen Ritenour
Suzanne Roberts
Howard Rubin
Phillip Ruzek
Talia Sanfilippo
Susan Scherer
Dyann Schierholtz

Mell Schierholtz
Gerti Schramm
Denise Schrock
Patricia Shelton
Sandra Siler
Elfrieda Sinclair
Margo Sloan
Tina Smith
Chet Stark
Michele Steen
Edwin Swartz
Christine Tomsik
Jodie Tuttle
Larry Tyler
Wendi Van Tine
Van Vanderbeck
Joe Voelkel
Mary Voelkel
Robert Wallace
Mike Walters
Helen Wellman
Jack Whipple
Jane Whipple
Marlene Williams
Sue Wilson
Jack Woods
Rosalyn Woods
Judith Wright
Gabrielle Yantone
Trish Young

Donor Honor Roll

June 2001-May 2002

Arthur Anderson Foundation*
Penny Applegate and Jay
Owens*
Roy and Jane Arnold***
Carl Balog
Stuart Barr*
Mary Beal***
Richard Bevens
Richard Bohn
Ronald Bonham***
Elizabeth BriskyHardy*
A.C. Burlingham
Eugene and Susan Burreson**
Louise Burt***
John and Shirley Byrne***
Andrew Carey, Jr.*
L. Jane Carr***
John and Amy Chapman**
Stella and James Coakley***
Companion Pet Clinic*
Cara Cullings*
Paul Dalseg*
Thayne and Margaret
Dutson***
Will Emery and Bonnie
Serkin***
Andrew Grear*
James and Bonnie Hall*
Mary Hauck*
James and Sandra Hedtke***
John P. Hennessey, Jr.
Kenneth Hilderbrand*
George Holdren***
Aki and Lillian Horita***
Mary Hughes*
Carmen Jones
Ernest and Zelma Josi*
Anne Kapuscinski
Vicci and Doyle Kelley*
Gordon and Michaela Kruse**

S. Jeanette Kunnen*
Christopher Langdon***
Hong Liner***
Charlene and Jim Lockman***
Frank and Carol Mason
Barbara Mate***
Robert McGorin***
William and Frances
McNeil***
Florence and Norman Miller*
Arthur and Tammy Mills*
Clifford and Marina Misener*
MKL Foundation*
John and Mary Lou Murphy*
Richard and Valeri Nichols
Wendy and Alan Niem**
Allison Northcutt*
Robert and Jerryann Olson***
Oregon Community Founda-
tion
Jim and Patricia Peachey*
William Percy*
Janet and Norman Pease
Richard and Linda Pratt
Arninne Rautio**
W.R. and Margaret Roehmer*
Jean Roth*
William and Susan Russell*
Marilyn Sander***
Dana and Donna Schmidt***
Carl and Sonia Schmitt*
Phillip and Jill Schneider***
Carol and Jack Shiningier*
Randolph Sleet
Richard and Farl Tubb***
David Weaverling***
Karen and Harlan Weber***
Pamela Weber***
Lavern Weber
Leslie Wheeler

Kathryn and Thomas
Whittaker*
Thomas Wildish*
C. Norman Winningstad***
Martha Winsor***
Roger Wissman*
Ted and Sue Yamamura***
James and Kelly Young*

*=Marine Mammal Endowment

**=Library Endowment

***=Weber Visiting Scientist
Fellowship Endowment

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OSU Programs at Hatfield Marine Science Center

<u>Research Administration</u>	<u>\$ Amount</u>	<u>Unit Sub-Total</u>	<u>Total</u>
Administration	346,510		
Visitor Center Support	137,153		
Non-Sponsored Research	4,818		
Non-Sponsored Education	33,495		
Sponsored Education	85,577		
Sponsored Research-Chapman	8,417		
Sponsored Research-Hansen	46,248		
Sponsored Research-Larison	16,992		
Sponsored Research-Trowbridge	952		
Sponsored Research-Other	<u>51,198</u>		
Total Research Administration		\$731,359	
<u>Physical Plant</u>			
State Support	427,873		
Federal Support	<u>282,411</u>		
Total Physical Plant		\$710,284	
<u>Cooperative Institute for Marine Resources Studies (CIMRS)</u>			
Administration	88,136		
Sponsored Research	2,279,331		
Sponsored Research-Chadwick	61,583		
Sponsored Research-Dziak	36,788		
Sponsored Research-Mellinger	12,467		
Sponsored Research-Peterson	56,010		
Sponsored Research-GLOBEC	<u>13,792</u>		
Total CIMRS		\$2,596,827	
<u>College of Oceanic & Atmospheric Sciences</u>			
Ship Support/Operations	2,507,741		
Ship Support & Communications	25,019		
Ship Scientific Equipment	<u>118,323</u>		
Total Ship Operations		\$2,651,083	
<u>Education Programs</u>			
Extension	286,588		
Sea Grant	262,251		
Visitor Center (self-funded)	118,402		
Sponsored Programs	19,691		
Self-Funded Programs	<u>82,057</u>		
Total Education Programs		\$768,988	
<u>Housing</u>			
Self-Funded Operations	<u>62,180</u>	\$62,180	
<u>Bookshop</u>			
Self-Funded Operations	<u>161,615</u>	\$161,615	
<u>Other</u>			
Guin Library	289,000		
OSU Foundation & Gifts	113,622		
Network Service	31,991		
Federal Agencies (through OSU)	<u>46,838</u>		
Total Other		\$481,451	

Total Hatfield Marine Science Center

\$8,163,787

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Coastal Oregon Marine Experiment Station Astoria

Research Type	Amount	Unit Sub-Total	Total
Seafood Laboratory Administration	317,609		
Experiment Station Non-Sponsored Research	183,292		
Cost Shared to Sponsored Research	150,012		
Self-Funded Research/Education	70,838		
Extension	15,315		
Sponsored Research	<u>160,415</u>		
Total Astoria			\$897,480

Newport

Marine Branch Station - Admin	309,957		
Cost Share to Sponsored Research	107,332	\$417,289	
Marine Mammal Research - Mate			
Marine Mammal Endowment	260,738		
Sponsored Research	371,787		
Non-Sponsored Research	26,952		
Tag Inventory	234,814		
Extension	<u>40,706</u>		
Total Marine Mammal Research		\$934,997	
Marketing - Sylvia			
Sponsored Research	72,568		
Non-Sponsored Research	<u>160,227</u>		
Total Marketing		\$232,795	
Management & Policy - Hanna			
Sponsored Research	52,324		
Non-sponsored Research	<u>681</u>	\$53,006	
Fish Disease - Reno			
Sponsored Research	5,394		
Non-Sponsored Research	<u>65,594</u>		
Total Fish Disease		\$70,988	
Fishing Analysis			
P.I. - Sampson			
Sponsored Research	210,429		
Non-Sponsored Research	2,456	\$212,885	
P.I. - Berkeley			
Sponsored Research	27,831		
Non-Sponsored Research	<u>0</u>	<u>\$27,831</u>	
Total Fishing Analysis		\$240,716	
Aquaculture			
P.I. - Langdon			
Sponsored Research	360,731		
Non-Sponsored Research	<u>8,358</u>	<u>\$369,089</u>	
Total Aquaculture		\$369,089	

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Salmon Ecology			
<i>P.I. - Fleming</i>			
Non-Sponsored Research	\$106,496	\$106,496	
<i>P.I. - Banks</i>			
Sponsored Research	278,183		
Non-Sponsored Research	<u>\$181,345</u>	<u>\$459,528</u>	
Total Salmon Ecology		\$566,024	
Other			
Federal Agencies (through OSU)	30,369	30,369	
Total Newport			<u>\$2,915,272</u>
Total Coastal Oregon Marine Experiment Station			\$3,812,752
Cooperating Agencies at Hatfield Marine Science Center			
	\$ Amount	Total	% of Total
Environmental Protection Agency	3,300,000		17%
Oregon Department of Fish & Wildlife	4,540,000		24%
Vents Program - Federal	2,100,000		11%
Nat'l Marine Fisheries Service - NWFSC	6,275,000		33%
Nat'l Marine Fisheries Service - AFSC	1,062,000		6%
US Fish & Wildlife Service	<u>1,663,231</u>		<u>9%</u>
Total Cooperating Agencies		\$18,940,231	100%
<u>Funding Sources</u>			
<u>Direct State Funding</u>			
HMSC	959,225		
COMES	1,855,125		
CIMRS	56,980		
Extension/Ext. Sea Grant	579,033		
Ship Operations	<u>25,139</u>		
Total Direct State Funding		\$3,475,502	11%
<u>Other State Funding</u>			
Matching Funds (Endowments)	249,646		
Guin Library	<u>289,000</u>		
Total Other State Funding		538,646	2%
<u>Sponsored Research</u>			
Nat'l Oceanic & Atmospheric Admin (NOAA)	2,983,936		
Nat'l Science Foundation (NSF)	1,954,540		
US Dept of Agriculture (USDA)	320,559		
Office of Naval Research (ONR)	741,156		
Bureau of Land Management (BLM)	16,992		
Oregon Dept of Fish & Wildlife (ODFW)	80,647		
Oregon Economic Development Agencies	12,148		
California Dept of Water Resources	271,404		
Extension Service/Extension Sea Grant	193,717		
Donations & Private Business	568,349		
Sub-Contracts from Other Universities	<u>246,643</u>		
Total Sponsored Research		\$7,390,093	24%
<u>Other Funding</u>			
Self-Funding Units	572,299		
Cooperating Agencies	<u>18,940,231</u>		
Total Other Funding		<u>19,512,530</u>	63%
Total Funding		\$30,916,771	100%



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