

## TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>1</b>
<b>DIRECTOR'S STATEMENT</b> .....	<b>2</b>
<b>ORGANIZATION</b> .....	<b>3</b>
<b>EXECUTIVE BOARD</b> .....	<b>3</b>
<b>SCIENCE ADVISORY COUNCIL</b> .....	<b>4</b>
<b>ADMINISTRATIVE SUPPORT</b> .....	<b>6</b>
<b>PROJECTS SUPPORTED WITH CONTRIBUTED FUNDS FROM NOAA PARTNER LABORATORIES IN FY 2004</b> .....	<b>7</b>
<b>FY 2004 CONTRACTS</b> .....	<b>13</b>
<b>FY 2004 GRANTS FROM OTHER AGENCIES</b> .....	<b>13</b>
<b>INSTITUTE DIRECTOR'S RESEARCH ACTIVITIES</b> .....	<b>14</b>
<b>GRADUATE STUDENTS SUPPORTED THROUGH JOINT RESEARCH PROJECTS</b> .....	<b>15</b>
<b>2003-2004 PUBLICATIONS</b> .....	<b>18</b>
<b>CIMRS OUTREACH ACTIVITIES</b> .....	<b>20</b>

## DIRECTOR'S STATEMENT

The OSU/NOAA Cooperative Institute for Marine Resources Studies (CIMRS) represents a strong, long-term, NOAA-university partnership dedicated to research in marine science, graduate and public education, and cooperation with regional industries and communities that are dependent on marine resources.

An integral part of the OSU's Hatfield Marine Science Center (HMSC), CIMRS is a model cooperative institute for many reasons. By its co-location with three regional NOAA laboratories representing two NOAA Line Offices, the Institute is able to bring together research partners from a variety of disciplines to address complex multidisciplinary issues relating to the living and non-living components of the marine environment. It is also the administrative home for 28 research staff and 3 research faculty working on collaborative projects with NOAA investigators who serve as OSU courtesy faculty. No other OSU research institute provides both grant administration and personnel review in the manner of an academic department. In FY 2004, two CIMRS members sought promotion and were advanced in recognition of their excellent records of research and service. CIMRS faculty also conduct research with funding from agencies such as NSF and ONR, which extends the impact of the Institute and its value to NOAA.

The research focus of CIMRS addresses living and non-living marine resources and is thus linked to programs that require environmental sampling or observing within the ocean and programs that characterize seafloor habitats. This focus encompasses the broad field of marine fisheries (including fisheries oceanography, habitat research, and ecosystem-based management), geological/chemical oceanography, marine mammal acoustics, and the effects of climate change on marine ecosystems. It thus addresses ecosystem and climate mission goals in NOAA's 5-year research plan and poises CIMRS research to contribute to NOAA's 20-year research vision.

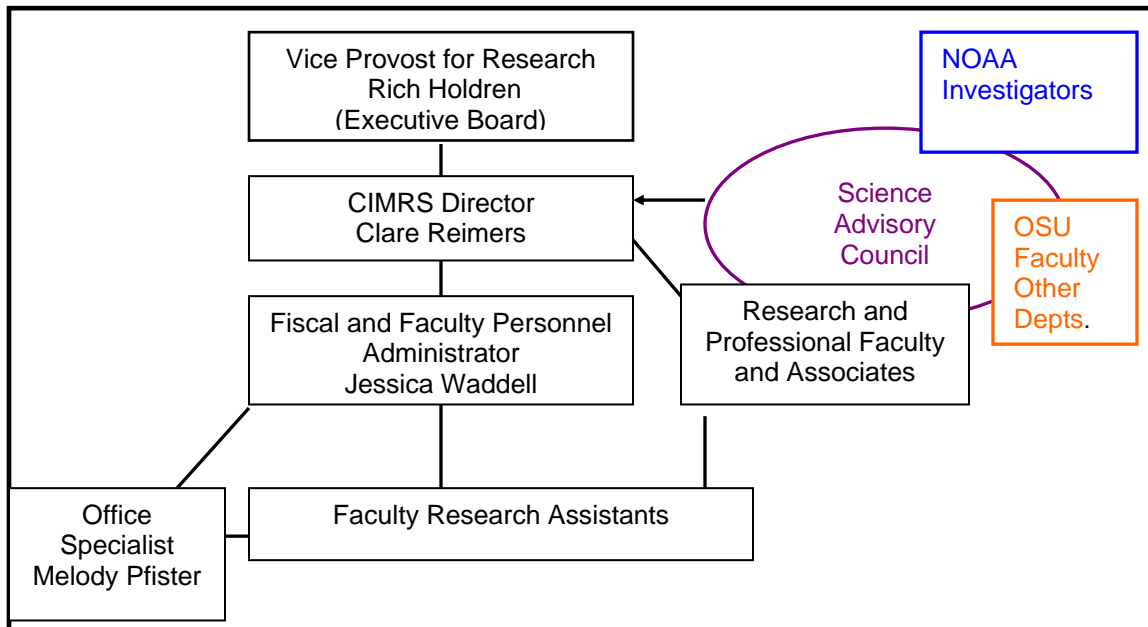
The Institute thrives because of the commitment of leaders from within the laboratories of its NOAA associates and the OSU Research Office. As a result during the past few years external research grant funding has grown, graduate student opportunities have diversified, and CIMRS has entrained many more OSU investigators from a broad range of disciplines to join together and address research problems of environmental, economic and social importance.

In summary, the scientific accomplishments of CIMRS demonstrate its value to both NOAA and the University. Its purpose is to serve as a bridge between traditional disciplines, a crossroad for fostering new ideas, and a dependable source of new research and analysis. It is anticipated that ongoing efforts will continue to raise the profile of the Institute and the partnerships it cultivates. For more information, please contact our website at <<http://oregonstate.edu/groups/cimrs>>.

Clare E. Reimers  
Director, Cooperative Institute for Marine Resources Studies

## ORGANIZATION

CIMRS is administered through the OSU Research Office with oversight from an Executive Board made up of members from the participating NOAA laboratories and collaborating OSU colleges and programs under the terms of a Memorandum of Understanding between OSU and NOAA/NMFS. A Science Advisory Council (SAC) gives input on research directions, progress, and policy to the Director. New members were invited to serve on the SAC in 2004 for 3-year terms.



## EXECUTIVE BOARD

Rich Holdren (Chair)  
Vice-Provost for Research, Oregon State University

Usha Varanasi  
Director, Northwest Fisheries Science Center, NOAA

Eddie Bernard  
Director, Pacific Marine Environmental Laboratory, NOAA

Sherman Bloomer  
Dean, College of Sciences, OSU

Erik Fritzell  
Assoc. Dean, College of Agricult. Sci., OSU

Mark Abbott  
Dean, College of Oceanic & Atmos. Sciences, OSU

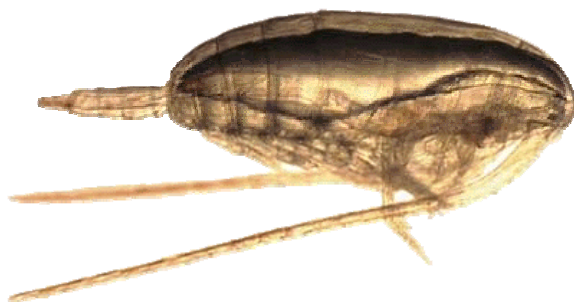
Robert Malouf  
Director, Oregon Sea Grant, OSU

George Boehlert  
Director, Hatfield Marine Science Center, OSU

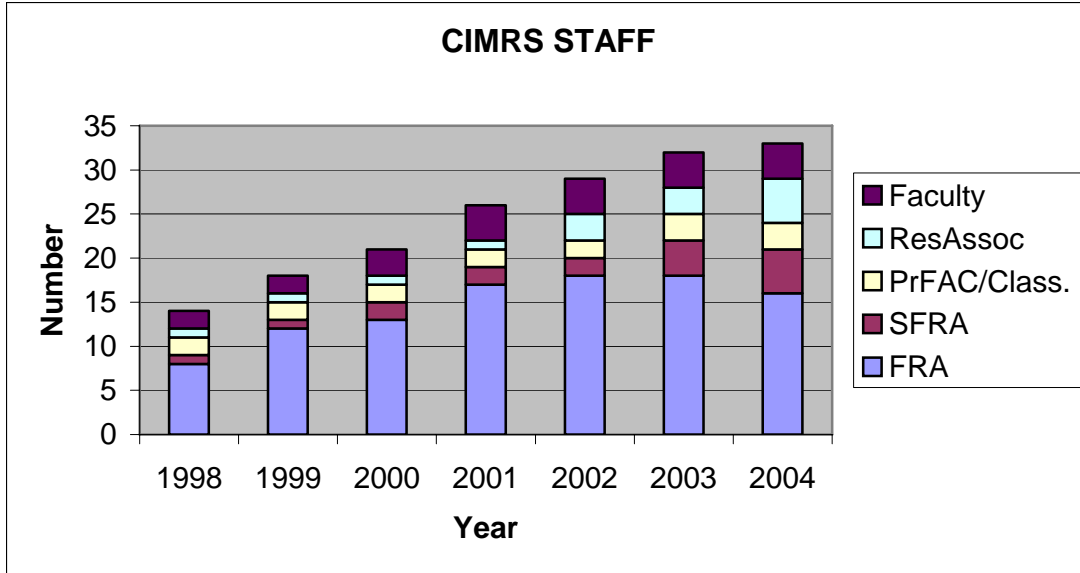
Clare Reimers  
Director, CIMRS (Ex Officio), OSU

## SCIENCE ADVISORY COUNCIL

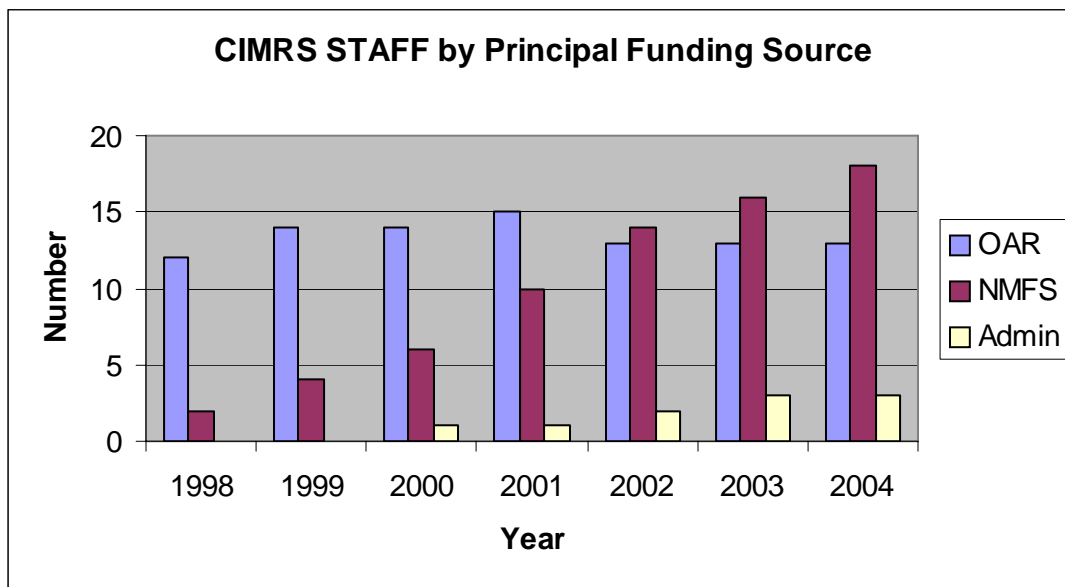
Michael Banks	Dept. of Fish and Wildlife, OSU, Newport OR
Hal Batchelder	College of Oceanic and Atmospheric Sciences, OSU, Corvallis OR
Kelly Benoit-Bird	College of Oceanic and Atmospheric Sciences, OSU, Corvallis OR
Bill Chadwick	CIMRS, OSU Hatfield Marine Science Center, Newport OR
Elizabeth Clarke	FRAM Division Director, NOAA Fisheries, Northwest Fisheries Science Center, Seattle WA and Newport OR
Tracy Collier	EC Division/Ecotoxicology, NOAA Fisheries, Northwest Fisheries Science Center, Seattle WA
Robert Embley	Ocean Environment Research Division, Pacific Marine Environmental Laboratory, NOAA, OSU Hatfield Marine Science Center Newport OR
John Ferguson	FE Division, NOAA, Fisheries, Northwest Fisheries Science Center, Seattle WA
Selina Heppell	Dept. of Fisheries and Wildlife, OSU, Corvallis OR
David Mellinger	CIMRS, OSU Hatfield Marine Science Center, Newport OR
Alan Mix	College of Oceanic and Atmospheric Sciences, OSU, Corvallis OR
Cliff Ryer	RACE Division, NOAA Fisheries, Alaska Fisheries Science Center, OSU Hatfield Marine Science Center, Newport OR
Ex-Officio – Clare Reimers	



The number of CIMRS staff has grown steadily over the past 7 years as a result of new research initiatives in fisheries ecology, stock assessment, and marine mammal acoustics. The range of responsibilities and expertise of the staff have also grown and been recognized through promotion.



Faculty =Research Professors and the Director, ResAssoc = Research Associates, PrFac = Professional Faculty, Class= Classified Staff, SFRA=Senior Faculty Research Assistants, FRA= Faculty Research Assistants.



## ADMINISTRATIVE SUPPORT

In FY2004, \$140,114 was expended by the university for CIMRS administration. These funds provided salary and benefits for the Director, Clare Reimers (0.2 FTE), the Fiscal and Faculty Personnel Administrator, Jessica Waddell (1.0 FTE), and a part-time office specialist (0.5 FTE). Administration funds were also used for personnel training and staffing, routine office supply costs, communication, computer network fees, equipment storage, hosting meetings, and contributing to public events at HMSC. Administrative support provided by the HMSC business office is not included in this figure.

Additional directed support from the NWFSC for project coordination provided another portion of the Director's salary and benefits (0.3 FTE).



“Marine Team” fisheries students experience survival training at HMSC.

## **PROJECTS SUPPORTED WITH CONTRIBUTED FUNDS FROM NOAA PARTNER LABORATORIES IN FY 2004**

This section summarizes directed research projects undertaken by CIMRS with research funding received from NOAA through the Northwest Fisheries Science Center and the Pacific Marine Environmental Laboratory. All projects were approved by the Assistant Administrator and the Grants Management Division of NOAA after independent merit review.

### **Projects under Grant NA17FE2705**

**Total Award \$1,777, 363; 9/1/03-8/31/04**

#### ***“The Effects of Ocean Variability on Marine Survival of Fishes”***

This project supports the active monitoring of ocean conditions, zooplankton distributions, and fish populations off the coasts of Washington, Oregon and California. New field efforts and retrospective analysis of historical data are being undertaken with all efforts emphasizing relationships between ocean conditions and growth and survival of marine fishes. Specific focus areas are *Plume Habitat and Pelagic Fish Ecology, Zooplankton Ecology, Nekton Distribution, Trophic Ecology, Pelagic/Demersal Fish Habitat and Bioacoustics Studies, and Long-term Indices of Annual Growth of Long-lived Groundfishes.*

OSU Investigators, Research Staff: George Boehlert, Professor, Fisheries and Wildlife, William Percy, Professor-Emeritus, College of Oceanic and Atmospheric Sciences; Vladlena Gertseva and Bryan Black, postdoctoral fellows; Becky Baldwin, Leah Feinberg, Joe Fisher, Julie Keister, Greg Krutzikowsky, Cheryl Morgan, Suzan Pool, Rian Hooff, Todd Sandell, Tracy Shaw, Mitch Vance (all CIMRS)

Collaborating NOAA Investigators: Ric Brodeur, Bob Emmett, Bill Peterson, Tom Wainwright, Kym Jacobson, FE/NWFSC; Mary Yoklavich, SWFSC

#### ***“Watershed and Estuarine Processes”***

Cumulative habitat loss, species introductions, and waste inputs have altered biological communities and reduced the resilience of many Northwest estuaries. This project concentrates on studies of *Estuarine Habitats and Salmonid Life History* and surveys of *Salmon Utilization within the Columbia River Estuary.*

OSU Investigator: Ian Fleming, Associate Professor, Fisheries & Wildlife, COMES

Collaborating NOAA Investigator: Dan Bottom, FE/NWFSC

### ***“Fisheries Habitat Investigations”***

The objective of this work is to integrate many types of oceanographic, biological, geological (e.g., seafloor bathymetry, sidescan sonar images, sediment and rock types, active fault zones, observations and measurements from submersibles) and groundfish fisheries data (including fishery dependent records) into a Geographical Information System (GIS) so that information can be overlain on spatial maps. These maps are then utilized to characterize, classify and predict the distribution of seafloor habitats, to study relationships between habitat type and productive versus unproductive fishing grounds, and to document the consequences of management measures on fishing activities and habitat. **See our Research Highlight Section, Page 12.**

OSU Investigators, Research Staff: Chris Goldfinger, Associate Prof., College of Oceanic and Atmospheric Sciences, Jack Barth, Professor, College of Oceanic and Atmospheric Sciences, David Sampson, Associate Professor, Coastal Oregon Marine Experimental Station; Anatoli Erofeev, Robert O’Malley, Rondi Robison, Chris Romsos (all COAS); Scott Heppell, Assist. Prof. Senior Res., Dept. Fisheries and Wildlife

Collaborating NOAA Investigators: Waldo Wakefield and Elizabeth Clarke, FRAM/NWFSC

### ***“Socio-Economics”***

This project recognizes the need for research on the linkages between fisheries and ecosystem management and regional economics. OSU is analyzing methods to alleviate negative impacts of regulation through economic incentives and alternative forms of technology. The immediate focus area is *Using Economic Incentives to Manage Bycatch in West Coast Groundfish Fisheries*.

OSU Investigator: Susan Hanna, Professor, Agriculture and Resource Economics Department

### ***“Cooperative Research”***

Information on West Coast groundfish can be increased through collaboration with the fishing community and other constituents interested in groundfish research and data sharing. Under this project, programs are enabling new collaborative research between scientists and constituents. This and other outreach efforts will increase communications between university scientists, the NMFS, and the fishing community. The program should also greatly enhance transfers of knowledge between scientists and constituents, and between the scientific community and the public.

The main project elements in 2004 are:

a) The Port Liaison Project. This program matches industry collaborators with university scientists through a proposal and advisory committee process.



***b) RFP Funded Projects:***

*Predator-prey dynamics in recovering systems: Influence of strong year classes of lingcod (Ophiodon elongates) on recovery of rockfishes (Sebastes spp.) on the Oregon coast*

*Marine Team: Student-led Investigations in the Marine Sciences*

c) Outreach. This effort is expanding the Headsup website to provide cooperative research information and general outreach information to fishers.

OSU Investigators: Susan Austin Goblirsch, Oregon Sea Grant Extension Agent, Lincoln Co. Extension Service; Flaxen Conway, Sociology Department; Selina Heppell and Scott Heppell, Department of Fisheries and Wildlife

Collaborating NOAA Investigators: Elizabeth Clarke, Waldo Wakefield, John Harms, FRAM/NWFSC



***“Stock Assessment Improvement”***

The focus of this project is the incorporation and evaluation of environmental parameters into population assessments of West Coast sablefish. Statistical studies are also being performed to establish the suitability of sea level as an independent variable and its control on recruitment trends. Incorporation of recruitment predictions in stock assessment models is being tested.

CIMRS also directed a search for a Visiting Professor in Marine Stock Assessment to join the institute for collaborative research in FY2005.

OSU Research Staff: Jim Colbert, CIMRS

Collaborating NOAA Investigator: Michael Schirripa, FRAM/NWFSC



**Projects under Grant NA17FE1167**

**Total Award \$104,639; 6/1/03-5/31/04**

***“Relationships Between Disease, Natural and Anthropogenic Factors that Influence Disease Prevalence and Survival of Juvenile Salmon in the Estuarine and Nearshore Ocean Environment”***

The overall objective of this project is to identify mechanisms and processes linked to environmental variables that can cause parasites to have an influence on the size and population structure of wild salmonids.

OSU Investigators, Research Staff: Larry Curtis, Professor, Environmental and Molecular Toxicology; Paul Reno, Associate Professor, Microbiology; Coral Stafford, Faculty Research Assistant; Claudia Bravo, GRA, CIMRS

Collaborating NOAA Investigators: Mary Arkoosh, Tracy Collier, EC/NWFSC

**Projects under Grant NA17RJ1362**  
**Total Award \$2,042,609; 7/1/03-6/30/04**

***“Ocean Environment Research”***

This multidisciplinary project seeks to quantify the effects of submarine volcanic and hydrothermal activity on the ocean. Continuous acoustic monitoring of spreading centers in the world’s oceans allows investigators to detect and study the chemical, physical, geological and biological effects of tectonic activity on the global ocean and to follow free-ranging populations of large cetaceans. Specific focus areas are *Ocean Observing Systems, Hydrothermal Venting, Marine Mammal Acoustics, Microbiology of Seafloor Vents and Eruptions, Fisheries Oceanography*. More than half of the funding covers ship-time expense for GLOBEC projects.

OSU Investigators, Research Staff: William Chadwick, Associate Prof., Sr. Res., Robert Dziak, Associate Prof., Sr. Res., Haru Matsumoto, Research Associate, David Mellinger, Assistant Prof., Sr., Res.; Andra Bobbitt, Leigh Evans, Matthew Fowler, Ron Greene, Joe Haxel, Sara Heimlich, Andy Lau, Susan Merle, Sharon Nieukirk (all CIMRS)

Collaborating NOAA Investigators: Robert Embley, Chris Fox, Stephen Hammond, John Lupton (all PMEL/OERD)

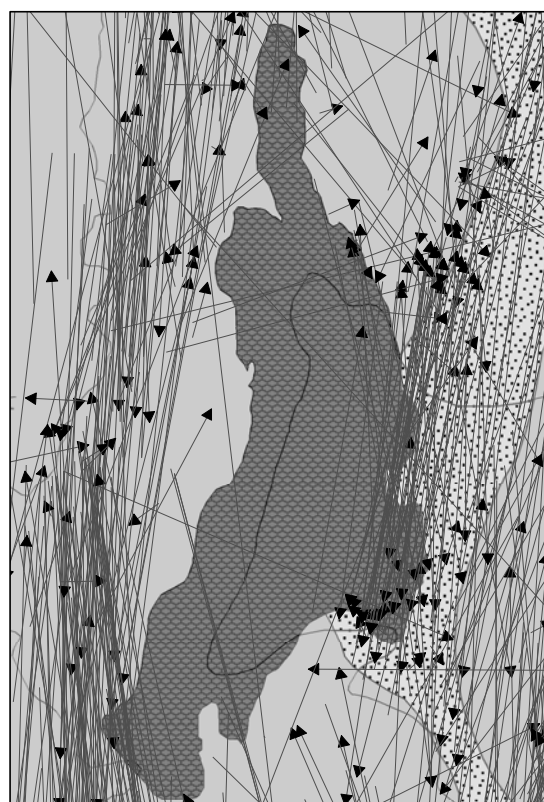


## CIMRS RESEARCH HIGHLIGHT

In May 2004, OSU scientist Scott Heppell and graduate student Marlene Bellman completed an investigation into the distribution of bottom trawl effort off the Oregon coast. The primary objective of this study was to examine trawl effort shifts over benthic habitats in response to regulatory changes in the US West coast groundfish fishery. In particular, this study focused on a PFMC-mandated restriction in trawl footrope size for landing nearshore and shelf rockfish. This regulation, enacted in 2000, linked various groundfish trip limits to large and small footrope configurations (PFMC 2000, 1999). By inhibiting the large footrope gear necessary to pass over rough terrain and obstructions, this restriction was designed to redirect fishing effort off of high-relief rocky areas where depleted rockfish species are most abundant. The investigators used habitat maps prepared by OSU Associate Prof. Chris Goldfinger to select five specific study sites located along the Oregon coast, which represented major rocky banks that were thought to be high-intensity targets for rockfish trawling prior to the implementation of the footrope restriction. They demonstrated that there has been a substantial shift in trawl effort off of rocky banks, with an average decrease in fishing intensity of 86% in 2000 and 2001 when compared to 1998 and 1999. The figure on this page shows the shift in trawl fishing effort at one study site. This work indicates that not only was the PFMC footrope restriction successful in moving effort away from sensitive habitat, but that effort can be quantified with regard to a variety of factors, including physical habitat type.



**Reference Site 4**                      **1998 - 1999**



**2000 - 2001**

ROCK
  MUD
  SAND/MUD
  Trawl Towlines

0 1 2 Km 1 : 175,000

## FY 2004 CONTRACTS

Title	Source	Total Funding	Duration	PI
Stock Assessment Graduate	AFSC	\$46,841	8/03-9/04	Reimers
Acoustic Marine Mammal Assessment: Tools for the Next Level	ONR	\$213,435	11/03-10/05	Mellinger
Historic Habitat Opportunities...	NOAA	\$36,520	2/10/04-8/31/04	Reimers
Growth and Survival of Juvenile Salmon in the Columbia River Plume	NOAA	\$77,530	4/1/04-12/1/04	Reimers
Survival, Growth and Health of Juvenile Salmon in the CRE	NOAA	\$77,910	5/1/04-12/31/04	Reimers
Top Trophic Studies Survival, Growth and Health of Juvenile Salmon in CRE	NOAA	\$34,208	5/10/04-11/30/04	Reimers
Passive Acoustic Monitoring of Right Whales in Historic and Unsurveyed Habitats	NOAA	\$107,069	10/1/03-9/30/05	Mellinger

## FY 2004 GRANTS FROM OTHER AGENCIES

Title	Source	Total Funding	Duration	PI
Hydroacoustic monitoring of Seismicity in the North Atlantic	NSF	\$180,201	1/03-12/05	Dziak, Matsumoto
Productivity, Biogeochemical Transformations and Cross-Margin Transport...	NSF	\$64,113	6/1/03-5/31/04	Peterson
New Millennium Observatory: Innovative Integration of Research and Education	NSF	\$8,345	4/6/04-12/31/04	Chadwick, Osis, Hanshumaker

## INSTITUTE DIRECTOR'S RESEARCH ACTIVITIES

The Institute Director's research was supported in 2004 through several grants through the College of Oceanic and Atmospheric Sciences where she holds a 0.5 FTE faculty appointment at the rank of Professor.

Project Title "Ocean Microbial Energy Generation Assessment (OMEGA)"

Source of Support: DARPA

Total Award: \$1,020,277

Period Covered: 03/15/04-03/14/05

Person Months Committed to the Project by PI: 3

Project Title: "The Seafloor Bio-fuel Cell: Long-term Power and Effects on Sedimentary Organic Matter"

Source of Support: NSF

Total Award: \$510,261

Period Covered: 03/01/03-2/28/06

Person Months Committed to the Project by PI: 7

Project Title: "Developing a Seafloor Power Source"

Source of Support: Sea Grant

Total Award: \$100,000

Period Covered: 08/01/03- 07/31/05

Person Months Committed to the Project by PI: 2

Project Title: "Electrochemical Energy Harvesting and Chemical Fluxes From Gas Hydrate Sediments"

Source of Support: NOAA-NURP

Total Award: \$109,993

Period Covered: 04/01/03-03/31/04

Person Months Committed to the Project by PI: 0.5



## **CIMRS FELLOWSHIP OPPORTUNITIES AND GRADUATE STUDENTS SUPPORTED THROUGH JOINT PROJECTS**

### **Fisheries Oceanography Graduate Fellowships**

The goals of NOAA's strategic plan are to build sustainable fisheries, to recover protected species, and to sustain healthy coasts. These goals require the support of sound scientific research to build the knowledge base for maintaining economically viable fisheries and, at the same time, minimize anthropogenic impacts on marine ecosystems. To accomplish these goals a Fisheries Oceanography Graduate Fellowship program was started within CIMRS in 2003 with funds provided by the Alaska Fisheries Science Center of NOAA/NMFS. This program seeks to recruit highly talented M.S. or Ph.D. students to oceanography, fisheries or wildlife science, resource economics, zoology, environmental science or a related field at Oregon State University, with an intended focus on ecological and natural resource issues in the Northeast Pacific, Aleutian Islands, and Bering Sea. In 2004, three fellowships (first awarded in 2003) were continued.

#### 2004 Fellows and Projects

Cara Fritz	Towards Establishing a Natural Disturbance Mosaic on the Pacific Northwest Margin Major Professor: Rob Wheatcroft, COAS
Julie Keister	Investigations of Variability of Mesoscale Energy off the Coast of Central Oregon and Northern California Major Professor: Tim Cowles, COAS
Rob Suryan	Comparative Foraging Ecology of Five Species of Pacific Seabirds: Multiscale Analyses of Marine Resource Utilization Major Professor: Dan Roby, F&W

## **GRADUATE STUDENTS SUPPORTED THROUGH JOINT RESEARCH PROJECTS**

A growing number of graduate student projects are being supported with contributed grant funds from the Northwest Fisheries Science Center. The CIMRS Director works to match qualified students with projects and courtesy faculty based at the Hatfield Marine Science Center.

### **Ph.D. Candidates – Fisheries and Wildlife**

Todd Miller	1999-2005	Trophic Dynamics within Varying Conditions of the Northern California Current Major Professor: Hiram Li NOAA Fisheries Rep: Ric Brodeur, NWFSC
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*College of Oceanic and Atmospheric Sciences*

Douglas Reese      1999-2004      Community Characteristics, Spatial Distributions, and Habitat Preferences of Marine Fauna within the Northern California Current Ecosystem  
Major Professor: William Percy, COAS  
Minor Rep: David Burch, Physics Dept.  
NOAA Fisheries Rep: Ric Brodeur, NWFSC

*Environmental Molecular & Toxicology*

Claudia Bravo      2002-2006      Toxicology of Polycyclic Aromatic Hydrocarbons: Dibenzo [a,l] pyrene (DB[a,l]P) in Rainbow Trout, *Oncorhynchus mykiss*  
Major Professor: Larry Curtis, E&MT  
NOAA Fisheries Rep: Mary Arkoosh, NWFSC

*Agricultural and Resource Economics*

Haixia Lin      2002-2006      Spatial Statistical Analysis of Marine Resource Economic/GIS data  
Major Professor: Susan Hanna, COMES

**M.S. Candidates - Marine Resource Management**

Josie Thompson      2002-2005      Life history of the Longnose Skate (*Raja rhina*) from the U.S. West Coast and Vulnerability to Fishery Impacts  
Major Professor: Scott Heppell, F&W  
Minor Rep: Douglas Markle, F&W  
NOAA Fisheries Rep: Michael Schirripa, NWFSC

Vicki Wedell      2002-2004      Participatory GIS for Local Fisheries management in the Community of Port Orford, OR  
Major Professor: Jim Good, COAS  
NOAA Fisheries Rep: Elizabeth Clarke, NWFSC

*Fisheries and Wildlife*

Lance Campbell      2002-2005      Life History of Columbia River Salmon  
Major Professor: Ian Fleming, COMES



NOAA Fisheries Rep: Dan Bottom, NWFSC

Brooke Martin      2002-  
Purification and Characterization of Vitellogenin,  
and use for Enzyme Linked Immuno-absorbent  
Assay (ELISA) for gender and maturity status in  
Black rockfish (*Sebastes melanops*)  
Major Professor: Selina Heppell  
Minor Rep: Scott Heppell  
NOAA Fisheries Rep: Grant Thompson, AFSC

### **Degrees Completed**

#### **M.S. *Marine Resource Management***

Chris Romsos      2002-2004      Mapping Physiographic and Lithologic Habitats of  
the Oregon and Washington Continental Margin for  
West Coast groundfish Species, and Habitat  
Analysis of Historic NMFS Trawl Survey Stations  
Major Professor: Chris Goldfinger, COAS  
Minor Rep: Scott Heppell, F&W  
NOAA Fisheries Rep: Waldo Wakefield, NWFSC

#### **M.S. *Fisheries and Wildlife***

Marlene Bellman      2001-2004      Shifting Groundfish Trawl Efforts: A Case Study to  
Evaluate Fisheries Management Measures and  
Effects on Essential Fish Habitat  
Major Professor: Scott Heppell, F&W  
NOAA Fisheries Rep: Waldo Wakefield, NWFSC

## 2003-2004 PUBLICATIONS

FY 03

- Brodeur, R.D. and Fisher, J.P., Ueno, Y., Nagasawa, K. and Pearcy, W.G. 2003. An east-west comparison of the Transition Zone coastal pelagic nekton of the North Pacific Ocean. *J. Oceanogr.* 59: 415-434.
- Feinberg, L. and W.T. Peterson. 2003. Variability in duration and intensity of euphausiid spawning off central Oregon, 1996-2001. *Prog. Oceanogr.* 57: 363-379.
- Gertseva, V. 2003. Tropho-ethological polymorphism of fish as a strategy of habitat development: A simulation model. *Ecol. Modeling* 167: 159-164.
- Gomez-Uchida, D.E., A. Hoffman, W.R. Arden and M.A. Banks. 2003. Microsatellite markers for the heavily exploited canary *Sebastes pinniger* and other rockfish species. *Molecular Ecol. Notes* 3: 387-389.
- Mellinger, D.K. and C.W. Clark. 2003. Blue whale (*Balaenoptera musculus*) sounds from the N. Atlantic. *J. Acoust. Soc. Am.* 114(2): 1-12.

FY 04

- Brodeur, R.D., Fisher, J.P., Teel, D., Emmett, R.L., Casillas, E. and Miller, T.W. 2004. Juvenile salmonid distribution, growth, condition, origin, and environmental and species associations in the Northern California Current. *Fish. Bull.* 102: 25-46.
- Chadwick, W. W., Jr., R. W. Embley, and C. G. Fox. 2003. Quantitative constraints on the growth of submarine lava pillars from a monitoring instrument that was caught in a lava flow, *J. Geophys. Res.*, 108(B11): 2534-2547.
- Chaytor, J.D., C. Goldfinger, R.P. Dziak, and C.G. Fox. 2004. Active deformation of the Gorda "Plate". Constraining deformation models with new geophysical data. *Geology* 32(4): 353-356.
- Dziak, R.P. 2003. P- and T- wave detection thresholds, Pn velocity estimate, and detection of lower mantle and core P-waves on ocean sound-channel hydrophones at the Mid-Atlantic Ridge. *BSSA* 94(2): 665-677.
- Embley, R.W., E.T. Baker, W.W. Chadwick, Jr., J.E. Lupton, J.A. Resing, G.J. Massoth, and K. Nakamura. 2004. Exploration of Mariana Arc Volcanoes reveal new hydrothermal systems. *Eos, Trans. Amer. Geophys. Un.* 85: 37, 40 (January 27, 2004).

- Lupton, J.E., D.G. Pyle, W.J. Jenkins, R. Greene, and L. Evans. 2004. Evidence for an extensive hydrothermal plume in the Tonga-Fiji region of the South Pacific. *Geochem. Geophys. Geosys.* 5(1): Q01003, doi: 1029/2003GC000607.
- Matsumoto, H., S. Nieukirk, M. Fowler, J. Haxel, S. Heimlich, D.K. Mellinger, R. Dziak and C.G. Fox. 2004. Sound in the sea: Hands-on experience with NOAA Vents Program. In: *Proceedings of Oceans 2003 Marine Technology and Ocean Science Conference, 22-26 September 2003*. San Diego, CA, 1565-1571.
- Mellinger, D.K., K.M. Stafford, and C.G. Fox. 2004. Seasonal occurrence of sperm whale (*Physeter macrocephalus*) sounds in the Gulf of Alaska, 1999-2001. *Mar. Mammal Sci.* 20(1): 48-62.
- Nieukirk, S.L., K.M. Stafford, D.K. Mellinger, R.P. Dziak, and C.G. Fox. 2004. Low-frequency whale and seismic airgun sounds recorded from the mid-Atlantic Ocean. *J. Acoust. Soc. Am.* 115(4): 1832-1843.
- Schabetsberger, R., C.A. Morgan, R.D. Brodeur, C.L. Potts, W. T. Peterson and R.L. Emmett. 2003. Prey selectivity and diel feeding chronology of juvenile Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon in the Columbia River plume. *Fish. Oceanogr.* 12(6): 523-540.
- Smith, D.K., R.P. Dziak, H. Matsumoto, C.G. Fox and M. Tolstoy. 2004. Autonomous hydrophone array monitors seismic activity at northern Mid-Atlantic Ridge. 2004. *Eos, Trans. Amer. Geophys. Un.* 85(1): 1, 5.

## CIMRS OUTREACH ACTIVITIES

Educational and scientific outreach is important in all aspects of CIMRS research. Websites are a venue that reaches an enormous audience. CIMRS investigators feature their collaborative research efforts in the fields of fisheries oceanography, geophysical and acoustic monitoring of spreading centers, ocean exploration, and bioacoustic monitoring of large cetaceans at several sites hosted by NOAA. One award winning website (<http://www.pmel.noaa.gov/vents>) features educational curricula, video clips of in situ seafloor experiments, and animated 3-dimensional fly-through movies of seafloor ridges.

The Visitor Center at OSU's Hatfield Marine Science Center also lends a convenient outlet for educational displays and programs. *OceanQuest* is a program that connects visiting audiences to real-time shipboard research through the use of interactive websites. NOAA's Teacher-at-Sea Program and the Ocean Exploration Program have helped sponsor educators on land and at sea who together present and interpret research activities for the general public. CIMRS investigators have also collaborated with Sea Grant Educational staff to design and prepare interactive exhibits. At the "ROPOS Exhibit", visitors can pilot a remotely operated vehicle to the seafloor and back with a joystick while viewing computer-generated and real video clips of the seafloor.



*Sound in the Sea*, a non-profit education program, for middle- and high-school aged students, is offered by CIMRS researchers through OSU's Saturday Academy, at OSU's Hatfield Marine Science Center. It offers a unique two-session hands-on engineering workshop that emphasizes marine biology and acoustics. Students make their own simple underwater hydrophone and then test it in Yaquina Bay.



A land seismometer exhibit was completed for the HMSC Visitor Center just a week before a 4.7 magnitude earthquake in Newport.