

# Maine Sea Grant College Program



**Annual Report 2006**

## Maine Sea Grant College Program Annual Report 2006

### Introduction

Maine Sea Grant has been busy during this reporting period both implementing the research, extension, communications, and education programming integral to our NOAA-funded activities, and supporting the national Sea Grant enterprise as active participants in the Sea Grant network.

#### **Supporting the national Sea Grant enterprise:**

In June, 2005, Maine Sea Grant hosted “Sea Grant Week 2005: Rising to Tomorrow’s Coastal Challenges.” This very successful conference brought over 300 participants from all Sea Grant programs to the Samoset Resort in Rockland, Maine, where plenary and breakout sessions provided opportunities for collective learning and collaborative problem solving. Reviews of the event were very positive. The Maine Sea Grant program took on this activity with existing staff capacity while also conducting the periodic research competition and other program activities. Beginning in January 2005, Maine Sea Grant director, Paul Anderson, started his two-year term as president-elect of the national Sea Grant Association. During this term, the National Academy of Sciences conducted a review of the Performance Assessment Team process and SGA leadership was involved in an effort to enhance the relationships of the various networks within the Sea Grant enterprise.

Also during this reporting period, Maine Sea Grant prepared a new four-year strategic plan, “Setting the Course: from Discovery to Action (2006-2010)” in preparation for our PAT review that was conducted in April 2006. Although the PAT site visit took place after this reporting period, the preparations required more than six months of significant effort by all staff members. In February 2006, the Maine Sea Grant program moved to a new on-campus location at the University of Maine. Newly renovated space was prepared that allowed the program to move out of historic Coburn Hall where the Sea Grant program had been housed for nearly 26 years.

Questions should be directed to Paul Anderson, Maine Sea Grant director.

### **I. Award Reporting Institution/Grantee**

- Award Number: NA16RG1034
- Time Period: 2/1/05-3/31/06
- Award Title: Maine Sea Grant Omnibus Award 2001 & 2002
- Accomplishments and outcomes from this award (See award #NA03OAR4170054 for Extension, Education, and Communications outcomes.)

### **Research Accomplishments/Outcomes**

R-02-05 Chen, Yong

Project Title: Developing a Bayesian stock assessment framework for the American lobster (*Homarus americanus*)

Lobster is the most valuable fishery to the state of Maine. Sea Grant-funded researchers developed a stock assessment model for lobster that incorporates prior knowledge about the fishery and data

from different sources, yielding results that can be used for risk analysis of alternative management strategies. **Outcome:** This model is now used by the Atlantic States Marine Fisheries Commission. It is a significant departure from previous stock assessment models used by the Commission, which assumed constant and known mortality and did not use cumulative data from the past.

R-02-06 Dionne, Michele

Project Title: Ecological processes, energy pathways, and the impact of human activities on Maine marsh-estuarine secondary production: A salt marsh panne model

In order to increase our ability to manage, protect, and restore tidal marshes in the Gulf of Maine, this study tracked high marsh energetic pathways and quantified the contribution of high marsh habitat to diets of faunal communities in three types of salt marsh pannes.

**Outcome:** This work prompted three other researchers and their graduate students to also investigate marsh pool ecology, and the results will be forward to groups involved in marsh restoration.

R-02-04 Millard, Paul

Project Title: A biosensor platform for detection of fish pathogens

Early detection of microbial pathogens could greatly reduce the substantial economic losses to the aquaculture and fish farming industries. However, conventional approaches to direct microbial sampling of marine organisms are typically slow and labor-intensive. This study will combine robust molecular and solid-state electronic technologies to develop an inexpensive hybrid biosensor that can be used by individuals without specialized training to detect microbial pathogens quickly, accurately, and reliably. **Outcome:** Procedures for detecting specific sequences of DNA or RNA using isothermal amplification, in conjunction with fluorescence and acoustic wave detection, were investigated. Meanwhile, a new microwave acoustics patent may lead to a sensor for detecting pathogens in liquids.

#### **I. Award Reporting** Institution/Grantee

- Award Number: NA03OAR4170054
- Time Period: 2/1/05-3/31/06
- Award Title: Maine Sea Grant Omnibus Award 2003, 2004 & 2005
- Accomplishments and outcomes from this award

#### **Research Accomplishments/Outcomes**

R-05-01 Amirbahman, Aria

Project Title: Monitoring mercury fluxes in estuarine sediment porewaters using novel reactive membranes

Due to their dynamic nature, estuaries may function as traps for river-borne contaminants. An upstream former industrial facility is the source of high levels of mercury in water and sediment in the lower Penobscot River estuary. Amirbahman's study is assessing the extent to which estuarine storage and cycling affect mercury transport and availability. This project focuses on the pool of total mercury contained in sediment porewater, using an innovative chitosan-based, mercury-specific membrane sensor in the lower Penobscot Estuary. **Outcome:** Experiments with chitosan led

the researchers to create a more effective sensor using a synthetic gel, which has allowed them to assess the availability of mercury in the system. These results have been submitted to a group of state and federal agencies and private parties responsible for cleanup of the mercury contamination.

R-03-01 Belknap, Daniel

Project Title: Monitoring of coastal dynamics at the Saco River mouth near jetty modifications and beach nourishment projects

The U.S. Army Corps of Engineers (USACE) constructed a paired jetty system in Saco Bay to stabilize the Saco River mouth tidal delta, facilitating commercial navigation. Consequent beach erosion threatened homes and property loss. The USACE proposed jetty modifications, based on their belief of sand movement in the system. The Sea Grant-funded research team discovered sand is transported in the opposite direction to what the USACE believed. **Outcome:** The USACE is now developing new proposals for erosion mitigation based on the results of the study.

R-03-02 Brawley, Susan

Project Title: Enhanced spore production for net-seeding of native New England *Porphyra* in integrated finfish/seaweed aquaculture

Sustainable, integrated aquaculture has been proposed as a way to grow farm-raised products in a cost effective manner, while reducing the amount of surplus nutrients in the marine environment. Sea Grant-supported researchers worked with scientists from the Chinese Academy of Sciences and from Canada's Department of Fisheries and Oceans and a salmon farming company in Cobscook Bay to investigate integrating native (to Maine) *Porphyra* seaweed with salmon aquaculture sites, for both the production of a commercially viable product and possible improvements to water quality. **Outcomes:** The pilot study forged a strong university/industry partnership and proved a successful international collaboration. In addition, integrated aquaculture technology from Canada is generating interest in Maine, and workshops to bring together scientists and industry are being planned.

R-03-03 Johnson, Amy

Project Title: Accelerating growth in sea urchins

The sea urchin fishery in Maine ranks fourth in its economic importance to the state, although the urchin catch has declined since its peak in 1993. Urchins raised in aquaculture and either reseeded to depleted areas, grown in land-based culture facilities, or grown in floating or bottom-based sea farms may reduce the decline in the fishery. Sea Grant funds are helping researchers look at potential techniques to accelerate sea urchin growth, including the design of tanks that allows them to grow urchins from larva to adulthood. **Outcome:** Their experiments showed that flow and temperature are important factors influencing the growth of sea urchins, and therefore flow conditions should be considered when siting aquaculture or enhancement activities. These results were presented at the annual Maine Fishermen's Forum and to the Maine Sea Urchin Council.

R-05-02 Perry, Mary Jane

Project Title: Phytoplankton carrying capacity in the Damariscotta River estuary

The Damariscotta River is an estuary where oysters and mussels are farmed with great success, partly due to the river's high concentrations of phytoplankton. Sea Grant researchers studying the

variability of phytoplankton biomass in the Damariscotta make daily measurements of chlorophyll concentrations that are posted online. In February 2006, a visitor to the Web site observed the onset of the "spring bloom" and immediately advised one of the local mussel farmers to postpone his harvest because it looked like food might becoming available. **Outcome:** Scientific data used by the mussel farmer resulted in an improved, higher quality product for the Maine seafood market. The researchers are also working with Sea Grant to produce a fact sheet on phytoplankton in the river.

R-04-03 Rawson, Paul

Project Title: Population structure of sea scallops, *Placopecten magellanicus*, in two coastal embayments in Maine

In coastal Maine, sea scallops are currently managed as a single stock, or a demographically "open" population. Rawson is using a combination of ecological, population genetic, and geochemical fingerprinting approaches to assess the level of connectivity among sea scallop populations in Cobscook Bay and Penobscot Bay. His work has provided insight into whether it is biologically appropriate to manage coastal Maine sea scallops as a single stock. **Outcome:** This multidisciplinary project has informed scallop fishermen and managers about the timing and patterns of spawning and settlement, and the apparent lack of genetic differentiation among geographically separate scallop populations.

### **Extension, Education, and Communications Accomplishments/Outcomes**

**Maine hosts Sea Grant Week:** Maine Sea Grant hosted Sea Grant Week 2005 on June 3-8 at the Samoset Resort in Rockport, Maine. The information technology coordinator designed the conference Web site and continually updated it throughout the six months preceding the event. **Outcome:** Nearly 300 participants attended the conference and many expressed the opinion that it was the best Sea Grant Week ever.

**Sea Grant coordinates Nor'Easter Bowl:** Every third year, Maine Sea Grant coordinates the Nor'Easter Bowl, the regional competition of the National Ocean Sciences Bowl. Sea Grant staff coordinated the event, volunteered on a judging team, and worked closely with the School of Marine Sciences to write contest questions. **Outcome:** The University of Maine hosted 17 teams in 2005 from Maine, New Hampshire, and Vermont.

**Sea Grant publishes coastal watershed curriculum:** Sea Grant worked with a southern Maine middle school teacher to develop *Coastal Connections: Field, Lab and Classroom Experiences focusing on Coastal Watershed Study in Maine*. The unit provides students with research skills and field experiences that increase awareness of human links to local watersheds. **Outcome:** The curriculum is now available on the Maine Sea Grant Web site and will be published later in 2006 for distribution to Maine teachers.

**Sea Grant helps the tourism industry move toward sustainable practices:** As Maine's economy shifts toward one of service and tourism, natural resource managers are faced with the challenge of protecting the environment of recreation destinations and ensuring public access while fostering the economic opportunities. Sea Grant has emerged as a leader in advancing sustainable tourism concepts, leading on-the-water community tours (Ambassadors of the Bay) and planning initiatives (DESTINY 2010). **Outcomes:** The Ambassadors of the Bay journey resulted in a bay-wide network

that is collectively addressing issues related to community and environmental health. Sea Grant sponsored a sustainable and experiential tourism workshop in March 2006, and compiled resources for operators seeking to "green" their facilities and programs.

**Sea Grant confronts the threat of marine invasive species:** Marine invasives have not been a large problem in Maine in the past, but they now threaten the health and productivity of the entire Gulf of Maine. Sea Grant's leadership in addressing this issue continues through funded research and education. In the summer of 2005, Sea Grant extension team members participated in Bowdoin College's Coastal Science Institute on invasive species. **Outcomes:** A second institute was held in summer 2006, and the Maine legislature, informed by Sea Grant's *Maine's Marine Invasion* fact sheet, passed a resolution to address the threat from non-native invasive marine species.

**Sea Grant helps head off aquaculture conflicts:** The introduction of aquaculture to Maine's nearshore waters has created conflicts with other users, including the fishing community, recreational users, and landowners. In the past few years, there has been an increase in the number of aquaculture sites proposed and significant public opposition to some of these sites because of concerns about the placement of aquaculture facilities and the potential environmental, aesthetic, and ecological impacts. It is critical that the public receive unbiased and accurate information about aquaculture activities, so that discourse is based upon facts rather than misinformation. **Outcome:** Sea Grant produced a brochure, called *Marine Aquaculture in Maine: How the Public Can Participate in the Leasing Process*, which has been distributed at informational sessions in communities where aquaculture facilities are proposed.

**Sea Grant helps steer bay management initiative:** Bay management is an example of local, ecosystem-based natural resource management that considers coastal waters as a whole ecosystem, not as a collection of isolated species or uses. Sea Grant is represented on the Bay Management Steering Committee, which is examining the application of bay management principles to aquaculture and other activities. **Outcomes:** Sea Grant helped plan and facilitate five public meetings along Maine's coast in 2005 to elicit feedback on the value of each particular bay to local communities, existing conflicts, and how to involve local and state officials, fishermen, environmental groups, business groups, recreational users and waterfront landowners as "managers" of a bay. The steering committee is in the process of developing recommendations to the state's Land and Water Resources Council.

**Sea Grant leads Maine Healthy Beaches Program:** Funded by a \$259,000 EPA grant, the Maine Healthy Beaches (MHB) program was launched in 2003, in which southern Maine coastal swim beaches are monitored systematically, using quality control and quality assurance methods. An online database provides the U.S. Environmental Protection Agency, towns, and state park officials with immediate access to water monitoring data, allowing them to make decisions about posting advisories more efficiently. **Outcomes:** In the summer of 2005, there were 47 beaches participating in the MHB program, with 100 to 140 samples taken each week. Radio and television spots, posters, and brochures were produced and numerous feature articles appeared in newspapers in the last year. A public interface with the online database of water quality was launched and the site received over 80,000 hits last summer in July and August. Town officials in several towns worked together with state agencies on three studies to determine the sources of pollution on their beaches, and they are using this information to develop remediation plans.

**Sea Grant helps develop marine area characterization guide:** For the past few years, Sea Grant has been involved in a statewide working group to develop scientifically defensible recommendations that could be used to characterize geographically discrete marine areas of Maine. These recommendations formed the framework for a citizen's guide to marine characterizations. **Outcome:** The guide will be published in fall 2006 and will help Maine residents and others in the region in collecting existing information and new data on their local coastal areas.

**Sea Grant leads recreational island monitoring effort:** There are over 100 islands on the Maine coast that are open to various levels of recreational use. Given the importance of the tourism industry to Maine's coastal economy, it has become critical to develop management strategies that protect recreation destinations while preserving island ecosystems and ensuring public access. Sea Grant has led an island monitoring program, which systematically documents campsites and shoreline and intertidal zones, in order to identify appropriate measures of social and environmental change on Maine's recreational islands. **Outcomes:** In summer 2005, baseline data was collected on seven pilot islands. The Maine Coastal Islands National Wildlife Refuge is using the baseline information to help track island changes that can be correlated to recreational use in the Refuge. An article on the island monitoring project, authored by Maine Sea Grant's science writer, appeared in the summer issue of *Friends of Acadia Journal*. The project was also covered in seven newspapers.

**Sea Grant addresses coastal access head on:** Working waterfronts and access to coastal resources are vital to the essence of coastal Maine. However, soaring shorefront real estate values and their associated property taxes are pricing many fishing and water-dependent businesses out of the market, and threatening recreational access to the coast. Congestion and conflict among diverse users of the waterfront has increased dramatically. Building on the success of a Sea Grant-sponsored forum held in the midcoast region of the state, Sea Grant organized the *Downeast Forum on Coastal Access* that was held in Machias in January 2006. **Outcomes:** 108 people attended the forum, six articles on the forum appeared in area newspapers, and over 90% of those who completed the online evaluation (55% of participants) said they had gained information and/or tools they could use to address coastal access issues in their communities. In addition, Sea Grant produced a brochure entitled *Harpswell's Working Waterfronts*, which was modeled after one Sea Grant produced in 2004 (*Moosabec: The Downeast Fishing Community of Jonesport and Beals*) that was very well received.

**Sea Grant promotes sustainable tourism:** Tourism is Maine's largest industry, larger than fisheries and aquaculture combined. Sea Grant began to address coastal tourism in 2002 by hiring an extension staff member to focus on this area. In the eastern Maine region, Sea Grant collaborates with Downeast Resource Conservation and Development's Vacationland Resources Committee (VRC) to implement DESTINY 2010, a 10-year strategy for sustainable tourism and economic development in Washington and Hancock Counties. **Outcomes:** Working in partnership with the VRC, Sea Grant helped to facilitate a meeting in 2005 where Washington and Hancock County tourism businesses provided feedback on the state's nature-based tourism plans. Sea Grant also assisted in planning for the first U.S. Ecotourism Conference, which took place in Bar Harbor in September 2005. Sea Grant co-sponsored (with VRC) another workshop, which took place on March 17, 2006 in Machias with 112 participants attending. Sea Grant compiled a CD of resources for this workshop and has taken the lead on developing a comprehensive resource guide to sustainable tourism practices.

- Project Completion Report (for projects completed during this year)
  - R-02-04, A biosensor platform for detection of fish pathogens, Paul Millard, University of Maine. See Attached.
  - R-02-05, Developing a Bayesian stock assessment framework for the American lobster (*Homarus americanus*), Yong Chen, University of Maine. See Attached.
  - R-03-03, Accelerating growth in sea urchins, Amy Johnson, Bowdoin College. See Attached.

## II. Impacts

### **Sea Grant develops lobster model adopted by Atlantic States Marine Fisheries Commission:**

Lobster is the most valuable fishery to the state of Maine. Sea Grant-funded researchers developed a stock assessment model for lobster that incorporates prior knowledge about the fishery and data from different sources, yielding results that can be used for risk analysis of alternative management strategies. **Impact:** This model is now used by the ASFMC. It is a significant departure from previous stock assessment models used by the Commission, which assumed constant and known mortality and did not use cumulative data from the past.

**Sea Grant solves beach erosion riddle in Saco Bay:** The U.S. Army Corps of Engineers (USACE) constructed a paired jetty system in Saco Bay to stabilize the Saco River mouth tidal delta, facilitating commercial navigation. Consequent beach erosion threatened homes and property loss. The USACE proposed jetty modifications, based on their belief of sand movement in the system. The Sea Grant-funded research team discovered sand is transported in the opposite direction to what the USACE believed. **Impact:** The USACE is now developing new proposals for erosion mitigation based on the results of the study.

**Sea Grant-led beach profile monitors provide solid baseline data to help predict future shape of beaches:** Many beaches in southern Maine are experiencing chronic erosion that threatens public and private property, as well as critical wildlife habitat. Sea Grant researchers worked with a Marine Extension Team member to develop a program that helps to determine how beaches change over time. Now in its seventh year, more than 150 local volunteers are monitoring 15 sandy beaches in southern Maine, entering their data online. **Impact:** Maine Geological Survey uses the data to determine beach replenishment costs and inform beach management decisions.

**Sea Grant partners with southern Maine town to obtain EPA smart growth funding:** Southern Maine is experiencing tremendous growth of both year-round and seasonal populations. This growth and associated land development have prompted York County communities to work together to craft a shared vision for a healthy landscape and quality of life. Sea Grant has worked with these communities as they plan for their future. Sea Grant has also played a leading role in watershed and water quality studies in coastal rivers of this area. This work has resulted in a successful application from the Town of Wells to the EPA Smart Growth Implementation Assistance Program. **Impact:** The Town of Wells has received a technical assistance grant from EPA to develop a town center plan that protects a nearby trout stream and creates a plan for sustainable economic growth.



**Sea Grant research leads to decay-resistant marine piers:** Shipworms have caused millions of dollars in damages to harbor structures and aquaculture facilities in Maine in recent years. With funding from Sea Grant, Roberto Lopez-Anido developed new composites technology that may protect piers in coastal waters from rot and shipworms. **Impact:** Lopez-Anido has filed a patent application for the wood composite shield, and the U.S. Coast Guard is building a demonstration pier at their base in Jonesport, Maine. The technology has been transferred to a Maine company and is now on the market.

**Sea Grant support helps launch successful alternative education program:** Sea Grant provided funds in 2003 to the Herring Gut Learning Center (HGLC) in Port Clyde for development of a saltwater aquaculture system. The Center provides opportunities for children who experience difficulty in the traditional classroom setting to become involved in marine science and real world applications. **Impacts:** Over 3,000 children participated in the center’s five curriculum-based aquaculture programs, which were offered to students in alternative education programs in four middle and high schools in the area. From September 2005 to January 2006, eight students in a local high school who were unsuccessful in passing biology participated in the HGLC program, *Science for a Sustainable Future*, and by January they had passed the course and earned the necessary science credits for high school graduation. In addition, HGLC is collaborating with the University of Maine’s College of Education to develop an instructional program in alternative teaching techniques for pre-service teachers enrolled in the master’s program. Since Maine does not currently offer formal training for pre-service educators wishing to teach in alternative education programs, this program will provide teachers with the necessary skills to apply their professional knowledge in alternative classrooms throughout Maine and the nation.

- a. Please also list any new businesses and/or jobs created, and patents and/or licenses received.

None

**III. Performance Measures**

**IV. Appendices**

- a. **Management Team and Staff Composition**

Management team composition and percentage of time the Sea Grant Director and management staff devoted to Sea Grant:

**FTEs (Full Time Employees = 12 man months) Devoted to Sea Grant**

Sea Grant Staffing	# of Individuals	# of FTEs funded by Sea Grant \$	# of FTEs funded by Non-Sea Grant \$
Administrative	5	.49	3.66
Communications	3	1.2	.8
Extension	9	2.82	6.18
Education	0	0	0
<b>TOTAL</b>	<b>17</b>	<b>4.51</b>	<b>10.64</b>

<b>Mgmt. Team Member</b>	<b>Position</b>	<b>FTEs devoted to Sea Grant</b>
Paul Anderson	Director	1
Susan White	Associate Director for Outreach	1
Jim McCleave	Assistant Director for Research	.167
Lynn Wardwell	Fiscal Officer	1

**b. Program Development Projects**

<b>Project Title</b>	<b>PI</b>	<b>Federal Funds</b>	<b>Matching Funds</b>
Assembling the history of a marine invasive species in Maine water temperature as a predictor of green crab ( <i>Carcinus maenas</i> ) outbreaks from 1956 to 2005	Robin Hadlock Seeley, Cornell University	\$2,500	
Diet, nest attendance and foraging areas of Arctic and Common Terns breeding on Seal Island NWR: Maine's largest tern colony	Scott Hall, National Audubon Society	\$5,900	
Learning from the Canadians – an interactive regional workshop on improving sea urchin management in Maine	Sherman Hoyt, UMaine Cooperative Extension	\$3,000	
Investigating the efficacy of lobster nurseries for stock enhancement	Brian Beal, UMaine Machias	\$5,000	
Science and policy for Maine groundfish	Benjamin Neal, Island Institute	\$1,500	
Fishing community comparison between Stonington-Deer Isle and small Iceland fishing communities	Stephen Robbins, Penobscot East Resource Center	\$1,500	
Special Issue <i>Northeastern Naturalist</i>	Robert Vadas,	\$3,000	

	UMaine		
Assessing the potential for successful culture of the Atlantic Horseshoe Crab, <i>Limulus polyphemus</i> , in Maine	Ruth Carmichael, UMaine Machias	\$5,500	
Metalliferous plants of the Callahan mine: Plant diversity, heavy metal tolerance, and potential for phytoremediation	Nishanta Rajakaruna, College of the Atlantic	\$5,600	
ISSC Conf 2005 Travel	Virginia Olsen	\$1,400	
Microbial fuel cells to accelerate biodegradation under anaerobic conditions: a low-maintenance, environmentally friendly approach to sediment bioremediation	Jean MacRae, UMaine	\$2,000	
Lobster Workshop Proceedings	Kathy Castro, RI Sea Grant	\$1,000	
Biotoxin Monitoring Workshop	Darcie Couture, Maine Dept. of Marine Resources	\$500	
Sears Island Planning: economic analysis of an education, recreation and ecotourism future	Stephen Miller, Islesboro Island Trust	\$5000	
Northeast Aquaculture Conference and Exposition conference support	Dana Morse, Maine Sea Grant/UMaine Cooperative Extension	\$1000	
Mapping Maine's Working Waterfronts	Rob Snyder, Island Institute	\$5,000	
Ocean Sciences g poster presentation entitled, "Assessing spring nearshore currents and sediment transport in the Saco River estuary, Saco Bay, Maine, USA".	Laura Brothers, UMaine	\$766	

### c. List of Partnerships

#### List Partners by Name in Each Category

Federal	Regional	Local & State	NGOs
Acadia National Park	Cobscook Bay Resource Center	Downeast Resource Conservation and Development / Vacationland Resources Committee	Casco Bay Estuary Project (2)
Agriculture Research Service, USDA	New Hampshire Coastal Program	Maine Bureau of Parks & Lands	Friends of Casco Bay
CICEET	Northeast Consortium (2)	Maine Coastal Program/ State Planning Office (7)	Island Institute (2)
Consortium for Oceanographic Research and Education	Northwest Atlantic Marine Alliance	Maine Department of Marine Resources (3)	Maine Association of Sea Kayak Guides and Instructors
Maine Coastal Islands National Wildlife Refuge		Maine Department of Conservation (2)	Maine Island Trail Association
Maine Conservation Corps/AmeriCorps		Maine Department of Health	MDI Water Quality Coalition
National Safe Boating		Maine Department of Environmental Protection (2)	Pleasant River Wildlife Foundation
NOAA Fisheries		DMR Maine Marine Patrol	SOS Maine
US Army Corps of Engineers (2)		Maine Geological Survey (4)	The Lobster Conservancy
US Coast Guard		Maine Soft-shell Clam Advisory Council	The Nature Conservancy
US Environmental Protection Agency (2)		Stonington Clam Committee	
US Fish & Wildlife Service		Town of Harpswell	
Wells National Estuarine Research Reserve (3)		Washington County Council of Governments	

**List Partners by Name in Each Category (cont.)**

<b>International</b>	<b>Industry/ Business</b>	<b>Academic Institutions</b>	<b>SG Programs</b>	<b>Other</b>
Gulf of Maine Council on the Marine Environment (2)	Maine Aquaculture Association	Bates College	MIT Sea Grant	Bigelow Laboratory for Ocean Sciences
Quebec Labrador Foundation / Atlantic Center for the Environment	Maine Lobstermen's Association	College of the Atlantic	New Hampshire Sea Grant	Maine Aquaculture Innovation Center
Department of Fisheries and Oceans, Canada		Jackson Estuarine Laboratory at the University of New Hampshire	North Carolina Sea Grant	Maine Fishermen's Forum Board
Chinese Academy of Sciences		Maine Maritime Academy	WHOI Sea Grant	
		Texas A & M University		
		University of Maine – School of Marine Sciences		
		University of Maine at Machias		
		University of Maine Cooperative Extension		
		University of New England		
		University of Southern Maine		
		Washington County Community College		

**d. Leveraged Funds (Not shown as match)**

<b>Project</b>	<b>Source</b>	<b>Amount</b>	<b>Years</b>
“Building on the promise...”	Northeast Consortium	\$65,749	1
“Developing off-bottom trawling gear”	Northeast Consortium	\$7,192	1
“Collaborative learning strategies to overcome...”	CICEET	\$6,804	1
Maine Beaches Conference 2005	Various local	\$7,300	1
Maine Oil Spill Advisory Committee competition administration	Maine Dept. of Env. Protection	\$12,500	1
“Collaborative fisheries management”	SURDNA Foundation	\$90,000	3
2005 Farmed Fish Health Management Workshop	Agriculture Research Service	\$5,000	1
“Assessment of nursery habitats in Casco Bay”	Maine Dept. of Env. Protection	\$92,630	2
Program Leadership Team	UMaine Cooperative Extension	\$9,000	2
Additional Support	University of Maine	\$31,452	1
Workboats for staff	University of Maine Office of Vice President for Research	\$43,300	1

## e. Publications List (print or electronic)

### Peer Reviewed Journal Articles/ Book Chapters:

Berkes, F., T.P. Hughes, R.S. Steneck, J. Wilson, D.R. Bellwood, B. Crona, C. Folke, H. Leslie, J. Norberg, M. Nyström, P. Olsson, M. Scheffer, and B. Worm, 2006, Globalization, roving bandits and marine resources, *Science*, 311:1557 – 1558.

Chen, Y., M. Kanaiwa, and C. Wilson, 2005, Developing and evaluating a size-structured stock assessment model for the American lobster, *Homarus americanus*, fishery, *New Zealand Journal of Freshwater and Marine Sciences*, 39:645-660.

Chen, Y., S. Sherman, C. Wilson, J. Sowles, and M. Kanaiwa, 2006, A comparison of two fishery-independent survey programs used to define the population structure of American lobster, *Homarus americanus*, in the Gulf of Maine, *Fishery Bulletin*, 104:247-255.

Chen, W., V. Panchang and Z. Demirbilek, 2005, On the modeling of wave-current interaction using the elliptic mild-slope wave equation, *Ocean Engineering*, 32 (2005) 2135-2164.

Dunnington, M. J., R. A. Wahle, M. C. Bell, and N. R. Geraldi, 2005, Evaluating local population dynamics of the American lobster, *Homarus americanus*, with trap-based mark-recapture methods and seabed mapping, *New Zealand Journal of Marine and Freshwater Research*, 39:1253-1276.

Hughes, T. P., D.R. Bellwood, C. Folke, R.S. Steneck, and J.E. Wilson, 2005, New paradigms for supporting resilience of marine ecosystems, *Trends in Ecology and Evolution*, 20:380 - 386.

Kelley, J. T., D. C. Barber, D. F. Belknap, D. M. FitzGerald, S. van Heteren, and S. M. Dickson, 2005, Sand budgets at geological, historical, and contemporary time scales for a developed beach system, Saco Bay, Maine, USA., *Marine Geology*, 214:117-142.

Kirschenbaum, S., S. Feindel, and Y. Chen, 2006, A study of tagging methods for the sea cucumber *Cucumaria frondosa* in the waters off Maine, *Fishery Bulletin*, 104:299-302.

Lopez-Anido, R., A.P. Michael, T.C. Sandford, and B. Goodell, 2005, Repair of wood piles with prefabricated FRP composite shells, *Journal of Performance of Constructed Facilities*, 19:78-87.

Maloy, A. P., B. Barber, and K. Boettcher, 2005, A PCR-based diagnostic assay for the detection of *Roseovarius crassostreae* in *Crassostrea virginica* affected by juvenile oyster disease (JOD), *Diseases of Aquatic Organisms*, 67:155-162.

Nelson, M. L., J. R. Gilbert, and K. J. Boyle. In press. The influence of sighting and deterrence methods on seal predation at Atlantic salmon (*Salmo salar*) farms in Maine, 2001-2003. *Canadian Journal of Fisheries and Aquatic Sciences*.

Panchang, V., and D. Li, 2006, Large waves in the Gulf of Mexico caused by Hurricane Ivan, *American Meteorological Society*, April 2006, pp. 481-489.

Rawson, P., 2005, Nonhomologous recombination between the large unassigned region of the male and female mitochondrial genomes in the mussel, *Mytilus trossulus*, *Journal of Molecular Evolution*, 61:717-732.

Ray, J. C., K.H. Redford, J. Berger, and R.S. Steneck, 2005, Is large carnivore conservation equivalent to biodiversity conservation and how can we achieve both?, In: *Large Carnivores and the Conservation of Biodiversity*, (Ray, J., K. Redford, R.S. Steneck, and J. Berger, eds), Island Press.

Sale, P. F., R.K. Cowen, B.S. Danilowicz, G.P. Jones, J.P. Kritzer, K.C. Lindeman, S. Planes, N.V.C. Polunin, G.R. Russ, Y.J. Sadovy, and R.S. Steneck, 2005, Critical science gaps impede use of no-take fishery reserves, *Trends in Ecology and Evolution*, 20: 74-80.

Steneck, R. S., 2005, An ecological context for the role of large carnivorous animals in conserving biodiversity, In: *Large Carnivores and the Conservation of Biodiversity*, (Ray, J., K. Redford, R. Steneck, and J. Berger, eds), Island Press.

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Thlusty, M. F., and K. Preisner, 2005, Organic matter production of American lobsters (*Homarus americanus*) during impoundment in Maine, United States, *New Zealand Journal of Freshwater and Marine Sciences*, 39:471-484.

### **Technical Reports**

Wahle, R.A., M. Dunnington, K. O'Donnell, and M. Bell, 2005, *Impact of dredged sediment disposal on lobster and crab abundance and movements at the Rockland disposal site*. 45p.

### **Proceedings/Symposia**

None

### **Theses/Dissertations**

Sheril Kirshenbaum, 2005, The assessment and management of the Maine sea cucumber, *Cucumaria frondosa*, M.S. in Marine Biology and Policy, University of Maine, Orono

Yuying Zhang, 2005, *Modeling the population and community of American lobster in the Gulf of Maine*. M.S. in Oceanography, University of Maine, Orono

### **Handbooks/manuals/guides**

Coastal Connections: Field, Lab, and Classroom Experiences Focusing on Coastal Watershed Study in Maine

### **Press Releases**

*Farmed fish health workshop celebrates thirteenth year*—March 14, 2005

*New lobster model provides improved basis for management*—May 4, 2005



*Sea kayak visibility studied*—May 24, 2005

*Maine Beaches Conference 2005 to explore "The Draw of the Sea: Yesterday, Today, and Tomorrow"*—July 13, 2005

*Downeast forum on coastal access planned for January 19*—January 11, 2006

*Maine Sea Grant Welcomes New Education Coordinator*—February 22, 2006

*National fellowships awarded to University of Maine graduates*—February 24, 2006

*Tourism workshop a success!*—March 26, 2006

*Farmed fish health workshop celebrates fourteenth year*—March 30, 2006

## **Other**

### *Web*

Sea Grant Week 2005 Web site

### *Brochures/fact sheets, etc.*

- Harpswell's Working Waterfronts
- Aquaculture in Maine: How the Public Can Participate in the Leasing Process
- Maine's Marine Invasion
- Research in Focus: Selectivity Tests with Knotless Mesh in Trawl Codends in the Northeast Groundfish Fishery
- Marine Extension in Action: Tracking Beach Erosion Could Help Management
- Marine Extension in Action: Sustainable Tourism along Maine's Coast
- The Draw of the Sea: Yesterday, Today, and Tomorrow
- Maine Sea Grant 2006-2010 Strategic Plan/ 200602008 Implementation Plan
- 2005 Lunar Calendar and Tide Table for the Coast of Maine
- PAT Briefing Book

### *Feature articles*

- 30-year History of the Maine Fishermen's Forum (Commercial Fisheries News)
- Island Monitoring (Friends of Acadia Journal)
- Penobscot River Future Tied to the Past (Bangor Daily News)
- River of Dams, River of Defiance (Bangor Daily News)

### *Posters*

- Two posters on the Kenduskeag Stream and the Penobscot River displayed in NOAA Fisheries educational kiosks

2. Insert the total number of publications below in each category.

Category	# of Pubs
Peer-reviewed journal articles/book chapters	16
Technical reports	1
Proceedings/Symposia	0
Theses/Dissertations	2
Videos/CDs/DVDs	0
Handbooks/manuals/guides	1
Press Releases	9
Newsletters/Periodicals	0
Other (e.g. websites, such as Haznet or SGNIS)	17

**f. Students Supported**

Students supported by any Sea Grant funds (i.e., hourly support, tuition and/or stipend).

Category	# of new students	# of continuing students	# of Degrees Awarded
Knauss Fellowship			
Industry Fellowship			
NMFS/SG Fellowship	1		
State Fellowship			
Sea Grant Supported MS/MA Graduate Students	1	1	
Sea Grant Supported PhD Graduate Students	1	3	
Sea Grant Supported Undergraduate Students		3	
Other			
<b>TOTAL</b>	<b>0</b>		<b>0</b>

**g. Program Awards and Honors**

Natalie Springuel (Sustainable Tourism)	2005	Governor's Public Service Award	Governor Baldacci
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Photos by Edwin Remsberg

