

Coastal and Ocean Sciences at Oregon State University

**Prepared by Oregon Sea Grant
Robert Malouf, Director
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Executive Summary

The purpose of this report is to document the depth and breadth of research, education, and outreach activities in coastal and ocean sciences at Oregon State University. The scale and diversity of those activities are not well known outside of OSU, and in fact they are significantly underestimated, even by the faculty, staff, and students of the university. The report shows that relevant teaching and research activities are widely distributed among several colleges, departments, centers, institutes, and programs, both on and off campus. The broad distribution of the activities among 9 of OSU's 11 colleges is a testament to its multidisciplinary nature, but it could also be the primary reason that OSU's remarkable capabilities have never been fully inventoried and reported.

The authors of this report used a variety of official sources of information, such as unit reports, course catalogs, Web site postings, and university grant records. However, since the term "coastal and ocean" lacks precision, whether or not a particular activity should be included under it is also imprecise. We made an effort to be consistent and conservative in our decision making; nevertheless, it is important to keep in mind that the content of the inventory was determined by many individual, subjective decisions. The report is a snapshot of faculty interests and course offerings in the 2005–2006 academic year and research funded during the 2005 fiscal year. We have made no effort here to show long-term averages or to otherwise include more than one year's activities.

The university's organizational chart shows that the directors of centers, institutes, and programs (CIPs), such as HMSC, COMES, and Sea Grant, report to the vice president for research, who reports to the OSU president. All academic faculty members, including those who are key players in the CIPs, are also members of colleges and in most cases of academic departments. Extension faculty members also belong to colleges and departments, but they report to program leaders (who report to deans) and to the dean and director of Extension, who reports to the provost. Reporting relationships, and, potentially, the institutional commitments are varied and can be quite complex. In any case, even at the highest levels of the university's administration, there is no single individual who has explicit responsibility for oversight of programs in coastal and ocean sciences at OSU.

Over time Oregon State University has established a number of specialized CIPs, 17 of which are partially or wholly involved in coastal and ocean sciences. The two most important features that these 17 CIPs have in common is that (1) they involve more than one department and, in most cases, more than one college, and (2) an important element of their mission and focus relates to coastal and marine environments, species, or issues.

Our examination of available information yielded 107 course offerings relating to coastal and ocean sciences at OSU. Ten of them are undergraduate courses, 52 are graduate courses, and 41 are open to both undergraduates and graduates. The courses are offered in 10 departments within five colleges. Nearly half (49%) of OSU's courses in coastal and ocean sciences are offered by the College of Oceanic and Atmospheric Sciences. About half of the courses relate to biology, but the remainder are fairly well balanced among the other subject areas.

There are a large number of majors and degrees at OSU that could include students having interests in coastal and ocean issues. From among the possibilities, we looked for

those degree programs that are exclusively or dominantly coastal and marine in their focus, particularly those that we knew involved faculty who from time to time mentored students who were interested in coastal and ocean issues. As a result we found 13 majors that are directly related to coastal and ocean sciences in six colleges.

Currently (2006) there are five named endowed chairs in coastal and ocean sciences held by six senior faculty members at OSU. Three of the five chairs and four of the six professors are in the biological sciences. One of the chairs (HMSC director) is not subject-area specific, and one of them is in ocean education.

Total outside funding awarded to OSU faculty for research on subjects relating to coastal and ocean sciences in FY 2005 was about \$79 million, which is about 44% of the \$177 million total of all grants and contracts to OSU in that year. Over 450 separate ocean-related awards were made to faculty in seven colleges, 15 departments, and nine CIPs.

As might be expected, outside funding for research relating to coasts and oceans comes to OSU from a wide variety of sources. Federal funds, which account for about 55% of the total, are awarded by a wide range of agencies in 10 cabinet-level departments as well as by seven independent agencies. However, 76% of the federal funds come from just four agencies. They are the National Science Foundation (36%), the U.S. Department of Commerce (16%), the National Aeronautics and Space Administration (13%), and the Department of Defense (11%).

In FY 2005, grants and contracts for activities in coastal and ocean sciences at OSU from private funding sources totaled nearly \$34 million and accounted for 42% of the external support for work in the area. By far the largest contributors were the D&L Packard Foundation and the Gordon and Betty Moore Foundation, which together awarded nearly \$28 million to OSU scientists. In addition awards totaling about \$1.1 million came from 12 different private businesses.

Thirty-eight grants and contacts to OSU from 13 different public and private universities totaled about \$2.7 million in FY 2005. These awards were generally subcontracts to OSU researchers from grants and contracts having principal investigators on the faculty of the other universities. The original sources of those funds were not determined for this report.

A total of 17 grants and contracts were awarded by the state of Oregon to OSU for research on coastal and ocean issues in FY 2005. Those awards totaled about \$1.4 million, which is less than 2% of the nearly \$80 million awarded from all sources for work at OSU on those issues.

Our examination of available information identified 150 faculty members as being involved in coastal and ocean activities. Because the biological sciences quantitatively dominate both research and teaching, it is not surprising that 69 (that is, 46%) of the faculty members involved in coastal and ocean sciences are working in one of the biological sciences. At the other end of the scale, only 12 of them (8%) are working in social sciences, policy, or economics.

Coastal and Ocean Sciences at Oregon State University

I. Introduction

The purpose of this report is to document the depth and breadth of research, education, and outreach activities in coastal and ocean sciences at Oregon State University. The scale and diversity of those activities are not well known outside of OSU, and in fact they are significantly underestimated even by the faculty, staff, and students of the university. The report will show that relevant teaching and research activities are widely distributed among several colleges, departments, centers, institutes, and programs, both on and off campus. The broad distribution of the activities among 9 of OSU's 11 colleges is a testament to its multidisciplinary nature, but it could also be the primary reason that OSU's remarkable capabilities have never been fully inventoried and reported.

The authors of this report used a variety of official sources of information, such as unit reports, course catalogs, Web postings, and university grant records. However, since the term "coastal and ocean" lacks precision, whether or not a particular activity should be included under it is also imprecise. We made an effort to be consistent in our decision making, but we would like readers to understand that the content of this inventory was determined to some extent by many individual, subjective decisions. Our approach in general was to be conservative when we determined whether or not to include a particular activity. For example, course offerings that provide essential foundations for work in ocean sciences (such as chemistry, biology, physics, and statistics) were not included here. Similarly, research projects that did not actually focus on the marine or coastal environment or on a marine species were not included, even though the results might have application to the marine environment. For example, we would not include a research project on temperature tolerance of fish unless it directly involved one or more marine species.

This report is a snapshot of faculty interests and course offerings in the 2005–2006 academic year and research funded during the 2005 fiscal year. We have made no effort here to show long-term averages or to otherwise include more than one year's activities.

II. Institutional Structure and Coastal and Ocean Sciences at OSU

Table 1 shows the university's organizational chart. Those units having significant activity in coastal and ocean sciences are highlighted. Note that directors of centers, institutes, and programs (CIPs), such as HMSC, COMES, and Sea Grant, report to the vice president for research, who reports to the OSU president. All of the faculty, including those who are key players in the CIPs, are also members of colleges and in most cases of academic departments with department heads or chairs who report to deans, who in turn report to the provost. Extension faculty members report to program leaders (who report to deans) and to the dean and director of Extension, who reports to the provost. In short,

the reporting relationships, and potentially the institutional commitments, are varied and can be quite complex. In any case, even at the highest levels of the university's administration, there is no single individual who has explicit responsibility for oversight of programs in coastal and ocean sciences at OSU.

III. Centers, Institutes, and Programs Involved in Coastal and Ocean Sciences at OSU

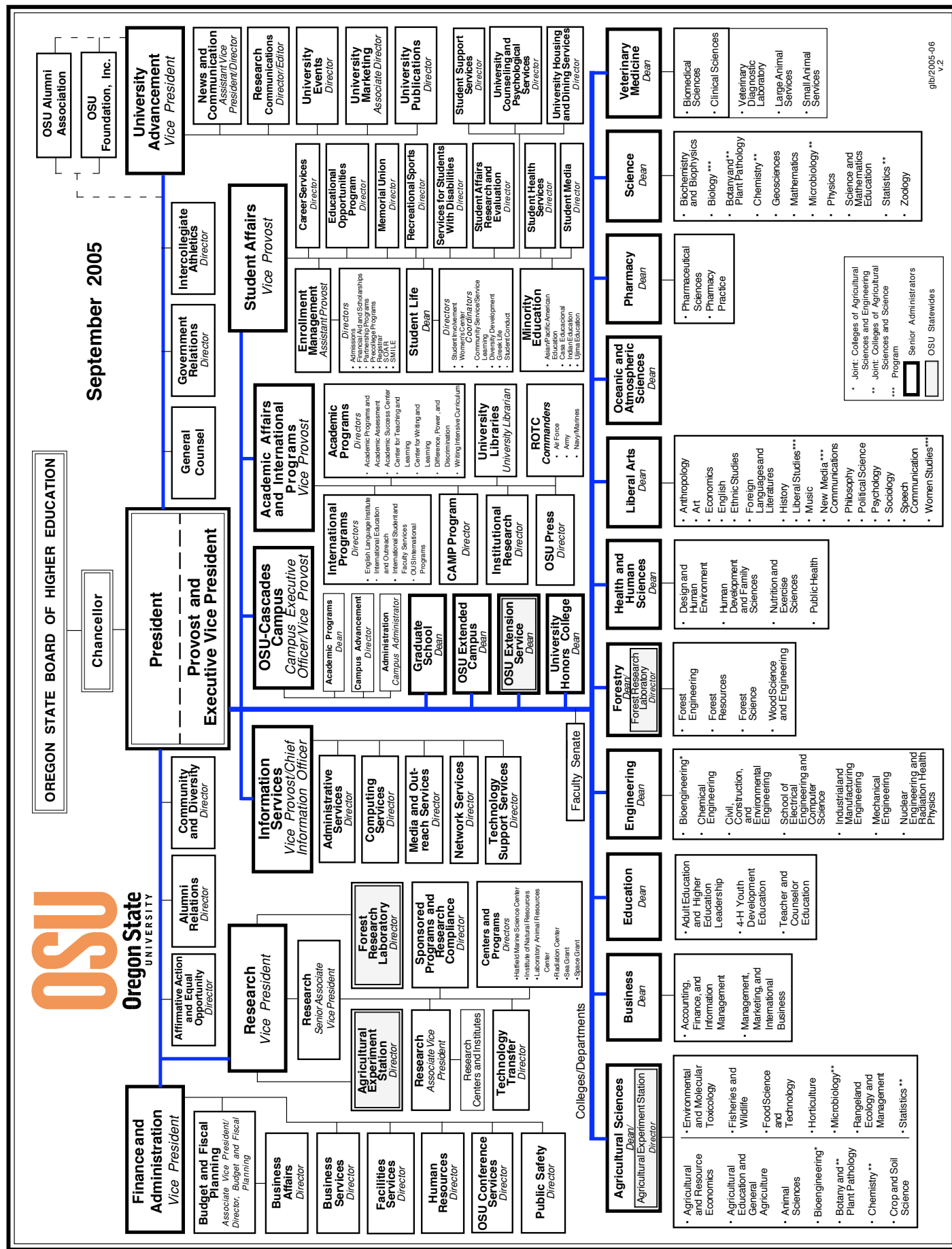
Over time Oregon State University has established a large number of specialized CIPs. Efforts are underway to standardize the definitions, nomenclature, and policies associated with the CIPs, but a degree of uncertainty still exists about what constitutes, for example, a center as opposed to a program or an institute. From the current list of the university's active CIPs, the authors of this report subjectively decided which of them should be included here. The two most important features that the 17 CIPs listed here have in common are (1) that they involve more than one department, and in most cases more than one college, and (2) that important elements of their mission and focus relate to coastal and marine topics, species, or issues. Additional information about each CIP is given in appendix I.

1. Aquaculture Collaborative Research Support Program (ACRSP)
2. Center for Fish Disease Research (CFDR)
3. Coastal Landscape Analysis and Modeling Study (CLAMS)
4. Coastal Oregon Marine Experiment Station (COMES)
5. Cooperative Institute for Oceanographic Satellite Studies (CIOSS)
6. Cooperative Institute of Marine Resources Studies (CIMRS)
7. Hatfield Marine Science Center (HMSC)
8. Institute for Natural Resources (INR)
9. Institute for Water and Watersheds (IWW)
10. Marine and Freshwater Biomedical Sciences (MFBS) Center
11. Marine Mammal Program (MMP)
12. Molluscan Broodstock Program (MBP)
13. O.H. Hinsdale Wave Research Laboratory (WRL)
14. Oregon Natural Heritage Information Center (ORNHIC)
15. Oregon Sea Grant College Program (OSG)
16. Oregon State University Seafood Laboratory (OSU-SFL)
17. Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

IV. Courses and Degrees in Coastal and Ocean Sciences at OSU

Courses

We developed the information in this section by first examining the titles of all courses listed in the OSU 2004–2005 *General Catalog*. When questions arose about course content and relevance to coastal and ocean sciences, we turned to on-line course descriptions for more details. However, whether or not a course should be included in our count was sometimes a difficult decision. There are also a great many courses, such as chemistry and physics, that teach skills and provide knowledge that are essential for any student who intends to pursue a career in any profession relating to the coast and ocean. There are courses on watersheds offered in the College of Forestry and courses in physiology in



the College of Science that relate directly to coastal and ocean sciences. However, consistent with our decision to be conservative in our inventory, we included only courses that directly and in most cases uniquely deal with coastal and ocean sciences.

Table 2 provides a sense of the level of involvement of the various departments and colleges in teaching graduate and undergraduate courses on marine and coastal topics. The list contains 107 course offerings, 10 of which are undergraduate courses, 52 are graduate courses, and 41 are dual listed, that is, they are open to both upper-division undergraduates and graduates. The courses are listed in 10 departments within five colleges. Nearly half (49%) of OSU's courses in coastal and ocean science are offered by the College of Oceanic and Atmospheric Sciences.

Table 3 shows counts of those same courses listed by subject area, independent of college or department, in order to give the reader a sense of the overall depth and breadth of OSU's course offerings in coastal and ocean sciences. About half of the courses relate to biology, but the remainder are fairly well balanced among the other subject areas.

Additional details, including the course numbers and titles, are given in appendix II by subject area, department, and college.

Table 2. Number of undergraduate and graduate courses in coastal and ocean sciences offered by OSU's colleges and departments

College/Department	Graduate	Under-graduate	Dual Listing	College Total
College of Science				
Zoology	2	2	3	
Botany and Plant Pathology	0	0	2	
Biology	0	2	3	
Geosciences	1	1	0	
Microbiology	0	0	2	
Science and Math Education	0	0	1	
College of Science Subtotals	3	5	11	19
College of Agricultural Sciences				
Fisheries and Wildlife	2	2	19	23
College of Oceanic and Atmospheric Science	40	3	9	52
College of Engineering				
Civil Engineering	10	0	2	12
College of Pharmacy	1	0	0	1
Total	52	10	4	107

Degrees

There are a large number of majors and degrees at OSU that conceivably could involve an emphasis on coastal and ocean issues. From among the possibilities, we have teased out those degree programs that are exclusively or dominantly coastal and marine in their focus or that we know involve faculty who from time to time mentor students having interests in coastal and ocean issues. The resulting table (table 4) lists six colleges offering 13 majors and 59 undergraduate degrees. Please note that the table shows majors and that the titles

Table 3. Number of undergraduate and graduate courses in various subject areas offered at Oregon State University

Subject Area	Number of Courses Offered			
	Graduate	Under-graduate	Dual Listing	Total
Biology and Fisheries	11	6	32	49
Geology	10	1	3	14
Chemistry	9	0	1	10
Physics and Engineering	22	0	3	25
Other	4	3	2	9
Total	52	10	41	107

of the majors are not necessarily synonymous with departments. For example, within the Department of Fisheries there is a fisheries science major. There is no Department of Fisheries Science at OSU. Similarly, the outdoor recreation leadership and tourism major is in the Department of Forest Resources.

V. Fellowships, Scholarships, and Endowed Chairs in Coastal and Ocean Sciences at OSU

Undergraduate and Graduate Scholarships, Fellowships, and Internships

The opportunities at OSU for support to undergraduate and graduate students who have interests in coastal and ocean sciences vary widely in amount, duration, specificity, and source (table 5). We have listed only those scholarships, fellowships, and internships that are either specifically limited to students interested in coastal and ocean sciences or otherwise closely associated with the coasts or oceans. In addition to those listed here, there are a multitude of somewhat more general opportunities for support available to all students at OSU.

Endowed Chairs

Currently (2005) there are five named endowed chairs that are specifically limited to the coastal and ocean sciences (table 6). They are held by six senior faculty members at OSU. Three of the five chairs and four of the six professors are in the biological sciences. One of the chairs (HMSC director) is not subject-area specific, and one is in ocean education. In addition, there are two named endowed chairs that are not specifically limited to coastal and ocean sciences but that are currently held by noted researchers whose work focuses on the ocean.

Table 4. Majors and degrees relevant to coastal and ocean sciences offered at Oregon State University

College and Major	Degrees Offered
1. Agricultural Science	
Agriculture and Resource Economics	MAg, MS, PhD
Fisheries and Wildlife	BS, HBS
Fisheries Science	MAg, MS, PhD
2. Oceanic and Atmospheric Sciences	
Atmospheric Science	MA, MS, PhD
Geophysics	MA, MS, PhD
Marine Resource Management	MA, MS
Oceanography	MA, MS, PhD
3. Science	
Biology	BS, HBS
Environmental Science (Oceanography option as a minor)	BS, HBS
Geology	BA, BS, HBA, HBS, MA, MS, PhD
Zoology	BA, BS, HBA, HBS, MA, MS, PhD
4. Liberal Arts	
Anthropology	BA, BS, HBA, HBS
Applied Anthropology	MA, PhD
Sociology	BA, BS, HBA, HBS
5. Engineering	
Bioresource Engineering	MENG
Civil Engineering	BA, BS, HBA, HBS, MA, MS, PhD
Electrical Engineering	BS, CRED, MENG, MS, PhD
6. Forestry	
Outdoor Recreation Leadership and Tourism	BS

Table 5. Undergraduate and graduate scholarships, fellowships, and internships in Coastal and Ocean Sciences at OSU

<p>A. Opportunities for Student Support Based at OSU</p> <p>Oregon Sea Grant Natural Resource Policy Fellowship. One available every other year; places graduate student from any Oregon university in an Oregon state agency for one year, beginning in July. The student chosen for the fellowship will interview with five Oregon state agencies to find the best fit for the student and the agency. \$30,000.</p> <p>Oregon Sea Grant Legislative Fellowship. One available every other year; places a graduate student from any Oregon university in the Salem office of a host legislator during the Oregon legislative session. \$26,000.</p>
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Table 5, cont.

Sea Grant Undergraduate Research Fellowships. Intended to support three undergraduate student research projects in the areas of marine and coastal science, resources, policy, history, economics, or education. The fellowships will begin January and run through September. **\$1,500 winter and spring terms, \$2,500 summer term, \$100 travel and supplies.**

Science Communication Internship. Focuses on science writing or multimedia production at Oregon Sea Grant Communications, working in a professional office dedicated to communicating science to nonspecialists. Available to senior undergraduates or graduate students considering a career in science writing, video production, or other means of communicating science to nonspecialist audiences. **Stipend varies.**

Hatfield Marine Science Center (HMSC) Visitor Center Summer Internship. Three summer internships at HMSC in Newport annually for OSU undergraduates seeking opportunities for community service, field experience, or the independent study requirements of their program.

Markham First Year Student Award. One-time funding of up to **\$10,000** to support an incoming first-year graduate student who plans to be resident at HMSC after the first academic year in Corvallis.

Fred and Joan Crebbin Memorial Fellowship. For qualified graduate students, with preference to those involved in marine science public education programs as interns and to students whose major study emphasis is marine biology, particularly mammals. **Up to \$3,000.**

Holt Marine Education Fund Award. Support for an undergraduate or graduate student project with outcomes benefiting marine education. **Up to \$6,000.**

Walter G. Jones Fisheries Development Award. Support for academically qualified graduate student pursuing research that contributes to fisheries development. **\$1,300.**

Cecil and Martha MacGregor Scholarship in Marine Science. To cover housing expenses for undergraduate student(s) in residence at HMSC during the summer. **Up to \$1,000.**

Mamie Markham Research Awards. Several awards to support graduate student research in marine science at HMSC. **Up to \$10,000 for each award.**

Lylian Brucefield Reynolds Scholarship. To support a graduate student in residence at HMSC. **Up to \$1,000.**

Anja Robinson Fellowship. To support graduate student research in shellfish aquaculture. **Up to \$800.**

Bill Wick Marine Fisheries Award. To support graduate student research in fisheries ecology, food processing, economics, or marketing. **Up to \$4,000.**

Research Experience for Undergraduates (REU funded by the National Science Foundation). Paid research internships for 10 students during the summer at HMSC, in Newport; offers students the unique opportunity to work on individual research projects over a 10-week period at HMSC under the guidance of university and agency scientists who serve as mentors. **On-site housing, transportation to and from Newport, and a monthly stipend are provided.**

Table 5. cont.

Wayne V. Burt Endowed Memorial Fund. OSU, COAS for top physical oceanography or atmospheric sciences graduate student. **Given as needed, mostly on emergency funding basis, at the Dean's discretion, up to \$1,500.**

William Quinn Endowed Memorial Fund. OSU, COAS. **Given as needed, mostly on emergency funding basis, at the Dean's discretion, up to \$500.**

The Native Americans in Science, Engineering, and Natural Resources (NAS-ENR) Program. OSU. A collaborative effort between the Colleges of Agricultural Sciences, Engineering, Forestry, Oceanic and Atmospheric Sciences, and Science. Established in 2005 with funds from the five colleges, OSU, and the National Science Foundation. Provides paid internship opportunities for Native American and Alaskan Native undergraduate students. Goal—to increase the number of Native American/Alaskan Native students earning BS degrees in science, technology, engineering, and mathematics and who are eligible for graduate school.

Armantrout Graduate Fellowship. OSU, Department of Fisheries and Wildlife. Preference to students conducting research on wild salmon or fisheries habitat improvement, excluding aquaculture. **One award of \$500.**

H. Richard Carlson Scholarship. OSU, Department of Fisheries and Wildlife. To a graduate student with research emphasis in marine fisheries biology. One award of **\$1,500**

Harriet M. Winton Graduate Scholarship. To a graduate student studying infectious diseases of fish in the Department of Microbiology. **\$900.**

Fryer Fellowship. To a graduate student currently working on infectious diseases of fish (finfish or shellfish) research at OSU. **Minimum of \$1,000.**

Chipman-Downs Memorial Fellowship. To assist graduate students in the College of Oceanic and Atmospheric Sciences (COAS) with completion of dissertations, to recognize outstanding achievement, and to provide emergency funding.

Richard Mathews Memorial Scholarship. To assist in recruiting new COAS graduate students and to support deserving COAS graduate students.

Geoffrey Dimmick Memorial Fellowship. Awards to assist COAS Marine Resource Management graduate students having financial need.

Denner Memorial Fellowship. An annual award to assist a COAS graduate student with financial need.

Wrolstad Memorial Fellowship. An annual award to assist a COAS geophysics or marine geology graduate student with financial need.

B. Nationally Based Opportunities for Student Support

Dean John A. Knauss Marine Policy Fellowships. Matches approximately 40 highly qualified graduate students nationwide with hosts in the legislative branch, the executive branch, or appropriate associations and institutions located in the Washington, D.C., area. Fellows spend one year working on substantive national policy issues related to marine issues. Nominations (up to five annually) are made for the state of Oregon by Oregon Sea Grant. **\$33,000 stipend, \$7,000 health insurance.**

Table 5, cont.

NOAA Coastal Management Fellowship. A national program established and funded by NOAA's Coastal Services Center to provide two years of professional, on-the-job education and training opportunities for postgraduate students in coastal resource management and policy. Nominations from the state of Oregon are made by Oregon Sea Grant. **\$32,000 per year, \$2,000 relocation, \$3,500 travel.**

National Sea Grant Industry Fellowship Program. Available annually nationwide to graduate students enrolled in either MS or PhD degree programs in institutions of higher education in the United States, with required matching funds from private industrial sponsors. The program supports up to five new Industry Fellows each year to work on research and development projects of interest to their partnering industry/company. Applications from the state of Oregon are made through Oregon Sea Grant. **Stipend varies.**

NMFS-Sea Grant Graduate Fellowship Program in Population Dynamics. Awards at least two new fellowships each year nationwide to PhD students who are interested in careers related to the population dynamics of living marine resources. Fellows work on thesis problems of public interest and relevance to NMFS under the guidance of NMFS mentors. **\$50,000 to \$125,000 a year for up to two years.**

NMFS-Sea Grant Graduate Fellowship Program in Marine Resource Economics. Awards at least two fellowships each year nationwide to PhD students who are interested in careers related to the development and implementation of methods for assessing the economics of the management of living marine resources. Fellows work on thesis problems of public interest and relevance to NMFS under the guidance of NMFS mentors. **\$50,000 to \$125,000 a year for up to two years.**

Ernest F. Hollings Undergraduate Scholarships. (NOAA). For eligible undergraduates studying oceanic, environmental, biological, and atmospheric sciences; mathematics; engineering; remote sensing technology; and physical and social sciences, including geography, physics, hydrology, geomatics, or teacher education, that support NOAA's programs and mission. **Up to \$8,000 per academic year during the junior and senior years, plus \$6,550 stipend, \$1,375 housing subsidy, and \$1,550 travel for a required 10-week internship during the summer between the junior and senior years at NOAA or a NOAA-approved facility, which includes Oregon Sea Grant.**

Table 6. Endowed chairs at Oregon State University that are specifically limited to coastal and ocean sciences (part A) or that are currently held by leading scientists working in one of those sciences (part B)

A. Restricted to Coastal and Ocean Science	
1. Wayne and Gladys Valley Professors in Marine Biology (2)	Jane Lubchenco Bruce Menge
2. Alice Rohm Professor in Oceanographic Education	Robert Duncan
3. Marine Mammal Research Professor	Bruce Mate
4. Hatfield Marine Science Center Director	George Boehlert
5. Carol and Barry Fisher Professor in Marine Fisheries	Deferred gift, unfilled
B. Not Restricted, but Currently Held by an Ocean Scientist	
1. Emile F. Pernot Distinguished Professorship in Microbiology	Steve Giovannoni
2. Miles Lowell and Margaret Watt Edwards Chair	Harry Yeh

VI. Research in Coastal and Ocean Sciences

Grants and Contracts

Total outside funding awarded to OSU faculty for research on subjects relating to coastal and ocean sciences in FY 2005 was about \$79 million, which is about 44% of the \$177 million total of all grants and contracts to OSU in that year (table 7). To put the scale of the effort into perspective, it is useful to compare the \$79 million received by OSU for

Table 7. Grants and contracts on coastal and ocean topics received by faculty members of Oregon State University in FY 2005

College/Department	Coastal and Ocean Award Dollars
College of Agriculture	\$11,420,810
Fisheries and Wildlife	\$2,401,941
Food Science and Technology	\$35,000
COMES—Newport/Astoria	\$4,070,766
Ag Integrated Plant Prot Ctr	\$10,000
Ag Microbiology	\$449,070
Aquaculture CRSP	\$4,300,000
Ag Statistics	\$154,033
College of Liberal Arts	\$161,530
Social Sciences	\$161,530
College of Engineering	\$5,012,836
Civil Engineering	\$1,905,783
Chemical Engineering	\$1,326,999
Computer Science	\$682,954
Elect and Comput Engineering	\$6,000
Kiewit Ctr Infrastr/Transport	\$1,091,100
College of Oceanic and Atmospheric Sciences	\$28,037,210
Grad School Special Programs	\$121,500
Pharmacy	\$904,707
College of Science	\$28,305,484
Botany and Plant Pathology	\$109,478
Chemistry	\$35,790
Geosciences	\$456,976
Microbiology (Science)	\$3,341,142
Zoology	\$24,362,098
VMD—Veterinary Medicine	\$94,788
Other	
Cooperative Institute for Marine Resources Studies	\$3,976,037
Hatfield Marine Science Center	\$640,261
Institute for Natural Resources	\$202,500
Sea Grant	\$667,189
Grand Totals	\$79,544,853

research on the coasts and oceans with the total of approximately \$78 million received by the University of Oregon in all subject areas and with the total of about \$50 million received in FY 04 by all the other five OUS campuses (PSU, WOU, EOU, SOU, and OIT) combined.

In 2005 OSU received over 450 separate ocean-related external awards that were made to faculty in seven colleges, 15 departments, and nine CIPs. However, two colleges, the College of Oceanic and Atmospheric Sciences and the College of Science, accounted for about \$56 million, or about 70%, of the OSU total for work on coastal and ocean sciences. Relatively little of the funding was in support of work in the social sciences and policy. For example, the College of Liberal Arts received relevant grants totaling only about \$160,000, which amounts to less than 0.5% of the OSU total.

It should be noted that an unknown number of the awards were for multiyear grants or contracts. That is, although awards were made in FY 2005, the amount awarded could be for anywhere from one to five years. Obviously, in those cases the annual expenditures on the grant would be less than its multiyear total. On the other hand, we know there were research expenditures in FY 2005 that were not included in our total, because the awards were made in a prior year. A specific example is Oregon Sea Grant, which has received an annual grant of about \$2.3 million for each of the past 10 years. But because of the timing of the receipt of Sea Grant funds, less than \$700,000 appears on the list for FY 2005.

To develop these data, we manually examined a list of all of the titles, principal investigators' names and affiliations, dates, funding sources, and amounts for all grants and contracts received through OSU's Research Office in FY 2005. Although our decisions about what to include and what not to include could only be subjective, we can confidently say that external funding for research and other coastal and ocean activities at OSU easily accounts for between one-third and one-half of the university's annual total of grants and contracts.

Funding Sources

Federal

As might be expected, outside funding for research relating to coasts and oceans comes to OSU from a wide variety of sources (table 8 and appendix III). Federal funds, which account for about 55% of the total, come from a wide range of agencies in 10 cabinet-level departments as well as from seven independent agencies. However, 76% of the federal funds come from just four agencies. They are the National Science Foundation (36%), the U.S. Department of Commerce (16%), the National Aeronautics and Space Administration (13%), and the Department of Defense (11%).

Private

In FY 2005 grants and contracts from private funding sources accounted for 42% of the total external support for activities in coastal and ocean sciences at OSU (table 8 and appendix III). By far the largest contributors were the D&L Packard Foundation and the Gordon and Betty Moore Foundation, which together awarded nearly \$28 million to OSU scientists. Awards totaling about \$1.1 million came from 12 different private businesses.

Other Universities

Thirty-eight grants and contracts to OSU from 13 different public and private universities (appendix III) totaled about \$2.7 million in FY 2005. These awards were presumably subcontracts to OSU researchers from grants and contracts having principal investigators on the faculty of the other universities. The original sources of those funds were not determined for this report.

Table 8. External sources of grants and contracts for research and other activities in coastal and ocean topics at Oregon State University in FY 2005

	Number of Awards	Funding Amount
Federal Agencies		
Dept. of Agriculture	16	\$1,234,977
Dept. of Commerce	78	6,953,042
North Pacific Research Board	1	138,146
NOAA	46	6,814,896
Dept. of Defense	45	4,719,997
Defense Advanced Research Projects Agency	3	342,428
The U.S. Army and Army Corp of Engineers	6	459,928
Office of Naval Research	36	3,917,641
Dept. of Energy	9	1,204,361
Dept. of Health and Human Services	2	583,712
Dept. of Interior	30	1,438,321
Bureau of Land Management	4	78,599
Fish and Wildlife Service	4	101,959
Geological Survey	17	1,059,550
National Park Service	5	198,213
Environmental Protection Agency	7	783,208
National Science Foundation	97	16,566,636
National Aeronautics and Space Administration	31	5,898,974
U.S. Agency for International Development	11	4,300,000
FEDERAL AGENCIES TOTAL	295	\$43,683,228
OTHER GOVERNMENT TOTAL	6	\$754,043
Private		
Foundations	29	28,107,132
Association	4	141,772
Institutes	8	415,172
Miscellaneous	12	1,202,267
Commercial	15	1,096,446
Universities	38	2,724,735
PRIVATE TOTAL	106	\$33,687,524
Oregon State Agencies		
Coop State Research Ext Ed Service	2	453,915
Governor's Watershed Enhancement Board	1	37,510
Oregon Dept of Fish & Wildlife	7	134,733
OR Dept. of Land Conservation and Development	4	58,900
Oregon Dept of Parks and Recreation	2	30,000
Oregon Dept of Transportation	3	705,000
OREGON STATE AGENCIES TOTAL	19	\$1,420,058
GRAND TOTAL	426	\$79,544,853

Oregon State Agencies

In FY 2005 the state of Oregon awarded a total of 17 grants and contracts to OSU for research on coastal and ocean issues. Those awards totaled about \$1.4 million, which is less than 2% of the \$79 million awarded from all sources for work at OSU on those issues. On the other hand, it is important to keep in mind that the state contributes to OSU's research enterprise in ways that are not reflected in grants and contracts. State-funded staff and faculty salaries, facilities costs, and some matching funds are not included in any of these totals.

VII. Academic Faculty Involved in Coastal and Ocean Sciences at OSU

Obviously the research and teaching enterprise relating to coastal and ocean sciences at OSU involves a large number of faculty members. The accuracy of the estimate of the number of faculty members involved depends on the nature of the records examined and once again on the definition of "involved." Here we have defined involvement to mean members of the OSU academic faculty who are teaching or co-teaching a relevant course, who were listed as a principal investigator or co-principal investigator on a grant or contract in FY 2005, or who are engaged in extension or other marine-related outreach education programs. Courtesy faculty and professional faculty are *not* included in this count. However, it is important to note that many of them are working on marine topics, and they provide significant services to OSU and the state. In fact, we recommend that a thorough inventory and analysis of the coastal and ocean-related activities of courtesy and professional faculty be carried out in the future.

Our examination of available information identified 150 faculty members as being involved in coastal and ocean activities. Table 9 shows how those individuals are distributed among OSU's colleges and departments. Table 10 shows the subject areas in which the faculty members are involved, independent of college or department. Because the biological sciences quantitatively dominate both research and teaching, it is not surprising that 69 (46%) of the faculty members involved in coastal and ocean sciences are working in one of the biological sciences. At the other end of the scale, only 12 of them (8%) are working in social sciences, policy, or economics.

The reader will note that the College of Forestry (COF) is not among the colleges listed above for having course offerings or active research projects in coastal and ocean sciences. Yet, four members of the COF faculty are among those included in table 9. The four faculty members in question are involved in both teaching and research on watershed systems, landslides and hillside stability, or public communications. While these topics are certainly not uniquely coastal, they are so strongly relevant and important to the coast that we chose to include them here. We would also like to note that the Coastal Landscape Analysis and Modeling Study (CLAMS), which focuses on the Oregon Coast Range, is an ongoing project of the U.S. Forest Service.

College/Department	Number of Faculty
Agricultural Science	
Agricultural and Resource Economics	4
Fisheries and Wildlife	23
Food Science	4
College Total	31
Ocean and Atmospheric Sciences	
College Total (No Departments)	70
Engineering	
Civil, Construction, and Environmental	7
Electrical	2
Chemical	1
College Total	10
Forestry	
Forest Resources	2
Forest Science	2
College Total	4
Health and Human Sciences	
College Total (Public Health)	2
Liberal Arts	
Anthropology	1
Sociology	3
Political Science	1
College Total	5
Pharmacy	
College Total	1
Science	
Botany and Plant Pathology	3
Geosciences	2
Microbiology	5
Zoology	13
Biology	1
Science and Math Education	1
College Total	25
Veterinary Medicine	
College Total	2
OSU Total	150

Table 9. Professorial faculty at OSU involved in coastal and ocean teaching or research by college and department

Table 10. Professorial faculty involved in coastal and ocean sciences by subject area, independent of college or department

Subject Area	Number of Faculty	Percent of Total
Biological Sciences	69	46%
Physical Sciences	24	16%
Geological Sciences	22	15%
Chemistry	11	7%
Engineering	10	7%
Social Sciences	8	5%
Economics	4	3%
Education	2	1%
OSU Total	150	100%

Appendix I. Centers, Institutes, and Programs Involved in Ocean and Coastal Sciences at Oregon State University

The Aquaculture Collaborative Research Support Program (ACRSP)

<http://pdacrsp.oregonstate.edu/>

Hillary S. Egna, Ph.D., Director

The mission of the Aquaculture Collaborative Research Support Program (ACRSP) is to enrich livelihoods and promote health by cultivating international multidisciplinary partnerships that advance science, research, education, and outreach in aquatic resources. The Management Entity at Oregon State University is responsible for the programmatic and fiscal management of the program and reports directly to the United States Agency for International Development (USAID).

To establish the present portfolio of activities, the Management Entity, through a consultative process, set overall themes for aquaculture and responsible aquatic resource management research and outreach in developing countries and conducted regional priority-setting processes to engage regional stakeholders in Africa, Asia, and Latin America. Through a peer-reviewed competitive process, the Management Entity selects focused projects and manages them through to completion. The projects involved in the ACRSP are multidisciplinary and draw upon the great depth and expertise in U.S. universities, NGOs, governmental bodies, and the private sector.

Activities are currently ongoing in 23 countries: Bangladesh, Bolivia, Brazil, Cambodia, China, Colombia, the Dominican Republic, Ecuador, El Salvador, Ghana, Guatemala, Honduras, Kenya, Mexico, Nepal, Nicaragua, Panama, Peru, the Philippines, South Africa, Tanzania, Thailand, and Vietnam. The overall context for the program is sustainable aquaculture development in coastal and inland waters. Project areas include production technology; watershed management; and human welfare, health, and nutrition. Every project focuses on institutional strengthening and outreach while at the same time fostering economic growth, food security, and the wise use of natural resources.

An example impact includes the development of novel feeding methods in the Philippines that reduced farm management and feed costs by about \$400/hectare. This translated into a 17 percent increase in the net value of the crop. Farmers in the Philippines immediately adopted this method, and it has since been conveyed to researchers and adopted by farmers in other nations throughout the ACRSP network.

The ACRSP has a long track record of success in training and education. Over 530 students have been trained with university degrees—more than 400 of them advanced degrees—in disciplines related to business, ecology, health, agriculture, and natural resources. ACRSP has offered short-term trainings and topical workshops to over 3,500 people in developing countries. At present, ACRSP manages a portfolio of 19 direct subcontracts and has extended subcontracting relationships with another seven U.S. institutions. Annual program funding averages around US\$2.15 million from USAID, with an average of \$2 million per year in leveraged funding and university matching.

Center for Fish Disease Research (CFDR)

<http://oregonstate.edu/dept/salmon/>

Michael L. Kent, Ph.D., Director

The faculty of Oregon State University have been in the forefront of fish disease research for over 30 years, beginning with the pioneering efforts of Dr. John L. Fryer, OSU distinguished professor of microbiology emeritus and first director of the center, which was established in 1994. In 1999 Dr. Michael L. Kent, professor in the Department of Microbiology, became the director. Investigators have trained many of the nation's professional fish pathologists and fish health researchers, identified the causes of several important diseases afflicting fishes in the Pacific Northwest, and developed vaccines and diagnostic tests that are routinely used for

cultured and wild stocks of fish. In addition, they have provided a wealth of knowledge on the pathogenic mechanisms and epidemiology of most of the serious salmonid and other fish diseases of the U.S. and the world.

In 2001 the name of the center was changed from the Center for Salmon Disease Research to its present name to reflect the breadth of the fish species under investigation, which include wild marine fishes, ornamental species, and fish used as research models. Nevertheless, diseases of salmonid fishes remain a primary focus of the center.

The CFDR seeks to resolve disease problems that present a threat to all species of finfish and shellfish of the Pacific Northwest, the nation, and the world. The primary function of the center is to promote and assist the fish disease research of the CFDR investigators and those who desire collaborative ties. The CFDR is a multidisciplinary unit that serves as a research and educational center within OSU and the Oregon University System. Center investigators consist of faculty primarily from the Colleges of Agricultural Sciences, Science, Pharmacy, and Veterinary Medicine; the Hatfield Marine Science Center; and the Oregon Department of Fish and Wildlife pathology section. Several scientists from other institutions with an interest in fish disease are affiliate members.

The central research facility of the CFDR is the John L. Fryer Salmon Disease Laboratory (SDL), a 9000 square-foot regional fish disease research facility dedicated to the study of organisms infectious for salmonids and other species of marine and freshwater fish. The laboratory was constructed through a grant from the Bonneville Power Administration, with matching funds from OSU.

The SDL has wet laboratory capacity for maintaining fish, as well as providing space for an analytical laboratory, a tissue-culture facility, a microscopy room, office space, and a conference room/library. The researchers conduct studies in the areas of pathogenic bacteriology, virology, mycology, parasitology, immunology, and epidemiology.

The laboratory is supplied with specific-pathogen-free water from two wells, each with a capacity of more than 300 gpm. The water, which has an ambient temperature of 12.8°C, is processed through a degassing tower to eliminate any gas supersaturation and allow oxygen to saturate into the water. Heated water provides high-quality freshwater for warm-water species, such as zebrafish. Thus, this system provides consistent high quality water year-round. Effluent from the laboratory is treated with chlorine to prevent the escape of any pathogens from the facility. All systems are redundant and can be operated with a diesel-electric generator in the event of commercial power failures.

The wet laboratory is divided into two sections, one for stock fish and experiments not involving infectious agents and the other for holding fish to be used in disease experiments. The stock area has 49 tanks of various sizes from 3 to 12 feet in diameter. The experimental area has 128 one hundred-liter tanks and 120 twenty-five liter tanks that will accommodate various sizes of fish. Added at the end of 2004 are 18 thirty-gallon aquaria for zebrafish research. An added important piece of the facility is the isolation lab with 24 twenty-five liter tanks and over 300 square feet of space for isolation research.

Currently, several undergraduate students, graduate students, technicians, and faculty from OSU, outside universities, and other organizations are using the SDL to conduct experiments.

Some Diseases of Fishes under Investigation by Center Members

Diseases of Salmon and Trout

Salmon viruses, salmon bacteria, salmon parasites, idiopathic or noninfectious diseases of salmon

Selected Marine Fish Diseases and Parasites

Yellowtail rockfish (*Sebastes flavedus*), opakapaka
(*Pristipomoides filamentosus*)

Willamette Valley

Skeletal deformities related to parasites: *Apophallus* and
Myxobolus

Investigators and Partners

Oregon State University Members

Michael L. Kent, Ph.D., Director of the Center for Fish Disease Research and Professor,
Department of Microbiology
Jerri Bartholomew, Ph.D., Assistant Professor, Senior Research, Department of Microbiology
Christopher Bayne, Ph.D., Professor Emeritus, Department of Zoology
Sascha Hallett, Ph.D., Department of Microbiology
Jerry R. Heidel, D.V.M., Ph.D., Diplomate ACVP, AFS Fish Pathologist,
Director, Veterinary Diagnostic Laboratory, College of Veterinary Medicine
Jerry D. Hendricks, Ph.D., Professor, Department of Environmental and Molecular
Toxicology; Marine and Freshwater Biomedical Sciences Center
Richard Holt, Ph.D., Retired Fish Pathologist, Oregon Department of Fish and Wildlife,
Assistant Professor—courtesy appointment/Senior Researcher, Department of
Microbiology
Douglas J. Leisy, Ph.D., Assistant Professor/Senior Research, Department of Microbiology
Jo-Ann C. Leong, Ph.D., Distinguished Professor Emeritus, Department of Microbiology;
Professor and Director, Hawaii Institute of Marine Biology
School of Ocean & Earth Sciences & Technology, University of Hawaii at Manoa
Robert E. Olson, Ph.D., Emeritus Professor, OSU Hatfield Marine Science Center
Carl B. Schreck, Ph.D., Professor and Leader, Oregon Cooperative Fish and Wildlife
Research Unit, Department of Fisheries and Wildlife
Jan Spitsbergen, D.V.M., Ph.D., Research Assistant Professor, Department of Environmental
and Molecular Toxicology; Marine and Freshwater Biomedical Sciences Center
Christopher Whipps, Ph.D., Department of Microbiology

Affiliate Members

(non-OSU faculty, from the greater northwest region of the United States)
Tony Amandi, Oregon Department of Fish and Wildlife
Mary Arkoosh, Ph.D., Project Leader of Immunology Group Ecotoxicology Branch
Craig Banner, Oregon Department of Fish and Wildlife
Kenneth D. Cain, Ph.D., Assistant Professor (Aquaculture and Fish Health), Department
of Fish and Wildlife Resources, University of Idaho
Ralph Elston, Ph.D., AquaTechnics/Pacific Shellfish Institute
H. Mark Engelking, Ph.D.
Kym C. Jacobson, Ph.D., Zoologist, Estuarine and Ocean Ecology Program, Fish Ecology Di-
vision, Northwest Fishery Science Center, National Marine Fisheries Service; NOAA/NMFS/
NWFSC, Hatfield Marine Science Center
Keith A. Johnson, Ph.D., Eagle Fish Health Laboratory
Scott E. LaPatra, Ph.D., Director of Research and Development, Clear Springs Foods, Inc.
Jim Winton, Ph.D., Chief, Fish Health Section, Western Fisheries Research Center

The Coastal Landscape Analysis and Modeling Study (CLAMS)

<http://www.fsl.orst.edu/clams/>

Co-leaders:

Thomas Spies, Ph.D., USFS PNW Research Station
K. Norman Johnson, Ph.D., OSU Department of Forest Resources

CLAMS is a multidisciplinary research effort sponsored cooperatively through OSU's Col-
lege of Forestry, the U.S. Forest Service's Pacific Northwest Research Station, and the Oregon
Department of Forestry. The goal of CLAMS is to develop and evaluate concepts and tools to

understand pattern and dynamics of provincial ecosystems such as the Oregon Coast Range and to analyze the aggregate ecological and socioeconomic consequences of different forest policies and strategies across multiple ownerships of the province.

The six major objectives of the project are to

1. Characterize the spatial pattern and history of ecological and socio-economic components of the Coast Range
2. Develop ecological and socioeconomic models, measures, and linkages
3. Develop spatial policy evaluation tools and data for use by technical specialists
4. Project aggregate effects of current and selected alternative forest policies on key resources and outputs
5. Evaluate consequences of alternative fundamental strategies to natural resource management
6. Synthesize multiscale assessments and provide information for joint learning among stakeholders

These objectives will be met through development of a compatible set of spatial databases and spatial simulation models. Vegetation and physical conditions of the province will be characterized with GIS models that use LANDSAT imagery, 10 m digital elevation models and climate and geology data. Landowner behavior (land-use change and timber harvesting practices) will be simulated, based on landowner surveys. Coarse and fine-scale measures of biodiversity will be developed from the literature, limited field studies, and analysis of existing data. Habitat suitability models (fine-scale measures) will be developed for selected species and validated where possible against existing field-study data. Aquatic habitat potential measures for salmonids will be developed at the watershed scale. Indicators of landslide and debris flow potential will be developed. A spatial forest dynamics simulator will be used to project harvesting and stand growth under current and alternative policies for 100 years. A stand growth and yield model (Organon) and a forest succession model (Zelig) will be used to project forest development. Economic effects will be estimated using IMPLAN. Recreational opportunities and contingent valuation of biological diversity will also be evaluated.

Personnel

Thomas Spies: landscape ecology, PNW (Co-leader)
K. Norman Johnson: forest management and policy, OSU (Co-leader)
Pete Bettinger: modeling, University of Georgia
David Boughton: forest ecology, PNW
Kelly Burnett: aquatic biology, PNW
Brian Garber-Yonts: forest social science, OSU Dept. of Forest Resources
Gordon Grant: hydrology, PNW
Becky Johnson: economics, OSU
Jeff Kline: economics, PNW
Stephen Lancaster: hydrology, OSU
Gary Lettman: economics, Oregon Department of Forestry
Brenda McComb: wildlife biology, University of Massachusetts
Janet Ohmann: forest ecology, PNW
Gordon Reeves: aquatic biology, PNW
Mike Wimberly: forest ecology, University of Georgia

CLAMS Projects

Human Systems

Land Use History and Projections
Current Management Intentions
Socioeconomics

Terrestrial Biodiversity

- Assessing Biodiversity at Broad Scales
- Historical Vegetation
- Current Vegetation
- Current Wildlife Habitat Patterns
- Forest Growth with ORGANON and ZELIG

Watershed Processes and Aquatic Habitat

- Fine-Scale Models of Landslides and Debris Flow
- Broad-Scale Models of Landslides and Debris Flows
- Stream Delineation and Reach Characterization
- Aquatic Habitat

Landscape Models

- Modeling Landscape Management and Policies
- Simulation of Current and Alternative Policies

The Coastal Oregon Marine Experiment Station (COMES)

http://marineresearch.oregonstate.edu/main_page.htm

Gil Sylvia, Ph.D. Superintendent (Agricultural Resource Economics, OSU)

Michael Morrissey, Director, OSU Seafood Laboratory, Astoria, OR

The Coastal Oregon Marine Experiment Station (COMES) conducts research to understand, utilize, and sustain marine resources and coastal ecosystems in order to benefit the citizens of Oregon, the Pacific Northwest, the nation, and the world. In furtherance of this mission, the long-term goals of COMES are to

1. Increase economic and social benefits from wise use, management, and sustainability of the state's valuable marine resources and coastal ecosystems
2. Develop new or improved seafood products and efficient production processes that provide safer and higher-valued seafood
3. Develop new and improved aquaculture products, processes, and systems
4. Improve marketing efficiency and expand the export and domestic markets for Oregon's seafood products
5. Develop systems for protecting living marine resources from diseases, genetic depletion, and other hazards
6. Support beneficial economic development of coastal Oregon communities
7. Communicate knowledge to students, scientists, managers, industry, and the public that supports wise utilization and sustainability of marine resources
8. Teach, advise, and mentor undergraduate and graduate students who become future leaders in marine science and resource management

To accomplish these goals, faculty at COMES will develop effective partnerships with on-campus faculty, departments, and colleges, the Oregon seafood industry, the OSU Cooperative Extension Service, the Oregon Sea Grant Program, the Oregon Department of Agriculture, the Oregon Department of Fisheries and Wildlife, NOAA Fisheries, and other state, federal, and nongovernmental organizations.

COMES includes faculty, staff, and students located at the Hatfield Marine Science Center and the Seafood Laboratory in Astoria. COMES is the largest applied marine research unit in Oregon and the largest branch experiment station in the United States dedicated solely to coastal and marine issues. COMES was established in 1988 by the Oregon legislature to conduct interdisciplinary and cooperative research to understand, utilize, and sustain Oregon's marine resources, industries, and coastal communities. 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. Seventeen years COMES has grown to include 11 tenured faculty, 30 staff and research associates, 40 graduate students, and over \$3 million annually in external grants and funds.

The research programs of COMES encompass seven primary areas: aquaculture, fish disease, fisheries science, fishery management, marine mammals, marine economics and marketing, salmon and marine fisheries ecology/genetics, and seafood science and engineering. Approximately half of the COMES faculty have joint positions within their academic homes, Oregon Sea Grant, 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 the National Marine Fisheries Service and the Oregon Department of Fish and Wildlife. COMES also helps sponsor workshops and conferences that further its mission of supporting wise use of marine resources. COMES is now hiring three tenured-track faculty in fisheries ecology, cetacean biology, and pinniped biology, which is expected to substantially boost the growth of COMES over the next five years.

The year 2004–2005 was highly successful and marked continued growth of COMES. Based on the Oregon Invests database, we determined that in 2004–2005, COMES programs generated over \$10 million in economic impacts and produced 30 new jobs for Oregon and Pacific Northwest coastal communities. These impacts are the result of research leading to improved utilization of marine resources, increased production of commercially harvested and cultured seafood, development of value-added seafood products, and improved policies for resource management. COMES published 78 manuscripts and reports, including 45 in refereed journals and books. COMES graduated 18 students, including 12 with a master's degree and 6 Ph.D's. COMES faculty also gave over 100 presentations and organized 16 workshops and conferences. For 2004–2005, it is estimated that for each \$1 million in state dollar expended, COMES faculty leveraged an additional \$3 million in federal grants and private support.

COMES projects

The Pacific Whiting Project
Community Seafood Initiative
Molluscan Broodstock Program
Marine Mammal Endowed Program
OSU Surimi Research and Technology School
Salmon and Marine Ecology Initiative

COMES personnel

Aquaculture—Chris Langdon
Fish Disease—Paul Reno
Marine Fisheries Ecology—TBA
Pinniped Ecologist—TBA
Cetacean Biologist—TBA
Commercial Fishery Dynamics—David Sampson
Fisheries Mgt & Policy—Susan Hanna
Marine Fisheries Genetics—Michael Banks
Marine Mammal Program—Bruce Mate
Resource Economics & Marketing—Gil Sylvia
Seafood Microbiology/Safety—Yi-Cheng Su
Value-Added Products—Michael Morrissey
Seafood Science & Surimi Education—Jae Park

The Cooperative Institute for Marine Resources Studies (CIMRS)

<http://oregonstate.edu/groups/cimrs/>

Director, Dr. Michael A Banks

The Cooperative Institute for Marine Resources Studies (CIMRS) was established to foster collaborative research between OSU and the National Oceanic and Atmospheric Administra-

tion (NOAA) in fisheries ecosystem studies, aquaculture, oceanography, and marine-resource technology and related fields. Today CIMRS brings university scientists together with scientists from NOAA's NW Fisheries Science Center, Alaska Fisheries Science Center, and Pacific Marine Environmental Laboratory to work on problems of mutual interest relating to the living and non-living components of the marine environment and their interrelationships.

The current CIMRS partnership brings together scientists from NOAA's NW Fisheries Science Center, the Pacific Marine Environmental Laboratory, and Oregon State University to work on problems of mutual interest relating to the living and nonliving components of the marine environment and their interrelationships. CIMRS research staff are currently involved in scientific efforts that parallel NOAA's program objectives in the areas of (1) geological/chemical oceanography, specifically, assessing the effects of spreading-center hydrothermal venting on the marine physical, chemical, and biological environment and defining the tectonic and volcanological processes producing oceanic crust at slow- and fast-spreading ridge systems; and (2) fisheries oceanography, long-term observations, mesoscale surveys and process studies of mesozooplankton, and selected species of euphausiids off the Oregon-northern California coast; distribution and trophic interactions of juvenile salmonids and associated taxa off the Oregon-northern California coast; and chemical and biological implications of ground-fish harvesting on the West Coast of the U.S.

CIMRS encourages and assists the education and training of scientists in disciplines related to marine resources by facilitating student internships, assistantships and workshops.

CIMRS is administered through the OSU Research Office and is directed by Director Michael A. Banks. The institute is governed by an executive board and meets regularly with members of the scientific advisory council. CIMRS research staff are based at the Hatfield Marine Science Center in Newport.

CIMRS Research Staff

Michael A. Banks, Director

Oceanic and Atmospheric Research, Pacific Marine Environmental Laboratory, Geology and Geophysics

Andra Bobbitt—Senior Research Assistant

Bill Chadwick—Associate Professor, Research (Adjunct, COAS)

Susan Merle—Senior Research Assistant

Acoustic Monitoring, Seismology/Whale Acoustics

Bob Dziak—Associate Professor, Research (Adjunct, COAS)

Matt Fowler—Research Assistant

Joe Haxel—Research Assistant

Sara Heimlich—Research Assistant

Andy (Tai-Kwan) Lau—Faculty, Unranked

Haru Matsumoto—Research Associate

Dave Mellinger—Assistant Professor, Research

Sharon Nieukirk—Senior Research Assistant

Hisham Qayum—Research Associate

Hydrothermal Emissions

Leigh Evans—Research Assistant

Ron Greene—Research Assistant

Courtesy Faculty

Robert Embley, COAS

Stephen Hammond, COAS

John Lupton, COAS

National Marine Fisheries Service, NW Fisheries Science Center

Zooplankton Ecology

Leah Feinberg—Research Assistant

Hongsheng Bi—Research Associate

Karen Hunter—Research Assistant
Jesse Lamb—Research Assistant
Cheryl Morgan—Senior Research Assistant
Jay Peterson—Research Assoc.
Tracy Shaw—Research Assistant
Jennifer Menkel—Research Assistant

Fish Ecology

Toby Auth—Research Assistant
Becky Baldwin—GRA
Mary Bhuthimethee—Research Assistant
Elizabeth Daly—Research Assistant
Jason Phillips—Research Assistant
Carrie Johnson—Research Assistant
Suzan Pool—Research Assistant
Jim Ruzicka—Research Associate
Todd Sandell—Research Assistant
Heather Soulen—Research Assistant

Fishery Resource Analysis and Monitoring

Jim Colbert—Research Associate
Vladlena Gertseva—Assistant Professor, Senior Research
Courtesy Faculty
Dan Bottom, COAS
Ric Brodeur, COAS
Kym Jacobson, F/W
Bill Peterson, COAS
Michael Schirripa, COAS
Waldo Wakefield, COAS

CIMRS Executive Board

Rich Holdren—Chair, Vice-Provost for Research, OSU
Usha Varanasi—Director, Northwest Fisheries Science Center
Eddie N. Bernard—Director, Pacific Marine Environmental Laboratory, NOAA
Sherman Bloomer—Dean, College of Sciences, OSU
Erik Fritzell—Assoc. Dean, College of Agricultural Sciences
Mark Abbott—Dean, College of Oceanic & Atmos. Sciences
Robert E. Malouf—Director, Oregon Sea Grant
George Boehlert—Director, Hatfield Marine Science Center
Clare E. Reimers—Director, CIMRS (Ex Officio)

Program Links

NOAA Vents Program
NOAA Ocean Exploration Program
NOAA Northwest Fisheries Science Center
NOAA Alaska Fisheries Science Center
NOAA Office of Public And Constituent Affairs
NOAA West Coast & Alaska Tsunami Warning Center
HeadsUp!
Marine Protected Areas
National Marine Labs
Pacific States Marine Fish. Comm.
Pacific Northwest Seismograph Network
Active Tectonic Lab, College of Oceanic and Atmospheric Sciences

Cooperative Institute for Oceanographic Satellite Studies (CIOSS)

<http://cioss.coas.oregonstate.edu/CIOSS/>

Ted Strub, CIOSS Director and Professor

Mike Freilich, CIOSS Deputy Director, Associate Dean, and Professor

The primary purpose of the Cooperative Institute for Oceanographic Satellite Studies (CIOSS) is to establish a cooperative (federal-academic) center of excellence for research involving satellite remote sensing of the ocean and its air-sea interface. CIOSS provides a mechanism to bring together the resources of a research-oriented university (OSU), NESDIS, and other NOAA line offices, with additional partners at other universities, and government and private agencies.

CIOSS research helps NOAA/NESDIS fulfill its mission in providing the remote sensing component of the “national backbone” for the Integrated Ocean Observing System (IOOS), which includes operational and research components within NOAA, ONR, NSF, and NASA. CIOSS contributes to the development of ocean observing and modeling systems through the following:

- Research that helps to develop and improve our understanding of, and operational products related to, the upper ocean and air-sea interface. It does this by using data from present and past satellites and by helping to plan future satellite sensors
- Research that helps to incorporate and assimilate those products and understanding into ocean and atmosphere circulation models
- Education and training in the same topics, reaching a wide range of audiences in formal education (K–16 education, graduate school, ongoing professional training) and informal education (public outreach)

CIOSS is designed to accomplish the following broad objectives:

- Foster and provide a focus for research related to NOAA’s mission responsibilities and strategic objectives in the coastal and open ocean, emphasizing those aspects of oceanography and air-sea interaction that use satellite data, along with models of oceanic and atmospheric circulation
- Collaborate with NOAA research scientists in using satellite ocean remote sensing through: evaluation, validation, and improvement of data products from existing and planned instruments; development of new multi-sensor products, models, and assimilation techniques; and investigation and creation of new approaches for satellite data production, distribution, and management
- Improve the effectiveness of graduate-level education and expand the scientific training and research experiences available to graduate students, postdoctoral fellows, and scientists from NOAA and other governmental laboratories and facilities
- Educate and train research scientists, students, policymakers, and the public to use, and appreciate the use of, satellite data in research that improves our understanding of the ocean and overlying atmosphere

Research Themes and Tasks

CIOSS activities are described within three categories: administration, research, and outreach.

Administration consists of activities related to the CIOSS office and broader infrastructure, internal and external governing boards, and the relationships between CIOSS, COAS, OSU, NOAA/NESDIS/STAR, other NOAA components, and other academic, government, and private institutions. Reports, proposals, and ongoing communications between CIOSS, NOAA, and other institutions are administrative duties, as are the logistical arrangements for workshops and other CIOSS-related meetings.

The overarching goal of CIOSS research is to develop, evaluate, improve, and use methods of ocean remote sensing and ocean-atmosphere modeling to increase our understanding of the ocean and atmosphere. This goal encompasses the mutual research interests of OSU/COAS/CIOSS, NOAA/NESDIS, and other NOAA line offices in

1. basic research in ocean, atmosphere and marine ecosystem dynamics
2. applications of basic research to the management of living and nonliving resources within the coastal and open ocean
3. contributions to ocean observing and modeling systems through the evaluation of plans for future satellite systems and models

Outreach consists of activities, undertaken by NOAA and academic partners, that link CIOSS research and its results to a broader community of students, scientists, resource managers, and the general public. These activities should increase the utility of the research by making those not directly involved with the research more capable of using and benefiting from the research (accessing its conclusions, data, methods, etc.). At the same time, the activities should increase awareness of the value of the research and of the roles of NOAA and academic scientists in conducting the research. The overall goal of outreach is to give the research a broader impact on a wider community. Because outreach is directly related to CIOSS research, it is included as a research theme. Research into the most effective methods of outreach is also included.

Research and outreach are conducted within five broad research themes:

1. **Satellite Sensors and Techniques:** Development of satellite oceanography techniques and applications; evaluation of existing and proposed satellite sensors, algorithms, techniques, and applications
2. **Ocean-Atmosphere Fields and Fluxes:** Development, evaluation, and analysis of improved fields of physical and biological variables in the upper ocean and of surface variables and fluxes at the air-sea interface, using combinations of remote sensing, in situ data, and modeling
3. **Ocean-Atmosphere Models and Data-Assimilation:** Use of satellite-derived fields to force and evaluate numerical models of the oceanic and atmospheric circulation, including the assimilation of those fields using methods of inverse modeling. For some applications, the ocean models will include components of marine ecosystems.
4. **Ocean-Atmosphere Analyses:** Dynamical and statistical analyses of data sets derived from satellites, models, in situ instruments, in order to increase our understanding of the physical, chemical, biological, geological, and societal processes that affect and are affected by the ocean-atmosphere system
5. **Outreach:** We include three broad Outreach areas, each to be related to CIOSS research and its results. These activities may involve research into the most effective methods of conducting outreach, designing interactive displays, etc.
 - Formal education of students (K–12, undergraduate, and graduate), other scientists, resource managers, and the general public in aspects of oceanography, surface meteorology, and the use of remotely sensed data sets and numerical models. Short courses and workshops are included in this category, as are workshops designed to develop or evaluate present and planned sensors and techniques.
 - Informal education of the same groups in the same subjects, but in contexts outside of the formal educational system, short courses, and workshops. This may take the form of Web-based material, presentations, forums, and exhibits at public science museums.
 - Data access includes activities that enhance the use of data sets derived from satellites and models by research scientists, students, educators, resource managers, and the general public.

CIOSS Fellows

Mark Abbott (Chair of Executive Board)—Dean of COAS OSU
 John Allen—COAS OSU
 Jack Barth—COAS OSU
 Andrew Bennett—COAS OSU

Paul Chang—Satellite Oceanography & Climatology Division, NOAA
 Dudley Chelton (Chair of Council of Fellows)—COAS OSU
 Pablo Clemente-Colon—SOCD, NOAA
 James Coakley—COAS OSU
 Curt Davis—COAS OSU
 Gary Egbert—COAS OSU
 Steven Esbensen—COAS OSU
 James Good—COAS OSU
 Kent Hughes—SOCD, NOAA
 Alexander Ignatov—SOCD, NOAA
 Michael Kosro—COAS OSU
 Alexander Kurapov—COAS OSU
 Ricardo Letelier—COAS OSU
 Eric Maloney—COAS OSU
 Laury Miller—SOCD, NOAA
 Robert Miller—COAS OSU
 Michael Ondrusek—SOCD, NOAA
 William Pichel—SOCD, NOAA
 James Richman—COAS OSU
 Roger Samelson—COAS OSU
 Eric Skvillingstad—COAS OSU
 Yvette Spitz—COAS OSU
 Peter Strutton—COAS OSU
 Michelle Wood—Biology, University of Oregon

CIOSS Executive Board

Greg Withee—NOAA, Assistant Administrator for NESDIS
 Al Powell—NOAA, Director of STAR
 Eddie Bernard—NOAA, Director of PMEL
 Mark Abbott—OSU, Dean of COAS, Chair
 Robert Malouf—OSU, Director of Oregon Sea Grant

Ex-officio (nonvoting) members:

Ted Strub—OSU/COAS, Director of CIOSS
 Dudley Chelton—OSU/COAS, Chair of CIOSS Council of Fellows

Hatfield Marine Science Center (HMSC)

<http://hmsc.oregonstate.edu>

Director, George W. Boehlert

The Hatfield Marine Science Center (HMSC) in Newport is Oregon State University's link to the Pacific Ocean. Situated on Yaquina Bay, the 49-acre campus is operated by OSU to serve the general public, students and staff of the university, partnering state and federal agencies, and visiting scientists from other institutions.

HMSC has a 40-year history of research, education, and outreach. Originally established as a marine laboratory for Oregon State University, it has grown to encompass a large group of partners. Within OSU, HMSC includes researchers, students, or faculty from five colleges and more than ten departments and serves as home to several university programs. On-site partners include a variety of agency activities involved in research and management of the marine environment who work closely with the local communities, including the fishing industry. The Visitor Center is a key site for public education.

HMSC is Oregon State University's campus for research, education, and outreach in marine and coastal sciences. Through its partnerships, HMSC improves scientific understand-

ing of marine systems, coastal processes, and resources and applies this knowledge to social, economic, and environmental issues.

HMSC brings OSU's diverse marine science programs together for effective collaboration and higher national and international visibility. The Center plays an integral role in marine and estuarine research and instruction, as a unique laboratory facility serving resident scientists and graduate students and as a base for oceanographic research. With a combined budget in excess of \$37 million, the HMSC also plays an important economic role on the Oregon coast.

The Hatfield Marine Science Visitor Center creates a unique, dynamic environment for lifelong exploration and discovery. The Visitor Center encourages adults and children to enjoy marine science.

Our exhibits and programs explain how scientific research enhances our ability to interpret the natural patterns that shape our world and enables us to better appreciate, manage, and sustain coastal and marine resources.

The Visitor Center also provides opportunities for conducting research on devices, methods, and concepts for informal science education that will advance the art of public education.

Co-located Agencies at HMSC

State Agencies

- Oregon Department of Fish and Wildlife

Federal Research Programs

- Fisheries Behavioral Ecology Program
- Salmonid Ecosystem Analysis Program
- West Coast Groundfish Assessment Program
- NOAA Vents Program
- Whale Acoustics Program
- EPA Aquatic Stressors Research
- Oregon Coast National Wildlife Refuge Complex

Cooperating Federal Agencies

- United States Department of Agriculture
- Environmental Protection Agency
- National Oceanic and Atmospheric Administration
- National Marine Fisheries Service
- Alaska Fisheries Science Center
- Northwest Fisheries Science Center
- Oceanic and Atmospheric Research
- United States Fish and Wildlife Service

Associated Marine Laboratories

- Western Association of Marine Laboratories
- National Association of Marine Laboratories

OSU Research Groups

- Molluscan Broodstock Program
- Marine Fisheries Genetics
- Marine Mammal Program

OSU Colleges and Departments

- College of Oceanic and Atmospheric Science
- Fisheries and Wildlife
- Microbiology
- Zoology

OSU Programs

- Coastal Oregon Marine Experiment Station
- Cooperative Institute for Marine Resources Studies
- Sea Grant Extension

R/V Ship Operations

R/V *Wecoma*

Length: 184.5 ft (56.4 m)

Speed: 12 knots—normal cruise

Range: 7,200 nautical miles

Endurance: 30 days

Crew: 13 including Electronics Technician

Scientists: 18 including Marine Technician

R/V *Elakha*

Length: 54 ft (16.4 m)

Speed: 10 knots—normal cruise

Range: 400 nautical miles

Endurance: 12 hours, 48 hours max.

Crew: 3

Scientists: up to 13

Institute for Natural Resources (INR)

<http://inr.oregonstate.edu/>

Director, Gail Achterman

The Institute for Natural Resources (INR) is a cooperative enterprise bringing the scientific knowledge and expertise of the Oregon University System and other Oregon higher education institutions to bear on resource management. INR acts as a catalyst, bringing together decision makers and researchers, and developing partnerships with state, federal, tribal and local decision makers and the talented faculty of Oregon's higher education institutions.

Created by the Oregon legislature with the Oregon Sustainability Act of 2001, the Institute works to provide Oregon leaders with ready access to current, science-based information and methods for better understanding our resource management challenges and developing solutions. The Institute expands OSU's leadership role in coordinating research, supporting policy analysis, and facilitating information sharing and actions, by partnering with natural resources agencies, other universities, private businesses, conservation groups, and local to national levels of government. Collaborative projects include working closely with the Oregon Watershed Enhancement Board to carry out parts of the Oregon Plan for Salmon and Watersheds by jointly developing access to integrated natural resources data and by developing a pilot conservation strategy for the Willamette Basin under a major grant from the Meyer Memorial Trust.

Gail Achterman is the director of INR. She has formed an advisory board and as needed, ad-hoc working groups will be created to guide specific projects. The administrative offices for the Institute are on the Oregon State University campus in Corvallis, Oregon.

INR comprises two programs: Policy Research and Information.

INR Policy Research Program

The Policy Research Program offers independent analyses of environmental and natural resource issues to describe plausible policy options and their likely strengths and weaknesses. Studies conducted by the Policy Program will respond to requests from citizens, businesses, and agencies at local, state, tribal, and federal levels. Citizen participation will be included in all Institute projects on public policies. Policy analyses will be grounded in rigorous criteria for defining the context for specific policy choices and will take advantage of expertise from throughout Oregon. As much as possible, analyses will be based on field data pertinent to the policies being considered.

The Policy Research Program is patterned to some degree after the highly respected National Research Council, which is the working arm of the National Academy of Science in Washington, D.C. Studies by the Policy Program will typically be conducted on a project-by-

project basis on topics selected by users. Studies will include planned interactions with users, consistently refining issues, and justifying analyses in an open public setting. This process will be similar to that used in the 2000 State of the Environment Report led by former OSU President Paul Risser.

Policy Research Program Projects

Near Shore Columbia Sediment Management
Salmon Anchor Habitat Project
Oregon Fire Program Review
Walla Walla Basin Habitat Conservation Plan
Aggregate Mining
Marine Science Advisory Panel
Coastal Community Water Supply
Climate Change Science Conference

INR Information Program

The Institute's Information Program integrates and provides comprehensive information about Oregon's natural resources and environment to support effective decision-making at local, state and regional levels. The Oregon Natural Heritage Information Center, part of the Institute, is working in partnership with the Oregon State University Libraries' Natural Resources Digital Library (under development) to make information, text, data, maps, photographs, and video more easily accessible to researchers and the public through Web-based portals. Additional partners include the Oregon Department of Administrative Services' Geo-Spatial Data Clearinghouse and other federal and state agencies.

Information Program Projects

Oregon Natural Heritage Information Center
OWEB Acquisition Prioritization
ODFW Comprehensive Wildlife Conservation Strategy
New Publications and Updates
Sage Map
Willamette Basin Conservation Project
North Coast Web Portal
Watershed Indicators
Pacific Northwest Regional Collaboratory
OSU Libraries' Natural Resources Digital Library

Current project partners

Oregon Department of Forestry
Oregon Watershed Enhancement Board
Defenders of Wildlife
Willamette Restoration Initiative
Walla Walla Watershed Alliance
Oregon Sea Grant

Partner colleges, units, and programs at OSU

College of Agricultural Science
College of Business
College of Engineering
College of Forestry
College of Liberal Arts
College of Oceanic and Atmospheric Sciences

College of Science
OSU Libraries
Oregon Sea Grant
Oregon Agricultural Experiment Station
Oregon State University Extension
Forest Research Laboratory

Partner centers and institutes from the Oregon University System

Center for Water and Environmental Sustainability at OSU
Center for Watershed and Community Health at Portland State University (proposed)
Environmental Leadership Institute at Portland State University (proposed)
Institute for a Sustainable Environment at the University of Oregon (proposed)
Walla Walla Watershed Alliance
Oregon Sea Grant

INR Advisory Board

Elaine Brong—Oregon-Washington State Director, U.S. Bureau of Land Management
Ralph Brown—Commissioner, Curry County
Rick Gustafson—Principal, Shiels, Obletz, Johnson, Portland
Dr. Michael Hibbard—Professor & Dept. Head, Dept of Planning, Public Policy & Mgmt,
University of Oregon
Esther Lev—Executive Director, The Wetlands Conservancy
Susan Morgan, State Representative Roseburg
Charlie Ringo—Senator, Beaverton
Dr. Craig Shinn—Assoc Professor & Assoc Director Public Administration PSU/Executive
Leadership Institute
Barte Starker—Executive Vice President, Starker Forests, Corvallis
Duncan Wyse—President, Oregon Business Council
James Brown—Natural Resource Policy Director, Office of the Governor
Jim Carnahan—Vice President, David Evans & Associates, Bend
Dr. Miles Hemstrom—Forester, USFS Forestry Science Laboratory
Sue Kupillas—Allied Solutions by Kupillas, Medford
Rob Miller—President, Mt. Jefferson Farms
Olney Patt, Jr.—Executive Director, Columbia River Intertribal Fish Commission
Stuart ‘John’ Shelk, Jr.—President, Ochoco Lumber Company, Prineville
Jack Southworth—Rancher, Seneca, OR
Sara Vickerman—Director, West Coast Office, Defenders of Wildlife

Ex Officio Members

Karyle Butcher—Donald & Delpha Campbell University Librarian Valley Library, Oregon
State University
Dr. Thayne Dutton—Dean, Agricultural Sciences, OSU
Dr. Rich Holdren—Vice Provost for Research, OSU
Dr. Hal Salwasser—Dean, College of Forestry, OSU

Institute for Water and Watersheds (IWW)

<http://water.oregonstate.edu/>

*Dr. Michael Campana, Director
Professor, Department of Geosciences*

The Institute for Water and Watersheds (IWW) is a hub for water-related teaching and research activities at the university, coordinating about 80 faculty in six colleges who teach and

conduct research in areas related to water and watersheds. Other goals of the IWW include engaging OSU faculty and students with external stakeholders and issues throughout the state and establishing a set of shared water and watershed “collaboratories” supporting research, teaching, and outreach.

Oregonians are beginning to witness the difficulties caused by water limitations. Water quantity and quality issues in the Willamette and Klamath Basins are the governor’s top environmental priorities. This situation is paralleled around the world and points toward a strong emerging area for growth in research, education, and outreach. OSU is ideally positioned to assume a leadership role in addressing water problems, with about 80 faculty in six colleges who teach and conduct research in areas related to water and watersheds.

The goals of the IWW are to

- provide coordination of water and watershed activities at OSU,
- connect a diverse student body with relevant issues across the state
- enable capture of new, high-value opportunities for research, education, and outreach
- engage OSU faculty and students with external stakeholders throughout the state
- establish a set of shared water and watershed collaboratories supporting research, teaching and outreach

History and Goals

The IWW was established in 2005. The vision for the institute was developed by a team of faculty in response to an internal OSU competition to fund six interdisciplinary research and education initiatives. The competition was a component of the university’s Strategic Plan—the university would build strengths in emerging interdisciplinary fields by funding six targeted initiatives. In January 2005, the winning proposals were announced with the Water and Watersheds Initiative among them.

OSU is ideally positioned to assume a leadership role in addressing water problems. There are 80+ faculty in six colleges who teach and conduct research in areas related to water and watersheds and bring in over \$11 million a year in extramural funding. OSU is renowned for its landscape-scale ecosystems research and has just initiated five new graduate degree programs in water resources. These research and education efforts have all occurred without the benefit of programmatic coordination or strategic vision. The IWW is designed to fill that gap.

IWW Goals

The IWW seeks to leverage OSU’s existing excellence in water and watersheds by

- providing coordination of water and watershed activities at OSU
- creating an innovative, place-based educational approach connecting a diverse student body with relevant issues across the state
- enabling capture of new, high-value opportunities for research, education, and outreach
- engaging OSU faculty and students with external stakeholders throughout the state
- establishing a set of shared water and watershed collaboratories supporting research, teaching, and outreach

The IWW will help grow external funding, increase the diversity and quality of OSU students involved in water resource activities, and advance OSU’s Strategic Plan and Land Grant mission.

Relationship to Former Oregon Water Centers and USGS

The IWW is the state water resources research institute for Oregon and is one of 54 state- or territory-based institutes established by the 1964 federal Water Resources Research Act. Through this program, the IWW receives federal matching funds from the U.S. Geological Survey to support water resources research and education activities in Oregon. In this role, it replaces the Center for Water and Environmental Sustainability (CWES) which operated from 2000 to 2005 and the Oregon Water Resources Research Institute (OWRRI) which

operated from 1960 to 2000. The center is a member of the National Institutes for Water Resources.

Partnerships

USGS Water Resources Research Institutes—The IWW receives federal matching funds to support water resources research and education activities in Oregon and awards small grants through this program.

The water resources institutes in each state have formed an association called the National Institutes for Water Resources.

The Cooperative Forest Ecosystem Research program (CFER)—CFER was developed to facilitate sound management of forest ecosystems, with emphasis on meeting priority research information needs of the BLM and ODF in western Oregon.

Institute for Natural Resources (INR)—INR provides Oregon leaders with ready access to current, science-based information and methods for better understanding our resources management challenges and developing solutions.

Universities Partnership for Transboundary Waters—The Universities Partnership for Transboundary Waters is an international consortium of water expertise, including ten universities on five continents, seeking to promote a global water governance culture that incorporates peace, environmental protection, and human security.

Marine and Freshwater Biomedical Sciences Center

<http://www.science.oregonstate.edu/mfbsc/>

David E. Williams, Ph.D., OSU, Center Director

William H. Gerwick, Ph.D., UCSD, Deputy Director

The mission of the Marine and Freshwater Biomedical Sciences (MFBS) Center is the development and use of aquatic models to investigate environmental problems of concern to human health. Founded with core support from the National Institute of Environmental Health Sciences, the center was formally established by the State Board of Higher Education as a research center of excellence.

The MFBS Center provides expertise and facilities for research and training in the use of aquatic models to address important issues in human toxicology and environmental health. The ultimate goal of these efforts is the advancement of approaches for the successful prevention and treatment of human diseases. The center's outreach program translates research findings into useful information for the public.

Research Cores

The MFBS Center supports two research cores: the Carcinogenesis and Toxicogenomics Research Core and the Neuro and Developmental Toxicology Research Core.

The Carcinogenesis and Toxicogenomics Research Core uses both zebrafish and trout in studies that apply genomic approaches to ascertain mechanisms of action in neoplastic processes and possible pathways for inhibiting tumorigenesis.

The Neuro and Developmental Toxicology Research Core uses a number of in vitro (cell culture, fish chromatophores) and in vivo (zebrafish) models to address mechanisms of action of marine algae natural products and other chemicals toxic to the nervous system or to the developing embryo.

Partners and Collaborations

Oregon State University

NIEHS Environmental Health Sciences Center

Linus Pauling Institute

Science and Math Investigative Learning Experiences (SMILE) Program

College of Health and Human Sciences

College of Pharmacy
Center for Gene Research and Biotechnology
OSU Extension Service
Hatfield Marine Science Center

State of Oregon

Oregon Department of Public Health
Oregon Department of Environmental Quality
American Cancer Society, Northwest Division
Oregon Department of Education
Select Oregon high schools participating in the OSU SMILE Program and the Hydroville Curriculum Project.
Collaborative on Health and the Environment (Oregon group)

National

NIEHS Centers

Other

Oregon Center for Environmental Health
Society of Toxicology

Marine Mammal Program

<http://oregonstate.edu/groups/marinemammal/Index.html>

Dr. Bruce R. Mate, Director; Professor Fisheries and Wildlife, Oceanography

Dr. C. Scott Baker, Associate Director; Associate Professor Cetacean Ecology

Dr. Marcus Horning, Professor; Assistant Professor of Pinniped Ecology

This OSU program primarily focuses on endangered marine mammal species whose distribution, movements, and critical habitats (feeding, breeding, and migration areas) are unknown for much of the year. Decision makers use this valuable information to manage human activities that may jeopardize the recovery of endangered whale populations.

The Mammal Program, located in Newport, Oregon, has studied the behavior, abundance, and distribution of marine mammals since 1975. The program began with population assessments of seals and sea lions, combined with studies of fishery competition. In 1979 the focus shifted to cetaceans, using conventional (short-range) radio tags and concurrent shore-based observations to track gray whales from Mexico to Alaska. Since those early days, the Marine Mammal Program has pioneered the development of satellite-monitored radio tags, allowing its scientists to track many species of whales and dolphins all over the world.

Simply leaving whales alone is not a guarantee of their survival and recovery. If they are to survive and thrive, then we must understand where they breed, feed, calve, and migrate. To accomplish this goal, the Marine Mammal Program conducts research, educates graduate students, and educates the public.

Established in 1975, the Marine Mammal Program at Oregon State University has gained international recognition and respect. This respect comes largely as a result of the program's pioneering role in developing a method of tracking whales (and other marine mammals) via satellite, and the number of significant discoveries concerning their biology and behavior that resulted from this new technique. Numerous projects have been undertaken since 1989. Each project has produced significant new findings that dramatically change previous notions about the natural history and behavior of whales. OSU research findings emphasize the need for international cooperation to create effective conservation policies.

In 2006 the program added two professors, Scott Baker and Marcus Horning, expanding its research into cetacean genetics as well as the ecology of seals and sea lions.

The OSU Marine Mammal Program does much more than research. It develops resourceful graduate students who become successful professionals in state and federal government, academics, and research. Mate often teaches as a guest lecturer at the OSU campus.

Mate and his students conduct numerous public programs such as the successful public whale-watching program Whale Watching Spoken Here, now administered by Oregon State Parks. Over the years, Mate has trained 2,500 whale-watch volunteers (200 to 400 per year) who provide information to more than 40,000 tourists each year during the height of the gray whale migration cycle.

Mate also leads exciting natural history trips to some of the world's most remote and spectacular marine mammal habitats. On these excursions, participants are able to observe the animals at close range and learn about their behaviors and habitat.

Natural History Trips

Every year, OSU Marine Mammal Program Director Bruce Mate and his wife Mary Lou lead a natural history trip to San Ignacio Lagoon in Baja California, Mexico. The lagoon is one of only three existing breeding and calving grounds for the entire population of Eastern Pacific gray whales, who migrate up to 5,000 miles along the Pacific coast to reach their destination.

Mate started his whale-tagging work in San Ignacio Lagoon in 1979 and knows the area, animals, and people well. During the trip, travelers visit several islands that provide close viewing of elephant seals, California sea lions, and harbor seals. Several species of dolphins can be seen during the ocean transit, often riding the bow wave of the boat. And for birdwatchers, the opportunities to see new species—especially seabirds—are truly exceptional. Each year, the species count averages around 70.

From time to time, Mate also leads excursions to other areas of the world where people can safely see marine mammals and birds at close range in their native habitats. In January 1999, the Mates led a three-week cruise to Antarctica. Previous trips have included Southeast Alaska, the Sea of Cortez, and the Galapagos Islands.

The Molluscan Broodstock Program (MBP)

<http://hmsc.oregonstate.edu/projects/mbp/index.html>

Chris Langdon, PhD.—Program Director

Ford Evans, PhD.—Co-Program Director

The Molluscan Broodstock Program (MBP) works in partnership with the West Coast oyster industry to improve the performance of Pacific oysters through genetic selection. Other objectives are to establish a broodstock management program with industry for sustainable, long-term improvements in commercial production and to maintain a repository for genetically selected oyster families and cryopreserved gametes.

The objectives of MBP has three objectives:

- To improve Pacific oyster broodstock through selection in order to enhance commercial yields and other desirable traits
- To establish a broodstock management program for industry for sustainable, long-term improvements in commercial production
- To maintain a repository for selected top-performing oyster families and cryopreserved gametes

MBP has been producing and selecting Pacific oyster families since 1996. The broodstock population is based on six founder cohorts of 50 families each, produced from 600 wild oysters collected from different areas on the West coast. This broad founder population, together with implementation of appropriate breeding schemes, has helped reduce the negative effects of inbreeding on family yields.

Each year, two cohorts of Pacific oyster families are produced in a pilot-scale hatchery located at the Hatfield Marine Science Center, Oregon State University. Selected broodstock are pedigreed using modern genetic “fingerprinting” techniques. Pedigreed broodstock are

spawned and eggs are fertilized with sperm from the appropriate male. Larvae and juvenile oysters (spat) are reared on algal diets under conditions that exclude potential infections from harmful microorganisms and parasites. Spat from each family are planted at commercial grow-out sites in California, Oregon, Washington, and Alaska. Families with the highest survival and yields (meat weights) are identified and crossed to produce subsequent generations for selection. Selected broodstock, together with advice on broodstock management, are provided to industry to enhance commercial production. A repository preserves valuable genetic material for future applications.

MBP has achieved an average increase in yield per generation of 20% (whole live weight), compared with yields of families from unselected broodstock. The West coast oyster industry has already made extensive use of MBP broodstock and plans to continue this in the future. At present MBP focuses on selecting for yield—the sum effect of both survival and growth. Future characteristics to be selected include shell and mantle color and shell shape.

MBP is funded as a Special Project through the USDA Cooperative State Research, Education and Extension Service (CSREES).

MBP has evaluated oyster family performance in a range of growing environments. We have planted MBP families as far south as Tomales Bay in California and as far north as Prince William Sound in Alaska. MBP uses the following growout sites:

Tomales Bay, CA
Yaquina Bay, OR
Willapa Bay, WA
Totten Inlet, WA
Dabob Bay, WA
Sequim Bay, WA
Westcott Bay, WA
Prince William Sound, AK

Industry Links

Academic

Oregon State University
Western Regional Aquaculture Center

Industry Partners

Taylor Shellfish Farms
Oregon Oyster Farms
Coast Seafood Company

Industry Links

Pacific Coast Shellfish Growers Association
Pacific Shellfish Institute
National Shellfisheries Association
USDA Agricultural Research Service

The Oregon Natural Heritage Information Center (ORNHIC)

<http://oregonstate.edu/ornhic/>

James Kagan—Acting Director

The Oregon Natural Heritage Information Center (ORNHIC) is part of the Oregon State University Institute for Natural Resources and has a mission to identify the plant, animal, and ecological community resources of Oregon. Publications include *Native Wetland Plant Associations of Northwestern Oregon*. As part of the Natural Heritage Network and NatureServe, ORNHIC contributes to a better understanding of global biodiversity and provides tools for managers and the public to better protect our vanishing species and communities.

The INR was created by OSU and the Oregon Legislature in 2001 as an independent institute in the Research Office. ORNHIC and OSU's Valley Natural Resources Digital Library, make up the Information Office of the institute. Gail L. Achterman is Director of the Institute for Natural Resources.

ORNHIC has a staff of 10 to 15 employees who manage the Institute's Information Center and the Oregon Natural Heritage Program. Currently, the center is located in Portland.

The Oregon Natural Heritage Program was created by the Natural Heritage Act of 1979. It is Oregon's Natural Areas Program and its Invertebrate Species Protection Program. It is managed by OSU in cooperation with the Oregon Department of State Lands. Located in Salem, the department manages 2.3 million acres of land owned by the state of Oregon. The department acts as the administrative arm of the State Land Board, which comprises the governor, secretary of state, and treasurer.

ORNHIC's key function is to maintain, develop, and distribute biodiversity information in Oregon. The center is working with partners to provide the most comprehensive information on plants, wildlife, fish, fungi, and vegetation throughout Oregon. To better do this, ORNHIC also manages the Oregon Gap Analysis Program (OR-GAP), a national program of the USGS to identify how well native animal species and habitats are represented in our present-day network of parks and reserves. Through OR-GAP, ORNHIC continues to develop and distribute GIS information on many of Oregon's species and habitats.

Partners

NGOs

- NatureServe
- NatureServe Explorer
- The Nature Conservancy
- The Nature Conservancy of Oregon
- Defenders of Wildlife
- Oregon Biodiversity Project
- Natural Areas Association
- Institute for Applied Ecology
- Berry Botanic Garden
- Conservation Biology Institute

State

- DSL
- ODF
- ODFW
- Oregon Plan for Salmon and Watersheds
- OWEB
- Spatial Data Clearinghouse

Federal

- BLM Data
- GAP
- REO Data
- NBII
- U.S. Fish & Wildlife Service
- USFS
- USGS

Universities

OSU
Research Office
NACSE
Virtual Oregon
Forest Science
PSU
UO

Oregon Sea Grant College Program

<http://seagrants.oregonstate.edu>

Dr. Robert E. Malouf—Director

Jay Rasmussen—Assistant Director for Extension

Joe Cone—Assistant Director for Communication

TBD—Assistant Director for Education

Oregon Sea Grant is a broad program that develops and supports research, outreach, and education to help people understand, rationally use, and conserve marine and coastal resources. As part of the National Sea Grant College program, Oregon Sea Grant receives major support from the National Oceanic and Atmospheric Administration, in addition to state appropriations and contributions from local governments and industry.

Besides overseeing one of the largest Sea Grant research and outreach programs in the nation, program leaders also work with the university, state and regional agencies, and other Sea Grant programs to develop collaborative projects that ensure top value for increasingly scarce dollars.

The program leaders

- Develop collaborative and cooperative relationships with other public and private-sector groups in order to maximize the program's limited resources and provide greater public benefit. Such collaborations have permitted Sea Grant to do effective work beyond its means in areas ranging from salmon and habitat restoration to biotechnology and marine education.
- Work with citizen advisors, stakeholders, other marine scientists and state and federal agencies to develop a research and outreach agenda that responds to pressing needs in which Sea Grant can make a difference
- Award modest program development grants, on relatively short notice, to enable rapid response to emerging issues and opportunities. Such small grants have proven to be the seed money needed to launch innovative research with potentially wide public benefit.
- Sponsor and oversee graduate fellowships that provide students with the chance to develop a working knowledge of marine issues, policy, and management
- Provide the university and state agencies with advice and assistance based on our more than 30-year track record of reliable research, effective outreach, and competitive grant management

Research

Oregon Sea Grant is the conduit for National Oceanic and Atmospheric Administration research and outreach grants, awarded competitively by the National Sea Grant College Program. Additional funding comes from the Oregon legislature and collaborative efforts with public and private sources.

Sea Grant provides competitive, peer-reviewed grants that allow top ocean and coastal researchers to apply their skills to issues of critical importance to the state, the region, and the nation. Over the years, the program's funding emphasis has changed to meet and anticipate the

region's changing needs. Urgent issues—the decline of once-abundant fisheries, the challenges posed by coastal population growth and climate change, the heightened awareness of invasive species—help propel Sea Grant's research priorities as the program strives to put limited resources where they can do the most good. Many research projects have outreach components, ensuring that the results of cutting-edge science will be put to work on the ground and at sea.

Researchers come from the leading ranks of academic science in Oregon. In some cases, Oregon researchers partner with others from the Pacific Northwest and beyond to explore questions of broader regional, national, or international scope.

Current research

Economic Leadership

Aquaculture—Shipping marine ornamentals, oyster reproduction, salmon disease
Biotechnology—Cultivating symbionts for marine research; how seaweeds cope with pollution
Fisheries—Market-based environmental standards; river parasites and salmon mortality; training stakeholders in stock assessment

Coastal Ecosystem Health and Public Safety

Ecosystems and Habitats—Invasive beach grass and Pacific dunes
Coastal Hazards—Tsunami inundation models; dune and beach erosion; near-shore sand transport; community hazard preparedness

Education and Human Resources

Marine Science Literacy—Sea Grant professorship in free-choice learning

Outreach

Outreach is the bridge that carries information from the academic institution to the public and, often, back again. Sea Grant, like the Land Grant programs before it, was founded on an outreach philosophy. And although we're required to spend at least 50 percent of our federal program funds on research, outreach is by far the larger part of our program, both in numbers of people and in activities.

Outreach can take many forms:

- The marine Extension agent who lives and works in a coastal community, providing residents with information, advice, and assistance and responding to questions and issues as they arise
- The writer finding the words to explain a complex research project to make it both understandable and interesting to the public
- The research team meeting with coastal fishers and their Extension liaison to ensure that an upcoming science cruise doesn't disrupt fishing activities
- The support staff who answer the phone and greet those who walk in the door of Sea Grant offices all over the state, answering questions, providing service or connecting them with those who can
- The specialist—part researcher, part Extension agent—who uses the tools of science to help create new methods of ensuring that seafood products are both safe and tasty.
- Increasingly, the Web developer, making both new and traditional outreach products available to people all over the world at the click of a mouse button

At Oregon Sea Grant, our Extension and Communications teams are full-time outreach units but providing objective, science-based information to the public is part of what all of us do.

Education

Oregon Sea Grant has a long history of marine education, both formal and informal. Students and teachers have benefited for years from Sea Grant's science-based marine education programs. We've provided dozens of graduate and undergraduate students with first-hand learning opportunities in ocean policy, resource management, and related fields. And uncounted coastal visitors go home knowing more about the sea thanks to Sea Grant-originated programs such as Whale Watch Weeks.

In recent years, we've turned our attention to learning just what it is that makes such programs work, from museums and aquariums to the things people choose to learn on their own.

Free-Choice Learning

For most of us, learning isn't something confined to school. In fact, some studies suggest that as much as 97 percent of what we learn takes place outside the classroom. How people learn when left to their own devices is the overriding question of Sea Grant's Free-choice Learning Initiative, a collaboration with the OSU College of Science and some world-class scholars in the field of free-choice learning. This young program is jointly based on the OSU campus and at the Hatfield Marine Science Center, whose Visitor Center serves as a living laboratory for the study of voluntary human learning.

Starting in 2006, Sea Grant is dedicating special funding over a five-year period to support a new Sea Grant professorship through OSU's College of Science. The first co-holders of that senior faculty position, Lynn Dearing and John Falk, will use the theme of ocean and coastal science to establish a national focal point for research and teaching in free-choice learning.

HMSC Visitor Center

People of all ages have a chance to learn about the ocean and coastal environment at the popular Visitor Center at Oregon State University's Hatfield Marine Science Center (HMSC). Located on the rich Yaquina Bay Estuary in Newport, Oregon, the Visitor Center is the public face of a complex of marine research labs operated by OSU, NOAA, the Oregon Department of Fish and Wildlife, and other agencies. Through interactive exhibits and programs, the Visitor Center helps explain that research and what it tells us about the natural world. Among the educational activities offered at the center are classes, nature walks, lectures, seminars, and year-round programs for the whole family. The Visitor Center also boasts a small but excellent bookstore specializing in books and games about the natural world. Admission to the Visitor Center is by donation.

Sea Grant Marine Education Program

Also based at HMSC, Sea Grant's marine education program offers classes, day camps, walking tours, and a variety of special programs, including our popular Home School Days, for children from pre-school up. Special programs are available on request for K-12 classes and home schoolers.

Aquarium Science Associate's Degree Program

This new degree program is a collaboration between Sea Grant Extension marine ornamentals specialist Dr. Tim Miller-Morgan, the OSU Veterinary School, and the Central Coast Community College. Both a two-year associate's degree program and a one-year certification (for students who have already earned BS degrees) are available. The goal is to provide instruction and training opportunities for students interested in learning aquatic animal husbandry skills. Graduates are already finding employment in public aquariums, research groups, fish hatcheries, aquaculture production facilities, aquarium service businesses, and the ornamental fish trade.

Graduate and Undergraduate Fellowships and Internships

Sea Grant offers a variety of graduate and undergraduate fellowships and internships, ranging from the John A. Knauss Marine Policy Fellowships, which place marine resource graduates in federal agency positions in the nation's capitol, to opportunities to work with the Oregon legislature and various marine resource agencies. Fellowship and internship opportunities change as funding is available; we maintain an e-mail list to announce new ones as they come along.

Advisory Council

Oregon Sea Grant's Advisory Council helps ensure that research and outreach programs address the needs and priorities of Oregon's ocean and coastal communities, businesses, and policymakers.

Council members, who are appointed for three-year terms, meet periodically to help set program priorities, offer advice on specific project proposals, and, generally, advise the program's administrative staff. Members and former members of the Advisory Council also act as advocates for Sea Grant under a variety of circumstances.

Current Advisory Council Members

Dr. Xanthippe Augerot, Portland, OR. Director of Science Programs for The Wild Salmon Center

Kirk Beiningen, Milwaukie, OR. Retired, Oregon Department of Fish and Wildlife

Anne Berblinger, Portland, OR. U.S. Department of Commerce Economic Development Administration; small farm owner

Ralph Brown, Brookings, OR. Curry County Commissioner; Commercial Fisherman; member, Pacific Fisheries Management Council

Ellie Dumdi, Junction City, OR. Past member, Lane County Board of Commissioners

Nancy Leonard, Waldport, OR. Waldport City Manager; member, Oregon Land Conservation and Development Commission; past member, Oregon Water Resources Commission

Bob Montgomery, Cascade Locks, OR. Former member, Oregon House of Representatives; former Manager, Port of Cascade Locks

Mikell O'Mealy, Portland, former Sea Grant Natural Resources Fellow now employed by the state Department of Environmental Quality's Portland Harbor office

Allan Rumbaugh, Coos Bay, OR. Former General Manager, Oregon International Port of Coos Bay

William Schreiber, Bay City, OR. Owner, FV Captain Ryan; current member of ODFW Developmental Fisheries Board

Merritt Tuttle, Oceanside, OR. Retired, National Marine Fisheries Service

The Oregon State University Seafood Laboratory (OSU-SFL)

<http://osuseafoodlab.oregonstate.edu/>

Dr. Michael T. Morrissey, Director

The Oregon State University Seafood Laboratory (OSU-SFL) was established in Astoria, Oregon in 1940 to meet the increasing needs of the seafood industry through research and development, Extension outreach to the fishing industry, and graduate research, training, and instruction. The Surimi School is held each year and attracts attendees from around the world, while the Seafood Consumer Center provides a place for research and development of technology for the benefit of consumers and the fishing industry.

The principal activities of the OSU-SFL are

- Research and development
- Extension service to the fishing industry
- Graduate research, training and instruction

Research Directions

The creation of the Coastal Oregon Marine Experiment Station has given faculty and staff an opportunity to define their research priorities:

- Value-added product development
- Seafood safety
- Seafood biochemistry and quality
- Surimi and surimi seafood
- Seafood waste issues

Specific research projects include new methods to measure surimi quality, the use of high-pressure processing in oysters and other seafood products, value-added product development, seafood safety and marketing of several seafood products, including tuna and whiting in the U.S. and foreign markets. Also being investigated are ways to improve the textural properties of surimi through the use of protease inhibitors, gel enhancers, and a number of starch ingredients. The development of new processing technologies using ohmic and dielectric heating, and high-pressure processing for seafood products have shown the viability of these methods. Seafood by-product utilization and water use in processing plants is another major area of research activity.

Seafood waste and water use in processing plants is another major area of research activity. Retrieval of bioactive compounds from shrimp waste and recovery of gelling proteins from surimi wash water permit increased utilization and a reduction of wastes in the seafood industry.

Seafood safety is a growing area of research for the OSU-SFL. The reduction of *Vibrios* in oysters, elimination of *Listeria* in smoked salmon, and pasteurization of surimi by e-beam radiation are some of the exciting areas of research currently underway. The OSU Surimi School is held each year in April and attracts attendees from around the world.

New Facility and Seafood Consumer Center

The OSU-SFL has expanded rapidly over the past 14 years and currently has 3 faculty, 5 technicians and 12 researchers, including graduate students, post-docs, and visiting professors working on various research projects. Federal funds were received through the U.S. Department of Agriculture, with matching funds from the state of Oregon to construct the new facility in Astoria.

The \$3.2 million facility has provided OSU faculty and graduate students with state-of-the-art technology to employ the more specialized tools of contemporary science. The new OSU-Seafood Research and Education Center is approximately 21,000 square feet, including a biochemistry, microbiology, and seafood engineering laboratory.

The new \$1.5 million Duncan Law Seafood Consumer Center (SCC), which sits next door, was completed in the summer of 1998. Funds for the SCC were received from the Federal Economic Development Agency and the Oregon Economic Development Commission. The mission of the SCC is to address issues in consumer education, training, research, and information. It will be run as a nonprofit venture with oversight of the SCC Board. The facility is a 9,500 square foot building located beside the OSU-SFL and contains a fully equipped demonstration kitchen, meeting rooms, and retail center. The mainstay of the SCC is the Seafood School, which provides professional and nonprofessional culinarians a center for hands-on education and training. The SCC works closely with the staff of the OSU-SFL in several areas, including product development. The new OSU-SFL and SCC have allowed us to expand our capabilities in seafood research and help industry meet the changing needs of the consumer in both domestic and foreign markets.

The Community Seafood Initiative (CSI) was launched in 2001 by the Seafood Laboratory and by ShoreBank Enterprise Pacific (Ilwaco, Washington) to increase economic opportunities for locally owned fishing and seafood businesses operating in Oregon and Washington coastal communities. By developing a new service-delivery model that combines applied research, training, education, and workshops with business, finance, and community economic

development resources, CSI has helped several local seafood businesses gain a competitive edge and improve their bottom line in today's fiercely competitive global seafood market.

Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

<http://www.piscoweb.org/what>

Kristen Milligan, Ph.D.— Program Coordinator

Jane Lubchenco, Ph.D.— Lead Principal Investigator

With core funding from the David and Lucile Packard Foundation and the Gordon and Betty Moore Foundation, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) integrates long-term monitoring of ecological and oceanographic processes at dozens of coastal sites with experimental work in the lab and field, exploring how individual organisms, populations, and ecological communities vary over space and time.

PISCO is a research consortium involving marine scientists from four universities along the U.S. West coast:

- Oregon State University
- Stanford University
- University of California, Santa Barbara
- University of California, Santa Cruz

Research

PISCO scientists collaborate on integrated studies of the nearshore ecosystems of the West coast. By conducting large-scale studies over many years and at many sites, PISCO is developing a comprehensive understanding of how coastal marine ecosystems function. PISCO takes an interdisciplinary approach to answering key research questions. A major goal of PISCO is to train students in the marine sciences and to communicate accurate scientific knowledge about coastal ecosystems to policymakers, environmental managers, the media, and the general public.

The consortium has the following primary goals:

- conduct a novel program in interdisciplinary training and research
- determine the processes underlying the dynamics of the nearshore portion of the coastal ecosystem along the U.S. West coast
- establish the scientific basis for the effective design, monitoring and evaluation of marine reserves, ecosystem-based management and other conservation measures
- begin to integrate this knowledge into the public and policy arenas

Major advances in marine ecology will require that a broad suite of research tools and scientific perspectives be brought to bear on the problems at hand. This is not an easy task. Science is progressing so rapidly that individuals trained in one field are often unaware of pertinent advances in other fields, much less capable of employing these tools.

PISCO is built around a group of established scientists who represent an unusual breadth of approaches to marine ecology. By promoting close collaboration among specialists in oceanography, ecology, molecular biology, physiology, and genetics, PISCO is able to make new advances toward understanding complex coastal ecosystems.

PISCO also actively links its scientific research with student training and public policy and outreach. PISCO scientists interact frequently with resource managers, policymakers, nongovernmental organizations, and the public, as well as scientists at other universities and government agencies.

PISCO conducts fieldwork along more than 2,000 kilometers of the U.S. West Coast from La Jolla, California, to Cape Flattery, Washington. Within this region, PISCO focuses on habitats from the intertidal zone to 10 kilometers offshore. These coastal and nearshore habitats represent the region of the ocean that is most affected by human activity.

The coastal marine ecosystem along the U.S. West coast is dominated by the California Current System, and crucial patterns of water flow, nutrient supply, and temperature vary dramatically from place to place and over time, both seasonally and annually.

Each of the four universities participating in PISCO takes responsibility for fieldwork in their respective sections of the West coast, along with additional field and lab experiments. PISCO's long-term, large-scale research will offer insight into how coastal marine ecosystems are influenced by oceanographic and ecological factors.

Two major impediments to conserving marine ecosystems are a lack of understanding of the basic processes governing the essential features of these systems and ineffective transfer of new scientific knowledge to the public and to policymakers. Recent breakthroughs in numerous disciplines have made possible larger spatial- and temporal-scale studies and new syntheses across disciplines—all of which show much promise for providing better guidance for management and conservation. For example, although it is recognized that marine reserves will play a key role in marine conservation efforts, basic information about the natural transport of organisms and materials in and out of reserves is not yet in hand—but is within reach.

Achieving a new integration across scientific disciplines and between science and policy will require new institutional and educational models. PISCO's collective expertise is being used to develop critical new cross-disciplinary methodologies for marine ecological research. These new methods then are applied to a broad-scale research program that is immediately relevant to marine conservation, policy, and management. The consortium is predicated on the assumption that research, training, and policy should be intimately linked, not separate activities.

Funding

The Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) was established in 1999 with major grants from The David and Lucile Packard Foundation totaling approximately \$24 million over six years. These resources enabled PISCO scientists to demonstrate that conducting integrated, cross-scale interdisciplinary studies of the nearshore portion of a large marine ecosystem could result in exciting scientific discoveries, useful information for society, and a unique opportunity to train students in interdisciplinary thinking.

Complementary funding from the A.W. Mellon Foundation, the National Science Foundation (NSF), the Department of Interior's Minerals Management Service, other federal and state agencies, and support from the four PISCO universities greatly enhanced PISCO's capabilities to address specific questions in light of the research, monitoring, outreach, and training framework provided by the core funding. Over the first six years this complementary and leveraged funding totaled more than \$29 million. Beginning in 2005, core PISCO activities were funded by collaborative grants from the David and Lucile Packard Foundation and the Gordon and Betty Moore Foundation, totaling \$24.5 million over five years.

Additional funding comes from a diversity of sources, including federal agencies (e.g., NSF, Minerals Management Service, NOAA-NURP, Sea Grant, National Marine Sanctuary Program, National Park Service); California and Oregon state agencies, private foundations, or donors (e.g., A. W. Mellon Foundation, Robert and Betty Lundeen Fund); and PISCO Universities (University of California, Oregon State University, and Stanford University).

Principal Investigators

The principal investigators direct PISCO's scientific program:

Jack Barth , Ph.D.—Oregon State University
Mark Carr , Ph.D.—University of California, Santa Cruz
Mark Denny, Ph.D.—Stanford University, Hopkins Marine Station
Steve Gaines, Ph.D.—University of California, Santa Barbara
Gretchen Hofmann, Ph.D.—University of California, Santa Barbara
Jane Lubchenco, Ph.D.—Oregon State University
Margaret Anne McManus, Ph.D.—University of Hawaii at Manoa
Bruce Menge, Ph.D.—Oregon State University

Stephen Palumbi, Ph.D.—Stanford University, Hopkins Marine Station
Pete Raimondi, Ph.D.—University of California, Santa Cruz
George Somero, Ph.D.—Stanford University, Hopkins Marine Station
Robert Warner, Ph.D.—University of California, Santa Barbara
Libe Washburn, Ph.D.—University of California Santa Barbara

Wave Research Laboratory (WRL)

http://wave.oregonstate.edu/About_Us/

Dan Cox, Ph.D.— Director

The O.H. Hinsdale Wave Research Laboratory (WRL), together with the Coastal and Ocean Engineering Program in the Department of Civil, Construction and Environmental Engineering at Oregon State University, is a leading center for research and education in coastal engineering and nearshore science. Strengths are a critical mass of faculty specializing in physical and numerical modeling of coastal dynamics; an expanding, interdisciplinary graduate program; one of the largest and technically most advanced laboratories for coastal research; and expertise in tsunami and coastal hazard mitigation.

Our educational efforts focus on

- Graduate programs in coastal and ocean engineering
- Research experiences for undergraduates
- Education and outreach

Our graduate degree program offers M.S., M.E., and Ph.D. degrees, with required courses to insure that graduates are well-founded in coastal engineering and nearshore science fundamentals that may be applied to the specialty area of their choice.

The Coastal and Ocean Engineering Program offers students the opportunity to work with a number of faculty on a range of research topics including nearshore hydrodynamics, sediment transport, coastal structures, and hazard mitigation.

The ties between the program and the WRL ensure that students will have access to state-of-the-art facilities for research in coastal and ocean processes.

Because complex coastal problems require multidisciplinary solutions, the Coastal and Ocean Engineering Program has ties to programs in oceanography, marine geology, and computer science.

Education efforts integrates research and education at the undergraduate level through our REU program and integrates research and education with programs focusing on K-12 outreach in science and technology.

At the WRL and in the Coastal and Ocean Engineering Program, we conduct research on coastal and nearshore processes:

- Wave-structure interaction
- Nearshore hydrodynamics
- Sediment suspension and transport
- Tsunami and coastal hazards
- Environmental fluid mechanics

The people at the WRL and in the Coastal and Engineering Program work in all aspects of coastal science and technology including

- Large-scale physical modeling
- Numerical modeling
- Fieldwork

Following are the historical milestones of the laboratory:

- In 1972, the WRL originated with the construction of the large wave flume to study the stability of coastal structures.

- In 1989, the WRL was expanded by the Office of Naval Research to include a directional wave basin and a spiral basin to study the complex, three-dimensional nature of coastal problems.
- In 2001, the WRL was designated by the National Science Foundation as a site for tsunami research under the Network for Earthquake Engineering Simulation.

Equipment at the WRL:

- Tsunami basin with multi-directional wavemaker
- Circular wave basin for littoral transport
- Large wave flume (342 ft or 104 m long)
- Control room for on-site researchers

Appendix II. Courses Listed in Coastal and Ocean Topics by Subject Area, College, and Department at Oregon State University

Subject Area: Biological Sciences

The College of Science

Department of Zoology

Z 350/352 Marine Ecology
Z 361 Invertebrate Biology
Z 461/561 Marine and Estuarine Invertebrates
Z 464/564 Marine Conservation Biology
Z 481/581 Biogeography
Z 565 Marine Conservation Science and Policy
Z 594 Community Ecology

Department Botany and Plant Pathology

BOT 416/516 Aquatic Botany
BOT 499/599 ST/Marine Phycology: Seaweeds of the Oregon Coast

Department of Biology

BI 399 ST/Behavior of Fish and Other Aquatic Organisms
BI 421 Aquatic Biological Invasions
BI 450/451 Marine Mammal Section
BI 450/550 Marine Biology
BI 450/551 Marine Biology Laboratory

Department of Microbiology

MB 492/592 Diseases of Fish
MB 493/593 Diseases of Fish Laboratory

The College of Oceanic and Atmospheric Sciences

OC 440/540 Biological Oceanography
OC 441/541 Marine Zooplankton
OC 442/542 Estuarine Ecology and Biogeochemistry
OC 642 Marine Nekton
OC 644 Marine Phytoplankton Ecology
OC 645 Marine Phytoplankton Physiology
OC 646 Physical/Biological Interactions in the Upper Ocean
OC 647 Marine Microbial Processes
OC 648 Marine Benthic Ecology
OC 649 Special Topics in Biological Oceanography

The College of Agriculture

Department of Fisheries and Wildlife

FW 323 Management Principles of Pacific Salmon in the Northwest
FW 407/507 Marine Team
FW 411/511 Conservation and Management of Marine Mammals
FW 420/520 Ecology and Management of Marine Fishes (HMSC)
FW 426/526 Coastal Ecology and Resource Management
FW 431/531 Dynamics of Marine Biological Resources
FW 433/533 Marine Aquaculture and Aquarium Science

FW 441-3 Group Problem Solving—Marine Fisheries
FW 454/554 Fishery Biology
FW 455/555 Sampling and Analysis of Marine Fish Stocks
FW 464/564 Marine Conservation Biology
FW 465/565 Marine Fisheries
FW 471/571 Environmental Physiology of Fishes
FW 472/572 Advanced Ichthyology
FW 473/573 Fish Ecology
FW 474/574 Early Life History of Fishes
FW 479/579 Wetlands and Riparian Ecology
FW 494/594 Diseases and Parasites of Marine Fishes and Invertebrates
FW 497/597 Aquaculture
FW 498/598 Aquaculture Laboratory
FW 499/599 Fish Stock Assessment Methods
FW Biology of Marine Mammals
FW 590 Coastal Population Genetics and Conservation

Subject Area: Marine and Coastal Geology

The College of Science

Department of Geosciences

GEO 103 Exploring the Deep: Geography of the World's Oceans
GEO 580 Advanced GIS Applications in the Geosciences

The College of Oceanic and Atmospheric Sciences

OC 460/560 Geological Oceanography
OC 461/561 Marine Geology Case Studies
OC 464/564 Coastal Sedimentary Processes
OC 633 Geochronology and Isotope Geology
OC 660 Paleoceanography
OC 661 Plate Tectonics and Structure of Ocean Basins
OC 662 Physical, Chemical and Biological Sedimentation of the Ocean
OC 663 Geochemistry of the Deep-Sea Sediment Record
OC 664 Littoral Processes and Sedimentation
OC 665 Analysis of Geological Data Bases
OC 666 Isotopic Marine Geochemistry
OC 669 Special Topics in Geological Oceanography

Subject Area: Marine Chemistry

The College of Oceanic and Atmospheric Sciences

OC 450/550 Chemical Oceanography
OC 651 Advanced Chemical Oceanography
OC 652 Chemical Oceanography Laboratory
OC 653 Marine Radiochemistry
OC 654 Marine Pollution
OC 655 Advanced Aquatic Chemistry
OC 656 Marine Organic Geochemistry
OC 658 Petroleum Geochemistry
OC 659 Special Topics in Chemical Oceanography

The College of Pharmacy

PHAR 540 Natural Products I: Marine

Subject Area: Physical Sciences and Engineering

The College of Oceanic and Atmospheric Science

OC 430/530 Principles of Physical Oceanography
OC 670 Fluid Dynamics
OC 671 Geophysical Fluid Dynamics
OC 672 Theory of Ocean Circulation
OC 673 Descriptive Physical Oceanography
OC 674 Turbulence
OC 675 Numerical Modeling of Ocean Circulation
OC 678 Satellite Oceanography
OC 679 Special Topics in Physical Oceanography
OC 680 Stability of Geophysical Fluid Flows
OC 681 Geophysical Waves
OC 682 Oceanographic and Atmospheric Data Analysis I
OC 683 Oceanographic and Atmospheric Data Analysis II

The College of Engineering

Department of Civil Engineering

CE 411/511 Ocean Engineering
CE 415/515 Coastal Infrastructure
CE 579 Deep Foundations
CE 607 Ocean Engineering Seminar
CE 639 Dynamics of Ocean Structures
CE 640 Selected Topics in Ocean and Coastal Engineering
CE 641 Ocean Engineering and Wave Mechanics
CE 642 Random Wave Mechanics
CE 643 Coastal Engineering
CE 645 Wave Forces on Structures
CE 647 Ocean and Coastal Engineering Measurements
CE 648 Finite Amplitude Wave Mechanics

Subject Area: Other

The College of Science

Department of Science and Mathematics Education

SED 431/531 Introduction to Studies in Free-Choice Learning

The College of Oceanic and Atmospheric Science

OC 331 Introduction to Oceanography (OC 331 also offered in OSU Honors College)
OC 332 Coastal Oceanography
OC 333 Oceanic Research Frontiers
OC 433/533 Coastal and Estuarine Oceanography
MRM 507 Marine Resource Management Seminar
MRM 525A Special Topics in Marine Resource Management—coastal
MRM 525B Special Topics in Marine Resource Management—ocean
MRM 525C Special Topics in Marine Resource Management—mrm

Appendix III. Summary of Private and Public Nonprofit Sponsors for Coastal and Ocean Sciences Awards 2004–2005

	Number of Awards	Funding Amount
Foundations		
OSU Agriculture Foundation	4	\$54,902
Andrew W. Mellon Foundation	1	\$76,000
D & L Packard and G & B Moore Foundations	21	\$24,586,938
Gordon and Betty Moore Foundation	1	\$3,237,000
Kresge Foundation	1	\$100,000
Texas A&M Research Foundation	1	\$52,292
Total Foundations	29	\$28,107,132
Associations		
American Soc of Pharmacognosy	3	\$28,334
International Association of Geophysical Contractors	1	\$113,438
Total Associations	4	\$141,772
Institutions		
Incorporated Research Institution for Seismology	2	\$273,255
Monterey Bay Aquarium Research Institute	2	\$44,106
Pacific Shellfish Institute	1	\$17,129
Royal Belgian Institute of Natural Sciences	1	\$64,508
San Francisco Estuary Institute	1	\$4,000
Caribbean Marine Research Center	1	\$12,174
Total Institutions	8	\$415,172
Miscellaneous		
Bermuda Biological Station for Research Inc.	2	\$199,903
Nature Conservancy	1	\$64,000
Network for Earthquake Engineering Simulation Consortium	2	\$841,100
NorthWest Academic Computing Consortium	1	\$10,000
Pac Groundfish Conservation Trust	1	\$12,845
Pacific Seafood	2	\$23,255
Pacific States Marine Fisheries Commission	2	\$31,164
Various Cooperators (Private & Non-Private)	1	\$20,000
Total Miscellaneous	12	\$1,202,267
Commercial		
Arete Associates	1	\$9,000
British Broadcast Corporation	1	\$93,896
Island Press	2	\$289,673
LGL Limited	1	\$158,454
Luiz Calvo Sanz, S. A.	1	\$35,000
Opendap	1	\$51,022
Raytheon Polar Services Co.	1	\$41,183
Science Applications International Corporation	2	\$201,465
Shorebank Enterprise Pacific	2	\$43,002
SuperGeo Technologies Inc	1	\$24,763

	Number of Awards	Funding Amount
The Boeing Company	1	\$41,264
Portland General Electric	1	\$107,724
Total Commercial	15	\$1,096,446
Universities		
Arizona State University	1	\$40,538
Cornell University	1	\$41,561
Montana State University	5	\$300,378
Northeastern University	1	\$27,000
Oregon Health and Sciences University	3	\$226,253
Stanford University	1	\$211,114
University of Alaska	4	\$277,610
University of California	7	\$880,138
University of Hawaii	4	\$156,276
University of Mississippi	1	\$59,142
University of Rhode Island	1	\$83,333
University of Washington	6	\$224,967
Woods Hole Oceanographic Institution	3	\$196,425
Total Universities	38	\$2,724,735