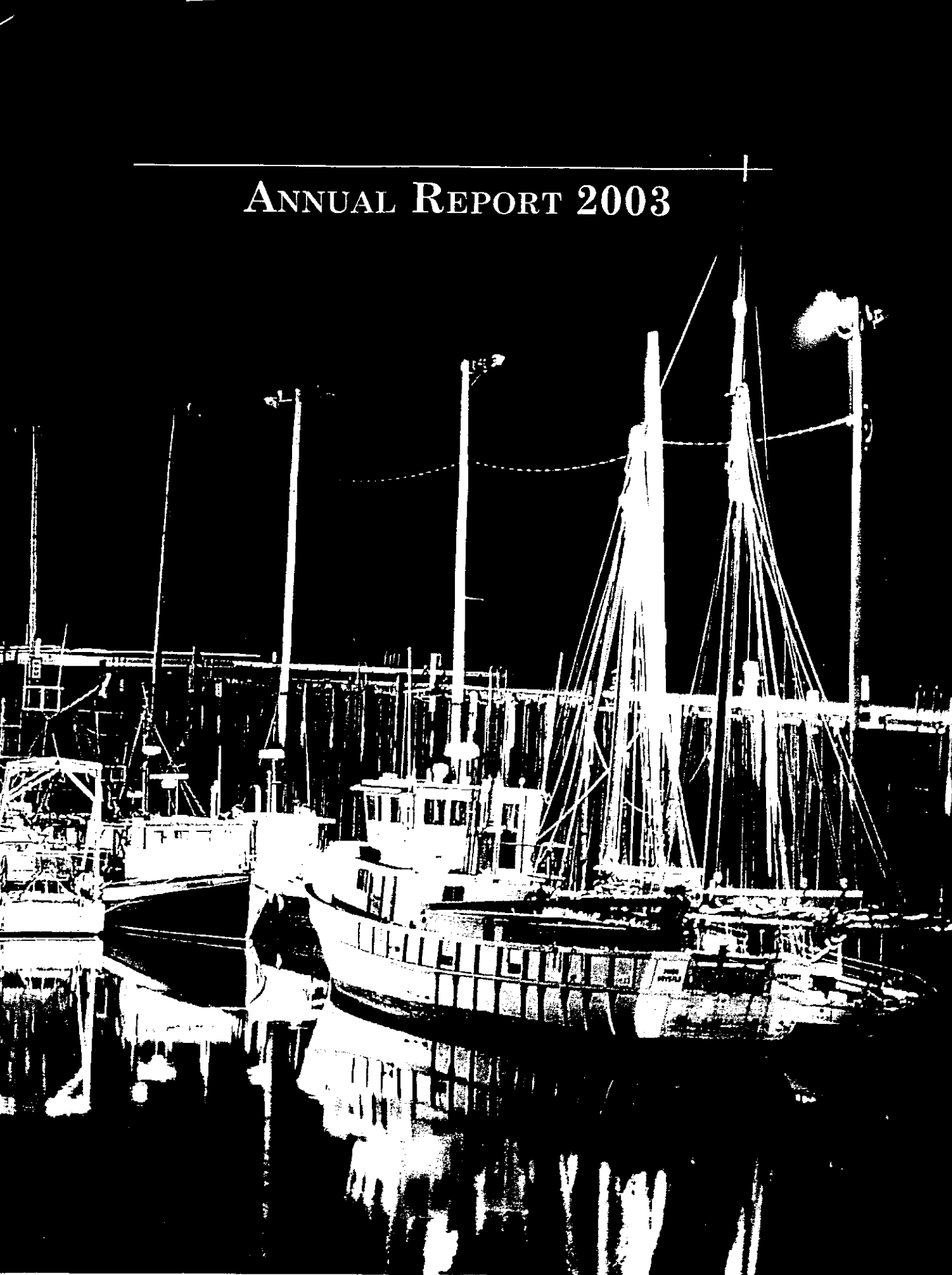
Annual Report 2003



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This annual report summarizes the accomplishments and activities of the Maine Sea Grant Program from October 1, 2002 to September 30, 2003. We have organized the report by program areas: management, research, extension/education, and communications. The projects and activities in the extension section are grouped according to the three theme areas (ecosystem health, aquaculture, and fisheries) listed in our strategic plan for 2001-2005, *Marine Science for Maine People*. If you have any questions about the Maine Sea Grant Program, please contact one of our staff members listed in the report or visit our Web site at: www.seagrant.umaine.edu.

MANAGEMENT

Maine Sea Grant continues to gain momentum as a vital participant in marine and coastal issues along Maine's coast. There have been many developments within the program over the past 12 months that have resulted in better management of the program thus ensuring the highest possible impact from the NOAA/Sea Grant investment.

In January 2003 Dr. James McCleave was hired as the Assistant Director for Research. McCleave brings to the position many years as an active researcher in Maine and significant experience in the administration of academic units. At Maine Sea Grant, McCleave is responsible for administering the annual research competition for both the National Sea Grant research funds and the Maine Oil Spill Advisory Committee (MOSAC) research funds. His duties also include soliciting research reporting information and synthesizing discoveries and impacts from our sponsored research activities. By adding McCleave to the management team, the Director and Assistant Director for Communications are able to focus on overall program management and outreach, thereby forming an ideal management team for the Maine Sea Grant Program.

During 2003, the Maine Sea Grant Program successfully petitioned the National Sea Grant Office to be considered for "college" status. The National Sea Grant Review Panel reviewed the written application favorably and a team visited in October 2003 as the final step in this assessment. We anticipate being able to report that we have been returned to the "college" status that the program enjoyed for over 20 years prior to our separation from the New Hampshire Sea Grant Program in 2000

The past year has seen strong growth in Internet use throughout the world, and the Maine Sea Grant Program has taken steps to maintain pace with this new technology. Our Web site, originally launched in 2000, is undergoing a significant facelift that is incorporating the latest technologies to ensure ready access to all users by complying with ADA requirements. We also have begun to use the Web site to support many extension programs and to provide materials to clients. A recent development is the integration of an online data capture tool for collecting feedback and information from program participants. This tool also will allow our many volunteer monitors to enter data from the various programs that we support using online data entry protocols. A related development is the completion of the program database that now houses all program information related to research, extension, and

education programs as well as financial information and project impacts. Much of the information included in this report was readily gathered from this database.

Maine Sea Grant continues to form effective partnerships with agencies and institutions throughout the state to create high impact collaborative programming. In many instances, Sea Grant staff have been able to attract external funds to help cover program costs and to provide salary relief. Examples include: Extension Associate Dana Morse was recently awarded two grants (two months salary total) by the Northeast Consortium for collaborative fishery research projects; and Extension Associate Tracy Hart was awarded two and a half months of salary support by the Quebec Labrador Foundation for her work on the coastal ecological characterization project. Our staff have also been very effective in obtaining continued support from the Maine Coastal Program (CZM funds), the U.S. EPA, the National Sea Grant Fisheries Extension funds, the University of Maine Cooperative Extension, the Maine Economic Improvement Fund (MEIF), and other private foundations.

Maine Sea Grant has been administering the research fund of the Maine Oil Spill Advisory Committee (MOSAC) for several years at a level of $100,000 per year. This year, the legislature approved an increase in this fund to $250,000 per year, thus making this competitive pool of funds even more relevant to the state's needs. The role that Sea Grant plays in the administration of this fund adds to our overall research portfolio and gains visibility for the program.

The remainder of this report will describe, in detail, many of the projects in which our staff have participated in the past year. Clearly, we are an energized program that has diverse talents and interests with a passion for the important issues facing our coast and the people who live here. The Maine Sea Grant Program owes its success to the dedication of the staff members who run the program and interact with constituents and stakeholders, and to the researchers who conduct the studies that serve as the basis for our increased understanding and knowledge of marine and coastal resources.

Maine Oil Spill Advisory Committee (MOSAC)

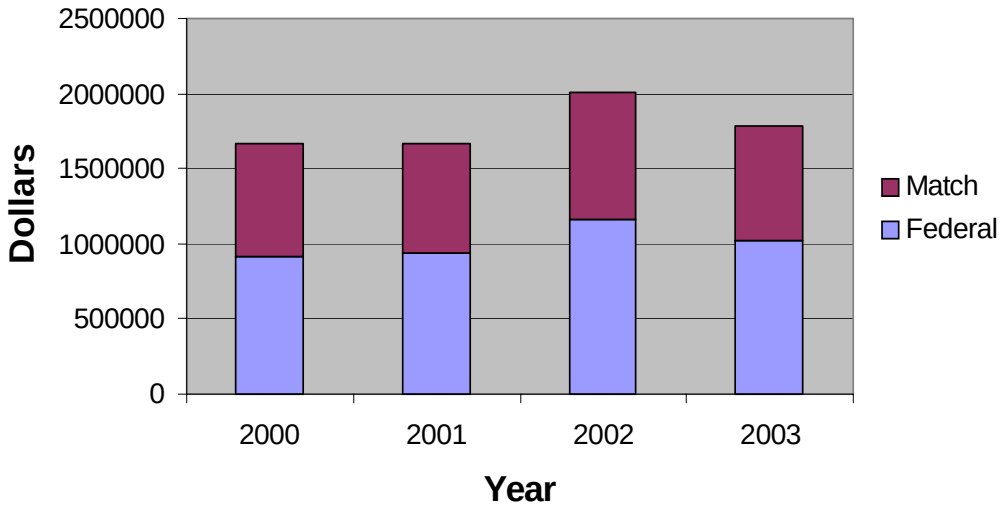
In 2003, Maine Sea Grant again administered a research fund for the Maine Oil Spill Advisory Committee (MOSAC), arranged in a memorandum of understanding between the Maine Department of Environmental Protection and the University of Maine. The competition resulted in approximately

$178,000 in awards to researchers who responded to the MOSAC RFP. Awards went to: Will Hopkins of the Cobscook Bay Resource Center for a project entitled *A Field Study of Circulation Patterns in Cobscook Bay* ($60,000); Jonathan Rubin of the Margaret Chase Smith Center for Public Policy at the University of Maine for *Measuring the Economic Damages from Oil Spills to Maine's Marine Economy* ($48,000); and Huijie Xue for her project on *Three-Dimensional Modeling of Cobscook Bay* ($70,000). Maine Sea Grant receives a modest administrative fee for providing this service and we anticipate continuing the arrangement for at least another two years.

Funding and Budget

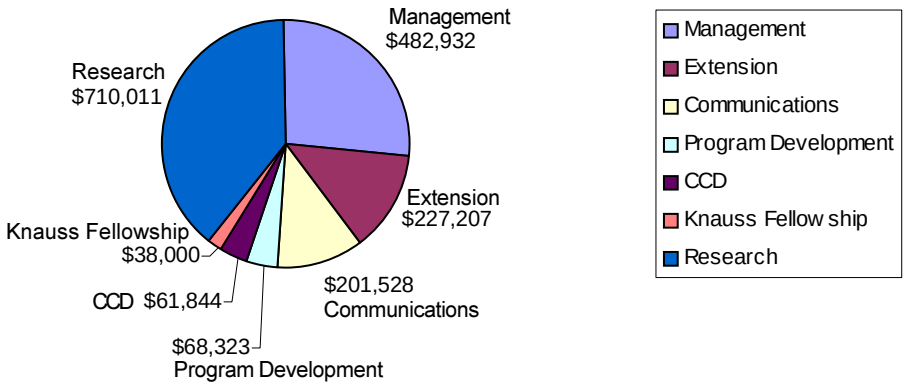
The overall funding for Maine Sea Grant in 2002-2003 was $1,789,845, with $1,025,498 in federal funds and $764,347 in non-federal matching funds (see Figure 1). The federal award includes base ($855,000), merit ($82,500), Coastal Community Development ($50,000) and a Knauss Fellowship ($38,000). Matching funds are derived from a combination of University of Maine resources, including the Maine Economic Improvement Fund and other University sources.

Figure 1: Total Federal Funding and Match 2000-2003



Maine Sea Grant continues to comply with the National Sea Grant Office guidance suggesting that at least 50% of the programs federal base funds plus merit funds ($937,500) be allocated to competitive proposals in research and education. Figure 2 shows the Maine Sea Grant budget for 2002-2003, indicating how the federal funds and matching funds were spent on various program elements. As indicated in the graphic, $710,011 of these funds supported competitive research projects in 2002-2003. The balance of the program budget covered extension/education ($227,207), communications ($201,528), management ($482,932), a Knauss Fellowship ($38,000), Coastal Community Development ($61,844) and program development ($68,323).

Figure 2: Maine Sea Grant Budget - 2003
Total = $1,789,845
(Federal NOAA award plus non-federal match)



RESEARCH

Research sponsored by Maine Sea Grant is focused in the three theme areas identified in the current strategic plan: aquaculture, ecosystem health, and fisheries. Using a pre-proposal review panel of in-state stakeholders assures that Maine Sea Grant funds research that is relevant to the needs of Maine's coastal communities, and often its importance extends to the Northeast/Maritime Provinces region, the Gulf of Maine, and beyond. The nature of research is such that the time frame for impact varies from immediate to longer-term.

Eight research projects and eight developmental research projects were under way in 2003. In the aquaculture theme area, Bowdoin College scientists are examining the potential of using artificial diets for increasing growth of sea urchins for aquaculture or reseeding projects. University of Maine scientists are combining molecular biological techniques and advanced sensor engineering to develop user-friendly biosensors for detecting pathogens in cultured finfish and shellfish. University of Maine and University of Connecticut scientists are working together to determine whether some complexities in the life cycle of Maine seaweeds (*Porphyra* species) can be manipulated to achieve ease of production in mixed species aquaculture, e.g., to mitigate finfish waste while growing a marketable seaweed product.

In the ecosystem health theme area, scientists at the Wells National Estuarine Research Reserve are examining the pathways by which energy flows through food webs in high salt marshes to understand what maintains healthy marshes and to determine which human activities may degrade them. University of Maine and Maine Geological Survey scientists are collaborating to study processes of sand transport in Saco Bay with respect to natural beach and shoreline changes, as well as those caused by jetty construction and artificial beach nourishment.

In one fisheries project, a University of Maine scientist is assessing the effectiveness of municipal-level soft-shell clam management in Casco Bay, viewed in the larger context of Maine's growing emphasis on decentralized, co-management of its coastal fisheries. Other University of Maine scientists are examining the effects of commonly used herbicides and pesticides on the survival and growth of larval and juvenile soft-shell clams, with respect to recent declines in clam fisheries. A team of scientists from the University of Maine and the Maine Department of Marine Resources are developing models for the stock assessment of the American lobster (Maine's most

valuable fishery) as alternatives to previously used models that have incorrectly predicted stock declines for the past several years.

One ongoing project from each theme area is highlighted in the following section.

RESEARCH PROJECTS

Assessing Potential Population-level Effects of Pesticide and Herbicide Toxicity to Soft-shell Clams in Maine: $108,631 (2002-2004)

Soft-shell clams, *Mya arenaria*, harvested from mud flats, are Maine's fourth most valuable commercial fishery, with an average annual value of $12.5 million during the last five years. However, the average annual harvest has declined from 3,121 metric tons (of clam meats) in the mid 1970s to 1,104 metric tons during the last five years. Decline in landings has been greatest in eastern counties, where many clam flats border agricultural land. This proximity, along with increased pesticide/herbicide use in eastern Maine, caused speculation that run-off of pesticides and herbicides has contaminated clam flats, leading to reduced viability of clams, especially larvae and juveniles. In 2002, Rebecca Van Beneden and Sara Lindsay were awarded a two-year grant (1) to determine the effects of pesticide/herbicide exposure to clams at various developmental stages from larva to adult, and (2) to use a life history model to determine the sensitivity of a simulated clam population to exposure at different developmental stages.

Research on the project to date has focused on the herbicide 2,4-diphenoxyacetic acid, commonly known as 2,4-D and marketed under various trade names. 2,4-D is widely applied to crops, pastures, forests, roadsides, lawns, and aquatic weeds.

Clam larvae obtained from hatcheries in Maine were raised in the laboratory. Early larvae (trochophores) and older larvae (veligers) had reduced survival after a single 24-hour exposure to 2,4-D at concentrations of 50 and 500 parts per million (ppm) compared with control larvae. Late-stage larvae (pediveligers) showed reduced survival only at 500 ppm. Lower concentrations did not cause reduced survival in these short-term tests. Juvenile clams experienced only slightly increased mortality at the highest concentration. Behavioral observations suggested that the juveniles retracted their siphons, closed their shells, and ceased filtering during exposure. A few months later, half of the surviving juveniles were subsequently exposed for 24 hours once a week for four weeks. Increase in shell length of exposed juve-

niles was lower than that of controls, and multiple exposure slowed growth more than a single exposure, over several months following treatment. The tissues of the different exposure groups are currently being examined for developmental anomalies.

Research is ongoing, but results of the larval survival and juvenile growth experiments indicate that single or pulsed contamination of clam flats by 2,4-D could be a factor contributing to reduced populations. Final results will be of considerable interest to the Maine Department of Marine Resources, which listed the impact of water quality and toxic substances on clam flat ecology as a priority. Jill Tonneson, an undergraduate student using aspects of this project for her senior thesis project in microbiology, presented preliminary findings to the legislature and others during the Undergraduate Research Day held at the State House in Augusta, Maine, last April.

Ecological Processes, Energy Pathways, and the Impact of Human Activities on Maine Marsh-estuarine Secondary Production: A Salt Marsh Panne Model: $92,485 (2002-2004)

The coast of Maine has more salt marsh area than any other state north of New Jersey, much of which is high marsh characterized by salt meadow hay (*Spartina patens*) and other marsh grasses. High marshes are inundated on some but not all high tides, e.g. about 70% of high tides at the Wells National Estuarine Research Reserve, the site of this study. Salt-marsh pannes, characteristic of New England high marshes, are shallow soft-bottomed depressions that retain water during low tides. The pannes, which make up about 15% of the area of the wetlands of the Wells NERR, are part of habitat diversity offering an aquatic refuge at low tide for fishes and invertebrates.

In 2002, Michele Dionne and Richard MacKenzie were awarded a grant to examine the flow of energy through the food webs of a panne/marsh system at Wells NERR. Understanding the functioning of such systems is important to guard against deleterious effects of human activities in the Gulf of Maine region. Run-off from paved areas, agricultural land, and lawns increases nonpoint-source pollution of marshes. Bridges, tide gates, and culverts restrict tidal exchange with adjacent estuaries altering the hydrologic regime and ecological processes. Further, "restoration" of marsh areas by creating artificial pannes may alter hydrology with unanticipated consequences.

Dionne and MacKenzie have (1) tracked energy pathways and determined the contribution of high marsh habitat adjacent to pannes to the diet and production of panne-dwelling fishes and invertebrates, and (2) compared the food webs of created, altered, and natural pannes. A stable isotope of nitrogen (^{15}N) was used to determine trophic levels at which the panne fauna fed and to determine the contribution of the adjacent marsh to the nutrition of the panne fauna. The ^{15}N content of the water in six pannes was artificially enriched at low tide. Sediments, phytoplankton, benthic algae, rooted plants, zooplankton, invertebrates, and fishes were all sampled before and after enrichment. As an example, the mummichog (*Fundulus heteroclitus*) comprised more than 90% of the fish fauna of the pannes and fed two trophic levels above primary production (plants), probably connected to primary productivity through polychaete worms and grass shrimp. Preliminary analysis has suggested that the pannes themselves contribute to the food web of the fauna in addition to the surrounding vegetated marsh. Phytoplankton within the pannes took up the ^{15}N, transferring it by dying and sinking to the bottom-dwelling algae and subsequently the bottom fauna and the fishes. The enrichment in ^{15}N in mummichogs in treated panes, compared with control panes, showed that the mummichogs fed in the pannes as well as in adjacent marshes. From panne fencing experiments, they found that pannes maintain very high densities of shrimp and fish throughout the growing season. Numbers of individuals ranged into the thousands for each group in pannes only 5 to 10 m in diameter. Given the large number of pannes on the high marsh surface, these data will provide new, increased estimates of nekton production attributable to high marsh habitat in the Gulf of Maine region. These largely unstudied habitat features of New England high marshes appear to play a very important role in supporting tidal marsh food webs.

Results to date of this ongoing study are increasing our ability to manage, protect, and restore tidal marshes in the Gulf of Maine.

A Biosensor Platform for Detection of Fish Pathogens: $140,000 (2001-2003)

Every year, infectious diseases cause substantial economic losses to industries that rely on the cultivation or harvest of marine finfish and shellfish. Early detection and precise identification of pathogens could reduce the harmful effect on the aquaculture and fisheries industries. Conventional techniques for culturing marine pathogens and identifying them with antibody reactions require technical expertise and are expensive and slow. A

sensitive molecular technique for identifying specific DNA from pathogens (called the polymerase chain reaction) is routinely used in fish pathology laboratories, but its potential for false positive results can lead to unnecessary destruction of cultured or captured fish and shellfish. Alternative pathogen detection methods that are cheaper, simpler, and more user-friendly than current methods are needed. In 2002, Maine Sea Grant awarded Paul Millard, Carol Kim, and John Vetelino a grant to combine (1) innovative molecular biological techniques for recognizing and amplifying the DNA and RNA of specific viral and bacterial fish pathogens and (2) solid-state electronic technology into biosensor instruments that can detect that DNA and RNA. A goal is to produce an easily used sensor that amplifies the DNA and RNA from the pathogen more specifically (reducing false positive tests) while maintaining sufficient sensitivity.

In this process, molecular padlock probes (MPP) are developed to recognize a segment of the DNA or RNA from a specific pathogen and amplify it (make millions of copies). These probe molecules are chemically bonded to the surface of quartz crystal microbalances (QCM), where pathogen molecules can attach. If the pathogen were present, its DNA or RNA would be amplified and be bound to the quartz crystal, changing its mass and allowing electronic detection. Techniques are being developed by which the crystal surface can be regenerated to allow it to be used many times.

To date, the team has developed molecular padlock probes for two viral fish pathogens: infectious hematopoietic necrosis virus (IHNV) and infectious salmon anemia virus (ISAV). Further, they have shown that these probes can be bonded onto the quartz crystal devices, which can detect synthetic viral DNA and RNA. Future work focuses on bonding methods, functional testing of the sensors, detection of actual pathogens in fish, and comparison of the MMP-QCM method with other diagnostic procedures. The comparisons will be done in collaboration with a company in Maine.

Commercialization of such instruments could occur within the foreseeable future. Once the technology is proved for sample disease pathogens, probes for many diseases could be developed rapidly as the need arises. The devices also have applications beyond identification of fish diseases. For example, sensors could be deployed on oceanographic buoys for monitoring harmful algal blooms.

Maine Sea Grant Research Projects - 2003

Belknap, D., J. Kelley, and S. Dickson, *Monitoring of Coastal Dynamics at the Saco River Mouth Near Jetty Modifications and Beach Nourishment Projects.* $69,570.

Brawley, S. and C. Yarish, *Enhanced Spore Production for Net-Seeding of Native New England* Porphyra *in Integrated Finfish/Seaweed Aquaculture.* $76,819.

Chen, Y. and C. Wilson, *Developing a Bayesian Stock Assessment Framework for the American Lobster.* $60,848.

Dionne, M. and R. MacKenzie, *Ecological Processes, Energy Pathways and Impacts of Human Activities on Maine Marsh-Estuarine Secondary Production: A Salt Marsh Panne Model.* $48,201.

Johnson, A. and O. Ellers, *Accelerating Growth in Sea Urchins.* $20,000.

Millard, P., C. Kim, J. Vetelino, and C. Pierce, *A Biosensor Platform for Fish Pathogens.* $70,000.

Townsend, R., *Assessment of Municipal Clam Management in Casco Bay.* $31,032.

Van Beneden, R. and S. Lindsay, *Assessing Potential Population-Level Effects of Pesticide and Herbicide Toxicity to Soft-Shell Clams in Maine.* $56,631.

TOTAL: $433,101

MARINE EXTENSION

MET Is Productive Partnership

Five years ago, the Maine Sea Grant and University of Maine Cooperative Extension programs aligned their coastal extension assets to create the Marine Extension Team (MET). This alliance includes five Sea Grant extension associates, five Cooperative Extension faculty and professional members, and the marine extension program leader. In the past year, this dynamic team has been involved in projects that run the gamut—from fisheries gear technology and aquaculture demonstration projects to ecotourism, coastal access, and habitat restoration efforts. Statewide programs in water quality monitoring, phytoplankton monitoring, and beach profiling use volunteers and work in collaboration with coastal communities and state agencies, while participation in aquaculture and fisheries-related programs involve applied research and facilitation efforts.

Integral to all outreach efforts is the solicitation and integration of stakeholder input, whereby staff members identify needs of coastal communities and address those needs through the University and other marine science institutions in the state. The MET is involved not only in formal and informal education, but also in community development and applied research projects in coastal counties related to fisheries, aquaculture, and ecosystem health issues. One of the most important roles the extension staff plays is to link the state's marine scientists and the information users. They convey the needs of the user groups to scientists working in disciplines related to marine and coastal issues. Staff members then transfer the research results back to the resource users, industry members, managers, and decision-makers. By providing a balanced approach to facilitation and building collaborations, the extension staff can help decision-makers and stakeholders identify critical information needs and foster opportunities to fill those data gaps.

We have chosen the following projects to highlight our accomplishments in the past year in our three theme areas of ecosystem health, aquaculture, and fisheries.

ECOSYSTEM HEALTH

Marine Extension Team Addresses Coastal Access

Maine has a long tradition of public access to private property both inland and along the coast. User conflicts over access to Maine' s coastal lands and to the water itself are increasing as a result of development pressures and a changing private property ethic. This loss of coastal access is changing the quality of life in Maine by reducing the coastal access sites for public use and by raising the costs of doing business for commercial fishing and tourism businesses that depend on waterfront access.

During the past year, the MET began programming to address coastal access issues with a $10,000 Program Leadership Team (PLT) grant from University of Maine Cooperative Extension (UMCE). During the fall of 2002, MET members conducted a training workshop on *Coastal Access Law and Policy* with John Duff, director of the Marine Law Institute in Portland. The workshop provided valuable information on the public trust doctrine, coastal private property issues, and the "fishing, fowling and navigation" law. About 30 coastal stakeholders attended the workshop, which provided the legal framework to address coastal access issues.

A number of organizations, including Maine Sea Grant, formed the Working Waterfront Access Coalition last year to address the decline of access for working waterfront communities through education, policy, planning, and investment. Partners include Maine Coastal Program, Maine Department of Marine Resources, Coastal Enterprises Inc., Maine Marine Trades Association, Maine Lobstermen's Association, Associated Fisheries of Maine, Maine Fishermen's Wives Association, Maine Aquaculture Association, and others. One of the coalition's most visible projects was to organize a governor's press conference on Maine's working waterfront. Governor John Baldacci spoke at the event, held on May 27 at the State Capitol in Augusta, and nearly a dozen newspaper and television reporters attended. This resulted in extensive media coverage in both print and broadcast formats. Marine Extension Team member Natalie Springuel has been the lead Sea Grant staff member in this coalition and in the Water Access Group, an inter-agency effort to broaden access-related resources for communities.

Maine Sea Grant has begun to help document access related incidents and transfer this information to the coalition and the Water Access Group in order to increase awareness of relevant community needs and address emerging conflicts. Maine Sea Grant's MET is particularly suited to this role be-

cause of its field-based approach with offices from southern Maine to Eastport, and was identified as such in a Land and Water Resources Council legislative report.

In December 2003, Maine Sea Grant/UMCE, in partnership with the Island Institute, Maine Coastal Program, and the Gulf of Maine Foundation, will hold a forum, "Working Waterfront Access 2003," to share information and experiences, across industries and communities, about the tools available to shape the future of Maine's working waterfront. The goal of the forum is to highlight the value of Maine's diverse waterfront and to identify challenges and solutions for waterfront-dependent communities and businesses.

Salt Marsh Restoration Efforts Under Way

Maine's salt marshes are not only very productive, but they also serve an important ecological function by protecting upland areas from erosion and floods and helping to maintain water quality in coastal areas. However, many of these salt marshes have been drained, dredged, filled, and diked, mainly to accommodate the growing coastal zone population and the ensuing development pressures. Other states in the Northeast have made great strides in salt marsh restoration through numerous demonstration projects. These efforts have restored functionality to hundreds of acres of salt marsh in those states. Maine lags behind in state and local support and implementation of restoration projects.

In January 2003, a steering committee was formed with representatives from Gulf of Maine Council for the Marine Environment, Coastal Training and Information Program of the Wells National Estuarine Research Reserve (WNERR), U.S. Fish and Wildlife Service's Gulf of Maine Program, New Hampshire Coastal Program, Maine Sea Grant, and the Maine Coastal Program. The goal of the group was to address the controversy regarding the merits of various salt marsh restoration methods, which stymies the advancement of restoration efforts in the Gulf, most notably in Maine. The steering committee organized a professionally facilitated, field-oriented workshop called *Bridges and Barriers to Salt Marsh Restoration in the Gulf of Maine* that was held on June 10 during which scientists, resource managers, and regulators from throughout the region could exchange ideas, learn about current research, and participate in hands-on activities. Interest in participation far exceeded space availability for the workshop.

In the past year, Maine Sea Grant's Extension Associate Kristen Whiting-Grant also worked with WNERR and NOAA Fisheries to develop two

publications that provide background information to community members who might support local restoration efforts, as well as state and municipal officials who regulate restoration projects. An introductory brochure was created, printed, and distributed early in the year to stakeholders interested in restoration efforts and want to know the next steps. A 20-page booklet entitled *Maine's Salt Marshes: Their Functions, Values, and Restoration,* which provides more detailed information, is being printed later this fall.

Taunton Bay Survey Assesses Needs

In 2003, Sea Grant chose to focus some of its extension efforts on the Taunton Bay region in Downeast Maine, due to the high number of emerging marine-related issues in the region, which have the potential to serve as models or case studies for the state. For example, a potential precedent for marine protected area designations was set by the five-year legislative closure of the bay to dragging. The closure sparked a level of research and resource characterization unprecedented in other marine areas of its size in the state. Taunton Bay also faces user conflicts—including shellfish aquaculture, development, dragging, and recreational use—now common to many of Maine's coastal areas.

With the assistance of the Margaret Chase Smith Center for Public Policy, the Center for Research and Evaluation at the University of Maine, Maine Sea Grant's Policy Advisory Committee, and other MET members, Extension Associate Tracy Hart developed a survey to gather information about the priorities and concerns of those who live and work in the three towns bordering Taunton Bay and to assess what specific topics new educational, municipal training, or research programs could address to meet existing needs related to Taunton Bay. The survey was distributed to a random sample of 600 registered voters in the region and a diverse group of 71 responded to it. Hart analyzed the results and produced a final report, available both in print and online on Maine Sea Grant's Web site (www.seagrant.umaine.edu). The published report was disseminated to all respondents, municipal officials, prominent stakeholders, and the general public through a press release. Hart has presented survey results to interested stakeholders at several public meetings.

The survey results indicate that Taunton Bay is clearly considered an important local resource for both its economic and non-economic benefits and that pollution runoff, development, and habitat loss are the greatest concerns of local respondents. A greater number of respondents supported

shellfish aquaculture leases for the bay than opposed them, and all but 3 % of those who responded believe Taunton Bay should remain closed to dragging.

The report has already contributed to decision-making about Taunton Bay resources. Both proponents and opponents of a proposed shellfish aquaculture lease in Taunton Bay submitted the results for consideration in the Maine Department of Marine Resources's (DMR) decision on the lease. Some of the survey results will also be included in the DMR report on the impacts of dragging to Taunton Bay and local fisheries.

Gulf of Maine Expedition Produces Report

Maine Sea Grant co-sponsored the very successful Gulf of Maine Expedition, which sent a team of educators on a sea kayak journey from Cape Cod, Massachusetts, to Cape Sable Island, Nova Scotia, over a five- month period. The Expedition was organized to raise awareness and caring about the ecology and cultural legacy of this international watershed and to promote low-impact coastal recreational practices, safety, and stewardship principles.

The Expedition, led by Marine Extension Associate Natalie Springuel, was a partnership of many organizations, agencies, and businesses with the major supporters being the Maine Coastal Program of the State Planning Office, the Gulf of Maine Council on the Marine Environment, Rippleffect, the Maine Association of Sea Kayak Guides and Instructors, and the New England Biolabs Foundation. The team paddled more than a million strokes each over 1000 nautical miles, and provided 25 educational workshops in communities throughout the Gulf, collected scientific data, and helped to increase public awareness on many issues around the Gulf of Maine. Team members met with over 2500 people either through formal programming or impromptu educational opportunities along the shore. In the process, the team extensively documented the Gulf of Maine for a snap shot of its status during the summer of 2002. Documentation includes first hand accounts by locals, species lists, data on Gulf-wide debris, and recreational use trends.

The team developed a Web site (www.gomexpedition.org) and created a comprehensive final report, which documents their findings and methods of the Expedition. The findings of the Gulf of Maine Expedition could provide a baseline by which changes along the Gulf can be measured in future years. The 100-page report was written collectively by the Expedition team, and 500 copies were printed in the summer of 2003. Hard copies were distributed to many of the 400 people on the Expedition's mailing list as well

as other interested individuals. The report is also posted on the Sea Grant and Gulf of Maine Expedition Web sites.

Since the Expedition's completion in September 2002, the team has delivered slide shows to over 1000 people in more than 30 presentations. The ongoing requests for these presentations will continue to be tracked as a measure of the Expedition's educational success.

Fourth Annual Maine Beaches Conference Tackles Controversial Issues

The sand beaches of southern Maine cover less than 4 percent of the state's coastline, yet they have significant ecological, economic, and social values. State, municipal, community, private, and environmental interests in Maine's beaches are often in conflict. The stalemates that sometimes result from these controversies stymie decision-making, leaving problems unaddressed. Inaction on these issues threatens the sustainability of this valuable resource.

The Maine Beaches Conference was first organized four years ago by Extension Associate Kristen Whiting-Grant to provide a forum for communication among beach stakeholders with diverse interests. This year's conference, *New Challenges and Opportunities for Coastal Communities*, was held on July 9 at Thornton Academy in Saco, Maine, and attracted nearly 160 participants. The event incorporated a variety of formats—including plenary and breakout sessions, informal discussion, question and answer, and field trips—and shared information with coastal property owners, recreational beach users, and beach managers about best management practices for promoting healthy beaches (e.g., flood management, designing safer structures in the coastal zone, dune restoration and landscaping, and preventing water-related illnesses), coastal water quality, coastal processes and the geology of Maine's sandy beaches, and beach management. It also provided a forum for discussion of relevant coastal policy issues. Researchers and beach profiling volunteers shared their scientific findings through a poster session.

More than 40 % of conference participants responded to an evaluation of the event. Due to their participation in the conference, over 75 %t of respondents indicated that their knowledge of Maine coastal land use regulations had increased; more than 88 % indicated an increase in knowledge of strategies for creating storm-resistant communities; 95 % said they had gained information about storm-resistant communities they could use at home or in their work; and 100 % indicated they would attend another Maine Beaches Conference in the future.

Microbial Source Tracking Gets Results

During the past two years, Maine Sea Grant has partnered with the Wells National Estuarine Research Reserve, the Jackson Estuarine Lab at the University of New Hampshire, University of Southern Maine, and the Maine Conservation Corps/Americorps Program to try to determine the sources of potentially harmful bacteria in two southern Maine watersheds. With a $194,000 grant received in 2001 from the Cooperative Institute for Coastal and Estuarine Technology, Marine Extension Team member Kristen Whiting-Grant led the effort to conduct water quality and microbial source tracking (MST) analyses in these watersheds to identify bacterial hosts, develop remediation plans, and provide recommendations to reduce contamination levels.

Over the two years of the MST project, 51 volunteers have been trained to collect samples and assist with lab procedures, providing scientists with the materials they need to conduct MST analyses. These volunteers contributed over 125 hours to the project in 2003. Data from the Webhannet watershed in Wells has been analyzed and interpreted and the findings have been used to guide remediation and outreach planning. The town of Wells has offered the support of both the Conservation and Clam Commissions in outreach and remediation efforts.

The largest single source of contamination was traced to humans, and human-related sources (pets and livestock) were also significant contributors. As a result, recommendations for strategies to reduce bacterial contamination include providing information to septic system users, pet owners, and gardeners using manure fertilizers; promoting Wells Harbor boat pump-out facilities; careful monitoring of contaminated areas; and conducting a new sanitary survey of the clam harvesting area.

A 54-page document with the analyzed data, *Microbial Source Tracking in Two Southern Maine Watersheds: Webhannet River Watershed Report*, was completed this summer and is being distributed to project partners; local, regional, state, and federal agencies; and interested citizens. The data could be used to manage and mitigate pollution sources.

Maine Phytoplankton Monitoring Program Expands

The Maine Phytoplankton Monitoring Program (MPMP), a citizen volunteer effort that provides a first-alert system to the Maine Department of

Marine Resources (DMR) biotoxin monitoring program, expanded last year to include aquaculturists. The productivity and marketability of product at Maine's aquaculture sites are influenced greatly by phytoplankton blooms and the presence of harmful algae blooms (HABs). In 2003, Sarah Gladu, coordinator of the MPMP and Marine Extension Team member, received funding for a project to include aquaculturists in the monitoring effort. The project is a collaboration of the University of Maine Cooperative Extension, Maine Department of Marine Resources, Maine Sea Grant, and the University of Maine's School of Marine Sciences.

In March, a Phytoplankton Volunteer Training workshop was held at the University of Maine's Darling Marine Center in Walpole, and 60 volunteers received 12 hours of hands-on training to enable them to collect quality data. A *Field Guide to Phytoplankton in the Gulf of Maine* was published last summer to assist volunteers in identifying phytoplankton, which will help to ensure that the data generated is of the highest quality. A second identification tool, a "Phytoplankton Identification Quiz" was also developed and is available online for volunteers to practice their identification skills. Aquaculturists were trained to monitor marine phytoplankton around their sites. These site-specific, real-time data will be used to develop crop management strategies. This project will strengthen the partnerships that support the Maine Phytoplankton Monitoring Program, enhance the capacity of this program, and enable citizens and scientists to work together to further knowledge about the relationship of phytoplankton and aquaculture in the Gulf of Maine.

Volunteers with the MPMP were instrumental in providing the DMR with information about location and movement of *Alexandrium* in the unusual "red tide" bloom occurring in the fall of 2003. This coastal bloom was geographically the largest in a decade and posed a significant potential threat to human health. According to a DMR staff member, "Volunteers along the coast of Maine have provided extremely helpful plankton data to the DMR, allowing us to follow the recent *Alexandrium* bloom and its recession. Not only are their reports of *Alexandrium* beneficial, but also those of other potentially toxic species, particularly *Dinophysis* spp. again this year."

Coastal Swim Beach Monitoring Program Off and Running

Maine has not in the past had any structure in place to monitor coastal swim beach water quality to protect public health, nor an education effort for

best practices at the beach by the public. The Coastal Swim Beach Monitoring Program, funded by a $259,000 EPA grant, has a long list of collaborators including Maine Sea Grant/UMCE, Maine Coastal Program, Maine departments of Health, Planning, Marine Resources, and Conservation; and nonprofits, municipalities, state parks, and citizen volunteers. MET member Esperanza Stancioff is the statewide coordinator, providing oversight in development and implementation of the program.

In 2003, a Quality Assurance Project Plan and Notification System were developed, regional laboratories were set up, training programs and educational programs were initiated, and feedback mechanisms were designed into the program. In the past year, eight new state parks/municipalities were added, bringing the total to 15 state parks/towns with 30 beach management areas involved in the program. The program now covers 85 % of the beaches in southern Maine with high usage, which are monitored systematically, using quality control and quality assurance methods. Due to the new monitoring effort established through this program, Maine's coastal beaches will be safer places to recreate.

Monitoring Database Developed

Coastal community science has been in place since 1988, when the first two groups began monitoring water quality to determine pollution sources and remediate them, primarily to increase harvesting of productive shellfish areas. However, until recently, there was no statewide database where data from these groups could be viewed and compared. With the beginning of the Coastal Swim Beach Program in 2002, coordinated by MET member Esperanza Stancioff, an online database was developed for this program and, eventually, other water quality efforts and the beach profiling program will be able to utilize the system. Stancioff coordinated the collection of geo-referenced site information, location descriptions, and other information required for the database. The swim beach monitoring coordinator tested the program and trained beach managers and laboratory data managers in using the system. Now managers can view the results as soon as the laboratory reads the sample for Enterococci bacteria, providing information necessary for making a decision on whether re-sampling is required or a swim beach advisory is necessary.

Medomak Watershed Group Identifies Pollution Sources

The Medomak Estuary continues to have conditional closures of shellfish harvesting areas, and a lack of funding has prevented the Maine Department of Environmental Protection (DEP) from determining the TMDL (total maximum daily load) quota. For the third year, the Friends of Medomak Watershed are monitoring the estuary and river to provide baseline data to the DEP and educate the community about human impacts on the watershed. In partnership with the Waldoboro Shellfish Committee, the group has been able to gather bacteria data in an effort to determine pollution sources.

The data gathered to date has aided the DEP as it provides guidance in establishing TMDL. The data gathered by the shellfish committee helped the Maine Department of Marine Resources by confirming localized pollution problems. In Bremen, the selectmen have been successful in removing several polluting septic systems with technical support from the MET and the Friends of Medomak Watershed.

Marine Area Characterization Working Group Launched

Currently, characterization tools are not widely applied in Maine's coastal and marine management practices. Information that exists about the state's bays and estuaries seldom is synthesized to develop a comprehensive description of the human and natural attributes of nearshore areas. A marine area characterization can serve as a data integration tool, providing baseline information to describe what an area is (its species, history, uses, threats, circulation patterns, and habitats) and how it functions. These inventories can also highlight serious gaps in data, providing a valuable tool for prioritizing research and monitoring efforts. If repeated over time, characterizations provide a marker from which to measure change in a bay's or estuary's health.

During the past year, Maine Sea Grant has partnered with the Quebec Labrador Foundation (QLF) to convene the 24-member Marine Area Characterization Working Group. The group, consisting of university and college research scientists, state agency personnel, and nonprofit organization staff, will develop a body of recommendations on the components and methods for conducting marine inventories. These recommendations will be used to develop a citizens' guide, which will assist Maine residents in compiling existing information and coordinating the collection of new data on the

ecological, physical, historical, and socioeconomic attributes of their local coastal areas.

The working group first met on June 13, 2003, to develop an overarching framework for the citizens' guide and to define the purposes and potential applications of characterization information. Working group coordinators, Jennifer Atkinson of QLF and Tracy Hart of Maine Sea Grant's MET, produced a primer on marine characterizations, which described five marine inventory-type projects conducted in Maine. The second meeting on October 24, 2003, focused on determining the critical components and methodologies associated with characterizations.

Marine area characterizations could help state managers to identify and compare the needs of various regions so they can better prioritize and allocate scarce resources. Also, the information could have important implications for many of the current trends in marine resource management, which emphasize ecosystem-based approaches, co-management of marine resources between state and local entities, stewardship, and area-based management, such as marine protected areas and bay area management plans.

MET Facilitates Public Meeting on Mainland Access

Cranberry Isles is a small group of islands with year-round and seasonal residents. At a special town meeting in 2002, voters took the unprecedented step of purchasing a two-acre piece of land in Manset, a village of Southwest Harbor on nearby Mount Desert Island. Over the years, residents had seen secure public access to the waterfront shrinking; without a state-run ferry, there was no guarantee that Cranberry Islanders would be able to get to and from shopping, medical appointments, schools, and other vital services provided in Southwest Harbor or other mainland communities. So, they appointed a committee, which researched options and settled, eventually, on the Manset shore.

After the vote, the committee charged with developing a long-term plan for the property held a public workshop to elicit ideas from seasonal (non-voting) and year-round residents. MET member Ron Beard, working with consultants helping the town to find alternative funding sources to purchase the property and with the Maine State Planning Office, facilitated a two-part meeting in July for town officials, committee members, and townspeople. The meeting resulted in a timeline, steps to complete a long-term plan, and ideas for using the new town-owned land.

AQUACULTURE

Aquaculture Task Force Appointed by Governor

This past summer, Maine's Governor John Baldacci appointed Paul Anderson, Marine Extension Team (MET) leader and Maine Sea Grant director, to the *Task Force on the Planning and Development of Marine Aquaculture in Maine*. Anderson is now chair of this prestigious 11-member group, which met during the summer and fall to deliberate upon the many policy questions surrounding marine aquaculture.

This Task Force was formed to ensure that the other sectors of the marine economy move toward a consensus on the future of aquaculture. According to Governor Baldacci, "Marine aquaculture is an important part of the State's marine economy. However, the controversy that has surrounded aquaculture in recent years has impeded Maine's ability to stand back and think comprehensively about aquaculture's place on the coast. This Task Force provides a much-needed opportunity for the kind of focused deliberation that will help us to move forward with marine aquaculture planning.

The Task Force is holding its public meetings all along the Maine coast, and members are spending time on the water and gathering information directly from stakeholders and experts. The work of the Task Force will culminate in a final report of recommendations to the Legislature's Joint Standing Committee on Marine Resources. The Task Force is also authorized to report out legislation, should it be necessary.

Workshop Addresses Key Salmon Health Issues

Salmon aquaculturists in Maine and the Maritimes are faced with a variety of health related challenges in raising their stock. On April 3, Maine Sea Grant/UMCE, in collaboration with the Maine Aquaculture Innovation Center, Maine Aquaculture Association, and local industry leaders sponsored the 11th Annual New England Farmed Fish Health Management Workshop to address many of the key issues involved in salmon farming. Coordinated by MET member Chris Bartlett, the workshop was held at the University of Maine at Machias, and attracted over 115 people. Experts were invited from Norway, Scotland, Canada, and the United States to speak on the control of Infectious Salmon Anemia, the health-related effects of marking salmon, and

the accomplishments of the Maine Finfish Aquaculture Monitoring Program, as well as other topics. An evaluation of participants showed strong support for the workshop, which will continue to be held annually in Washington County.

Northeast Aquaculture Conference Pulls Region Together

In 1998 and 2000, the Northeast Aquaculture Conference and Exposition (NACE) focused on aquaculture in Maine, New Hampshire, and Massachusetts, while there was a concurrent conference focusing on aquaculture issues in southern New England. In 2001, a group worked to combine the two events into one that would serve the entire region. NACE 2002 took place in Warwick, Rhode Island in November with approximately 250 people in attendance and nearly 30 tradeshow vendors.

Plans are now under way for the 2004 conference, which will take place in Manchester, New Hampshire. Extension Associate Dana Morse has been involved in the conference since its beginning and is responsible for the popular Technology Transfer session, which most recently highlighted demonstrations on algal culture techniques, oyster disease diagnostics, crop insurance, business planning, and small-scale re-circulating aquaculture technologies. For the upcoming conference, Morse is also serving as the Sponsorship Coordinator.

Salmon Marking Study Assesses Strategies

Due to the current listing of Atlantic salmon in Maine under the Endangered Species Act, efforts to mitigate any potential impact of farmed salmon on wild populations has been given high priority. Marking hatchery-raised salmon could be beneficial for identifying these fish at the mouths of rivers where wild stocks return to spawn. The National Fish and Wildlife Foundation Collaborative Marking Study Committee appointed the Marking Logistics Working Group to identify logistical barriers and the costs associated with implementing different marking strategies for commercially raised Atlantic salmon. MET member Chris Bartlett is a member of the working group, which has assessed 12 different marking methods and completed a cost analysis for them. The marking strategies could be implemented and become public policy in the future. The Maine Aquaculture Association is leading the study, which is funded by the U.S. Fish and Wildlife Foundation.

Sea Scallop Enhancement Uses Aquaculture Techniques

Enhancing wild scallop stock through aquaculture techniques has been occurring in Maine since 1999. MET member Dana Morse has been assisting industry and conservation groups since the work began and, incorporating this experience, has been providing educational programs about fisheries and aquaculture to interested citizens.

The stock enhancement program continued in 2003, with new participants joining from the midcoast region of the state and the industry showing interest in collecting spat from federal waters and in growing out sea scallops to market size. Morse has helped the industry to acquire federal-waters permits and will continue to assist both the stock enhancement program and longer-term efforts in scallop culture.

Cobscook Bay Management Plan for Aquaculture Involves Industry

Salmon farmers in Cobscook Bay have suffered substantial losses over the years due to naturally occurring pathogens and parasites, such as infectious salmon anemia and sea lice. The establishment of BMPs to mitigate the effects of diseases in a specific geographic area has been shown to be successful in other countries' livestock industries and in other salmon farming regions.

The Maine Aquaculture Association asked MET member Chris Bartlett to facilitate the development of a Cobscook Bay Management Plan, incorporating BMPs designed to minimize risks to fish health and the environment. The BMPs—including protocols for the separation of year classes, fallowing of farm sites, and biosecurity/ disinfection strategies—will be developed with the help of participating salmon farmers.

The Maine Department of Marine Resources, USDA, and other resource agencies will review the completed document and collaborate with industry to implement the proposed protocols. Ultimately, the Cobscook Bay Management Plan, or portions thereof, will become part of the standard operating procedures for salmon aquaculture in the region and be incorporated in formal regulatory policy.

Fisheries

Fisheries Education Workshops Draw Crowds

The decline of many commercial fisheries in New England has led to drastic actions to reverse over-fishing and improve fisheries management. Regulatory actions and economic consolidation have reduced the fishing capacity of many coastal communities traditionally dependent on commercial fishing. Also, Marine resource management in the Gulf of Maine has become increasingly complex over the past decade. To inform the fishing industry and coastal communities about some of these critical issues, Marine Extension Team (MET) members offered a Fisheries Education Workshop Series on by-catch reduction in the groundfish industry, the use of marine protected areas as a fisheries management tool, and rights-based fisheries management.

These three workshops were part of a northeast regional Sea Grant fisheries extension enhancement project involving Connecticut, New Hampshire, and Maine Sea Grant programs and coordinated by Rhode Island Sea Grant. All presentations and discussions from the 12 workshops are available in hardcopy and on the Maine Sea Grant Web site and on the Rhode Island Sea Grant regional project Web site. More than 160 people participated in the three workshops in Maine, which were coordinated by MET member Sherman Hoyt. The marine protected area workshop—a collaboration with the Maine State Planning Office, Maine Department of Marine Resources, and the Maine Fishermen's Forum Board of Directors—was held at the Maine Fishermen's Forum in March and drew the largest attendance. The other two workshops were held in Portland.

The fisheries workshops received extensive media coverage, including articles in the *Portland Press Herald*, *Bangor Daily News*, and *Working Waterfront*; a piece on Maine Public Radio; and news clips on television.

Gear Research Attracts Grants

Fishing regulations in the northeastern U.S. have become so restrictive that landing only target species or saleable non-target species is essential. Capturing fish that are non-saleable (because of market or regulatory considerations) must be avoided whenever possible. Thus, gear selectivity plays an important role in the successful management of fish stocks.

In a project funded by the Northeast Consortium (NEC), MET member Dana Morse collaborated with two harvesters from the Boothbay

Harbor region to conduct research on fishing gear. They have been evaluating the selective properties of knotless mesh used in the codend of a trawl net, versus a codend made of standard knotted twine. Some video camera evaluation has been done on fish behavior in the trawls, with more planned. Data is being analyzed on the catches, and preliminary details and photos have been posted on the Maine Sea Grant Web site. This collaboration has resulted in another proposal that was submitted to, and approved for funding by, the NEC. This $110,000 project, which started in fall 2003, is examining the effects of large, square-mesh side panels inserted into a trawl, and increased taper in the trawl belly, on the escapement of undersized fish in that region of the net. If successful, the experiment will lead to another tool that harvesters and managers can use to reduce discards in the trawl fishery for groundfish in the Gulf of Maine.

At the 2003 Maine Fishermen's Forum, Morse met a scallop harvester who was interested in applied research on scallop drags. Together, they developed a grant proposal to submit to the Northeast Consortium and were awarded approximately $95,000 for the project. The MET will work with harvesters to test a drag fitted with the regulation size ring (3.5" inside diameter) compared to a drag fitted with rings of 4" diameter. Two vessels will be utilized in a side-by-side test. This project is particularly timely since harvesters just found out that the federal-waters fishery must use 4" rings in the future.

Halibut Stock Assessment Program Completes Fourth Season

Little is known about the abundance of Atlantic halibut in the Gulf of Maine. The MET, in collaboration with the Maine Department of Marine Resources, NOAA Fisheries, and Maine commercial fishers have completed their fourth season of assessing halibut stocks and are beginning to see some results.

The program established an experimental fishery for six vessels operating in federal waters. Fishers using long-lines were trained to collect information on the size, age, and maturity of their catch, as well as on tag-and-release, sub-legal fish. Nearly 500 halibut were kept and more then 300 were tagged and released during the 2003 season. Since the inception of the program, 35 tagged halibut have been recaptured, 10 of which were caught in Canadian waters from as far away as Newfoundland. Fishers in Maine

territorial waters were brought into the program in 2002, with over 150 individuals having completed the training to date. Articles on the program have appeared in *National Fishermen* and *Commercial Fisheries News.*

Sea Urchin Summits Inform Management

Declining landings, inadequate management measures, and changes in urchin habitat have threatened the future of the commercial sea urchin fishery. The Maine Department of Marine Resources (DMR) and the Sea Urchin Zone Council (SUCZ) asked the Marine Extension Team, for the third year in a row, to help organize a summit to discuss timely issues with the industry. The main purpose of the summit is to promote the sustainability of the Maine sea urchin fishery by improving the SUCZ process and to assist the council in getting ideas and support for management actions from the sea urchin industry. The summit also provides a forum in which DMR can present stock assessment data and other research findings to the industry and receive feedback from them, and discuss management options in depth. According to Margaret Hunter, DMR marine resource scientist, "In the 2003 summit, we had the level of participation we needed to ascertain which management options would be most supported and opposed by the industry. This gave credibility to our recommendations to the legislature." Hunter goes on to say, "I think the council has taken the summits and the recommendations that come out of them very seriously, and they have greatly influenced the council's recommendations."

MET Leads MPA Policy Discussions

Marine protected areas (MPAs) are being considered for management of ocean ecosystems, as opposed to managing fishing effort for a target species. MPAs are similar to nature reserves, refuges, or parks on land. National and international conservation groups are suggesting that MPAs be tried in the Gulf of Maine. Fishing interests are highly skeptical, saying that the gulf is already a patchwork of restrictions. Scientists and fisheries managers are interested in learning what works.

During 2003, the MET played a key role in framing this public issue and generating dialogue about MPAs at the 2003 Maine Fisherman's Forum held in March in Rockport. MET member Ron Beard assisted with the design of the session and served as overall moderator and facilitator. Following presentations by the Commissioner of the Maine Department of Marine

Resources, scientists and fishers who had direct experience with MPAs, and resource managers, over 125 participants discussed ways to get fishers more involved in discussions about the possibility of using MPAs as an ecosystem management tool in the Gulf of Maine and how they might be used.

The half-day session identified those who need to be involved in the policy dialogue, how a deliberative process might work, and what participants would need to know along the way. Session participants agreed that whatever MPAs are identified must have clear missions, definable goals, and criteria for success; that the process would require flexibility, coordination, and cooperation; and that community or regional approaches should be explored. Furthermore, participants indicated that studies derived in MPAs should be linked to solid baseline information, including socio-economic profiles of the affected areas.

Sustainable Fisheries Grant Supports Shellfish Management

The Georges River Regional Clam Management Program (GRRCMP) was initiated in 1995 with a mini-grant from the Maine Community Foundation (MCF). Fishermen volunteers and the municipalities of Warren, South Thomaston, Thomaston, Saint George, and Cushing now run the program. In addition to its significant economic impact on the midcoast region, the program is an important test site for community-based fisheries management.

With a $20,000 grant from the Birch Cove Fund of the MCF, MET member Sherman Hoyt is continuing to track the activities of, and conduct educational outreach for, the Georges River Clam Management Program. The funds also provide start-up support for a project to develop a sustainable fisheries management plan for a new commercial species, the horse mussel, *Modiolus modiolus*. The Birch Cove grant will allow Hoyt to act as a liaison to the academic community at the University of Maine and at other institutions throughout the country that are studying fisheries management and marine policy.

MET Convenes Groundfish Industry Meetings

The groundfish industry has experienced major consolidation and loss of access to the resource as a consequence of management restrictions implemented by the New England Fishery Management Council over the past 15 years. Amendment 13 to the Magnuson Stevens Fisheries Conservation and

Management Act further restricts fishing effort and could threaten the existence of the Maine fishing fleet. With a reduction in Days-at-Sea (DAS), larger Maine boats are going to ports in Massachusetts to shorten their trips to the fishing grounds.

In June, MET member Sherm Hoyt organized three meetings to discuss with industry the federal permit buyback proposal initiated by industry and supported by Congress. If approved by the Northeast groundfish permit holders, the buyback would be funded primarily by industry through a loan from the federal government

In the fall, Hoyt also attended public meetings sponsored by Maine Department of Marine Resources to discuss with groundfish industry members the impacts of Amendment 13 and to help them plan individual and collective responses to another reduction in allocated Days-at-Sea and fishing effort.

Lobster Newsletter is Successful

In the past year, MET member Sherman Hoyt worked with the Zone D lobster council to develop the newsletter, the *Zone D Scuttlebutt*. Two prototype newsletters were produced in 2003 and distributed to the 1200 harvesters in that zone. Since the newsletter has been well-received, Hoyt is helping to find ways to make the newsletter a permanent communications tool for Zone D.

EDUCATION (K-12)

Although Maine Sea Grant currently does not have an education coordinator on staff, members of the Marine Extension Team conduct many formal and informal educational programs and have valuable connections with teachers and students throughout the state. Extension associates are asked to assist with lessons, provide field experiences, and participate in curriculum development. Given our scant resources, we are making significant contributions to the K-12 marine education needs through staff participation and through targeted application of program development funds. For example, The Lobster Conservancy received an $8100 award of program development funds from Maine Sea Grant in 2003 to hold teacher training workshops and curriculum development exercises related to their *Lobster Larvae in the Classroom* project. In the absence of a full-time marine education coordinator, Maine Sea Grant is creating and maintaining relationships with many organizations like The Lobster Conservancy, including the Island Institute, Herring Gut Learning Center, Cobscook Bay Marine Resource Center, Wells National Estuarine Research Reserve, Casco Bay Estuary Project, t Penobscot Bay Stewards, The Chewonki Foundation, and the Gulf of Maine Research Institute. Following are a few highlights of the past year.

The Silver Wake Trains Teachers

A silver blue wake, created when marine phytoplankton are disturbed, sometimes trails behind boats at dusk or swirls up when an object is dropped into coastal waters. The University of Maine Cooperative Extension (UMCE), Sea Grant, and the School of Marine Sciences (SMS) teamed up to develop an environmental education program for middle and high school teachers and students, called *The Silver Wake*. Using marine phytoplankton as a theme, the program encourages students to observe and respond to phenomena such as this; demonstrates how hands-on science can help meet *Maine's Learning Results* standards; and engages students not only in examining their local environments, but also in protecting them.

Funded by a $102,000 grant from the U.S. Environmental Protection Agency, *The Silver Wake* project began last fall. Marine Extension Team member Esperanza Stancioff and Sara Lindsay of SMS recruited 11 middle school teachers and three Maine Phytoplankton Monitoring Program volunteers and held a weeklong training institute in June at the University of

Maine's Darling Marine Center in Walpole, Maine, on the Damariscotta River estuary. Teachers were introduced to the microscopic world of phytoplankton, harmful algal blooms, photosynthesis and more. Silver Wake presenters included faculty from the University of Maine and the University of Rhode Island, as well as educators from UMCE/ Sea Grant and the Bigelow Laboratory for Ocean Sciences, and author Mary Cerullo.

The institute will be followed by a second two-day workshop in November 2003 at the University of Maine in Orono, and a third workshop in the spring of 2004 at the Darling Marine Center. Throughout the school year, Silver Wake instructors and volunteers will provide teachers with the support necessary to incorporate the ideas from the institute into their classroom curricula. They will also lead field trips to coastal habitats near the participating middle schools and assist with the curriculum materials teachers developed through the institute. Silver Wake has a Web site (www.ume.maine.edu/ssteward/silverwake.htm) where classroom activities will be available.

Cobscook Bay Current Monitoring Program Builds on its Successes

Cobscook Bay's dramatic tidal range and strong currents has caused difficulties in predicting the impacts of events, such as oil spills, or diseases that plague Maine's salmon farms. A program, which began in 1999 to monitor these tidal circulation patterns, is now poised to expand its efforts through a $130,000 grant by the Maine Oil Spill Advisory Committee. Maine Sea Grant's MET, in collaboration with the Cobscook Bay Resource Center, the University of Maine School of Marine Sciences, the Washington County Community College, and area high schools are tracking the ocean currents and developing a 3D circulation model for the Cobscook/Passamaquoddy Bay ecosystem. Part of the program has been designed to involve students in collecting meaningful scientific data about the waters surrounding their communities. Seven field trials with high school classes have been conducted to date, with 12 more anticipated over the next two years.

Nor'Easter Bowl Back in Maine

Since 2000, the MET has collaborated with the University of Maine School of Marine Sciences, University of New England, University of New Hampshire, and Bigelow Laboratory for Ocean Sciences to coordinate the

Northern New England Regional Ocean Sciences Bowl, also known as the Nor'Easter Bowl. The Nor'Easter Bowl is one of 24 regional ocean science competitions held annually as part of the National Ocean Sciences Bowl, sponsored by the Consortium for Oceanographic Research and Education. The program is designed to expose students who excel in math and science to the careers and academic programs in the ocean sciences, increase their knowledge of the oceans and, at the same time, raise public awareness of ocean-related issues.

In 2002, Marine Extension Associate Tracy Hart coordinated the event, which was held on March 8, 2003, at the University of Maine in Orono. Hart developed a Web site to recruit teachers throughout Maine, New Hampshire, and Vermont and to provide information about the bowl to the participating schools, volunteers, and the general public. Fifteen teams participated from Maine and New Hampshire, totaling 75 high school students and 15 teacher coaches. In addition, over 100 faculty, graduate students, and professionals from Maine Maritime Academy, University of New England, University of Maine School of Marine Sciences, University of New Hampshire, Bigelow Laboratory for Ocean Sciences, and the Maine Department of Marine Resources served as judges and volunteers during the competition. U.S. Representative Michael Michaud and Maine State Senator Mary Cathcart presented prizes at the awards ceremony. The winning team from Biddeford High School (Maine) received an all-expense-paid trip to San Diego, California, to participate in the national final competition.

MERITS Program Provides Opportunities for High Schools

The Maine Research Internship for Students and Teachers (MERITS) program is a summer program that provides research opportunities for high school students and teachers in the areas of science and technology. Opportunities for teachers and students to engage in hands-on marine research are scarce within Maine. By partnering with MERITS, Sea Grant supports collaboration between the Maine research and pre-college educational communities and encourages students to pursue careers in marine sciences or related technical fields. In 2003, Sea Grant funding supported one teacher and two high school student internships.

Maine Sea Grant and University of Maine Cooperative Extension - Marine Extension team (MET) Highlighted Projects - 2002 -2003

Chris Bartlett Washington County Community College, Eastport	Downeast Efforts in the Northeast Regional Cod Tagging Program
	2003 Annual New England Farmed Fish Health Management Workshop
	Nutrient Study of Cobscook Bay
	Cobscook Bay Management Plan for Finfish Aquaculture
	Salmon Marking Logistics Working Group
	Survey of Atlantic Halibut in Groundfish Closed Areas in the Eastern Gulf of Maine
Ron Beard Hancock County Cooperative Extension, Ellsworth	Cranberry Isles Mainland Access Facilitation
	Marine Protected Areas Workshop Facilitation
Sarah Gladu Knox-Lincoln Cooperative Extension Office, Waldoboro	Clean Water/Partners In Monitoring
	Maine Shore Stewards Advisory Board and Communications Resources
	Maine Phytoplankton Monitoring Program
	Maine Nonpoint Education for Municipal Officials (NEMO) Program
	Medomak Watershed Pollution Assessment
Tracy Hart University of Maine, Orono	Needs and Issues in the Taunton Bay Region: A Survey of Residents from Franklin, Hancock, and Sullivan, Maine
	6th Annual Nor'Easter Ocean Sciences Bowl: Nor'Easter Bowl 2003
	Developing a Citizens' Guide to Characterizing Discrete Marine Areas in Maine
	Enhancing the Involvement of Fishermen and Other Stakeholders in Marine Protected Area Activity Within Maine State Waters and the Gulf of Maine
	Where Land Meets the Sea: Developing Volunteer Intertidal Monitoring in the State of Maine
Sherm Hoyt Knox-Lincoln Cooperative Extension Office, Waldoboro	Building Science into the Maine Lobster Zone Process
	Tracking and Evaluation of a Community-based Fisheries Management Test Site: The Georges River Clam Management Program
	Development and Use of Stock Enhancement Techniques and Technology Transfer Outreach Materials for Maine's Sea Urchin Fishery
	Groundfish Industry Scoping Meetings - Amendment 13 and the Future of the Maine Groundfish Fleet
	Fisheries Education Workshops

Dana Morse Darling Marine Center, Walpole	Developing and Testing Novel Methodology for Land- and Nearshore-based Aquaculture of the Green Sea Urchin
	Northeast Aquaculture Conference and Expo 2004
	Field Trials of 4" Rings in the Inshore Scallop Fishery of the Gulf of Maine
	Selective Gear Research and Development to Reduce Bycatch: Investigating the Use of Square Mesh Side Panels and Increased Taper in a Groundfish Trawl
	Scallop Stock Enhancement
	Salmon Hatchery Effluent Management Utilizing Integrated Polyculture Technologies
Natalie Springuel College of the Atlantic, Bar Harbor	Waterfront Access
	Gulf of Maine Expedition
	Safety Study of Radar Reflectors on Sea Kayaks
	Sea Kayak Safety and Stewardship Brochure
	Recreational Island Monitoring Survey
Esperanza Stancioff Knox-Lincoln Cooperative Extension Office, Waldoboro	Coastal Swim Beach Study Elements
	Coastal Swim Beach Online Database
	Coastal Swim Beach Marketing Campaign
	The Silver Wake Program
Kristen Whiting-Grant Wells National Estuarine Research Reserve, Wells	"Barriers and Bridges" to Salt Marsh Restoration in the Gulf of Maine Workshop
	Annual Maine Beaches Conference
	Beach Profiling Program
	Microbial Source Tracking in Two Southern Maine Watersheds
	Salt Marsh Restoration Publications

COMMUNICATIONS

Many communications activities during the last year have supported the work of the Marine Extension Team (MET). Communications staff worked closely with the MET to deliver technical information in many different written formats. This includes developing fact sheets, project reports, and identification guides; contributing to local and national publications; writing and distributing press releases, brochures, and other informational materials; and designing displays to reach a variety of audiences in diverse venues. To distribute marine and coastal information to a broader audience, communications also collaborates with the Maine Coastal Program at the State Planning Office and the Wells National Estuarine Research Reserve to continue producing the *Sea & Shore* radio spot series for Maine Public Radio.

Communications staff have also played an integral role in compiling and producing several documents to support program management in the last year. These include the 2003-2005 Implementation Plan, *Marine Science for Maine People*, the College Status Briefing Book, and the 2003 Annual Report. Following are a few highlights of the year.

Displays are Custom-made

In the past, the Marine Extension Team (MET) shared a generic display that they used at their conferences, workshops, and other events. In 2003, the communications office designed and produced three displays, highlighting the major themes of ecosystem health, aquaculture, and fisheries listed in the program's 2001-2005 strategic plan. The MET has used the new displays at more than a dozen events in the past year.

New Field Guide Released

The book *Life Between the Tides: Marine Plants and Animals of the Northeast* was finally released in May 2003. Edited by Susan White, communications coordinator for Maine Sea Grant, and published by Tilbury House Publishers in Gardiner, Maine, the 128-page book includes invertebrates found in coastal waters, salt marsh vascular plants, seaweeds of the nearshore area, and fishes found in tide pools and salt marshes. It is an outgrowth of a very popular book, *Guide to Common Marine Organisms Along the Coast of Maine*, published by Maine Sea Grant in 1998. More than 1200 books have been sold so far, and reviews have appeared in the *York County Coast Star*, the

Maine Writers and Publishers Alliance newsletter, and elsewhere. White also did a presentation on the book with authors Les Watling and Jill Fegley for the Oceanside Meadows (Prospect Harbor, Maine) summer lecture series on June 19, which was attended by over 100 people.

Sea & Shore Radio Spots Continue

In 2003, communications staff produced another 22 *Sea & Shore* radio spots to provide information on critical marine and coastal issues in Maine, the Gulf of Maine region, and beyond to a broad audience. Sea Grant co-produces the spots in collaboration with the Maine Coastal Program at the State Planning Office and the Wells National Estuarine Research Reserve, which are aired during Maine Public Radio's very popular "Morning Edition" program.

Implementation Plan Updated

Last year, the communications office produced the 2003-2005 Implementation Plan to accompany the 2001-2005 Maine Sea Grant Strategic Plan, *Marine Science for Maine People*. The new implementation plan includes the activities of the Coastal Community Development program—which encompasses the Gulf of Maine Expedition, the Ecosystem Assessment Project, and the NEMO (Nonpoint Education for Municipal Officials) Program—and more specific and realistic evaluation techniques for strategies proposed to accomplish stated objectives.

Science Side Column Continues

Cheryl Daigle, science publications specialist, wrote three articles in the past year for the "Science Side" column that appears regularly in *Commercial Fisheries News*, an industry publication distributed to over 10,000 commercial fishermen, marine industry members, and others throughout the eastern seaboard.

MET Publications Produced

During the past year, the communications staff edited and/or designed many MET publications, including *Celebrating Our Coastal Heritage: Gulf of Maine Expedition 2002 Final Report*; *Field Guide to Phytoplankton in the Gulf of Maine*; *Maine's Salt Marshes: Their Functions, Values, and Restora-*

tion; *Microbial Source Tracking in Two Southern Maine Watersheds: Webhannet River Watershed Report*; the *Taunton Bay Report*; and the *Maine Shore Steward* newsletter, which has an annual distribution of over 10,500. In addition, communications produced promotional brochures, programs, and other materials to support several Sea Grant-sponsored conferences, including the 11th Annual Farmed Fish Health Management Workshop, the Maine Beaches Conference, and the Nor'easter Bowl, the regional competition of the National Ocean Sciences Bowl.

Communications Database Developed

The communications information technology specialist worked throughout the year to develop a communications database to track publications, press releases, exhibits, radio spots, and general Sea Grant press. Information provided by the database will be used to evaluate Maine Sea Grant's efforts to increase the program's visibility.

Web Site Gets a New Look

During the past year, a new program Web site has been developed that is ADA-compliant, more user-friendly, and faster. Since the Web site has become one of our major communications tools, this updated version should help to improve access to Maine Sea Grant's services and products when it goes online early in 2004.

Annual Report Wins Award

At a national Sea Grant conference held in Galveston, Texas, on April 26-30, the Maine Sea Grant Program won the Blue Ribbon award for their 2002 annual report. The nation's 30 Sea Grant programs competed in the publications contest for awards in 15 categories, including printed materials, videos, radio spots, CD-ROMs, and exhibits. Publications were judged on content, organization, appearance, and quality. To view the report, visit the program's Web site at www.seagrant.umaine.edu. Cheryl Daigle, science publications specialist, designed the report.

Press Releases

The communications office produced and distributed 12 press releases in the past year. They are:

August 15, 2003	Bacteria Sources Discovered in Webhannet Watershed
July 11	McCleave to Head Maine Sea Grant Research Program
June 20	Maine Beaches Conference Highlights Shoreline Homeowner Concerns
June 17	Taunton Bay Survey Results Just Released
May 23	"Who Gets the Fish?" Workshop Slated for Portland
March 12	Cove Brook Watershed Council Sponsors Community Garden Fair
March 10	Biddeford High School Team Wins Ocean Sciences Competition at The University of Maine
Feb. 28	Farmed Fish Health Workshop Draws International Speakers
Feb. 14	High School Students Dive into Ocean Sciences Competition
Feb. 7	Marine Protected Areas Highlighted at Fisherman's Forum
Nov. 19, 2002	Sea Grant Sponsors Workshop on Fisheries Bycatch
Sept. 27	Taunton Bay Survey Seeks Local Input

MAINE SEA GRANT STAFF - BOARD/COMMITTEE PARTICIPATION 2003

Coastal Swim Beach Committee- Esperanza Stancioff
Coastal Swim Beach Monitoring Program (Healthy Beaches)- Sarah Gladu
Cobscook Bay Fishermen's Association- Chris Bartlett
Cobscook Bay Management Area Group- Chris Bartlett
Cobscook Bay Resource Center Board (chair)/ Executive Committee- Chris Bartlett
Cove Brook Watershed Council (vice president)- Susan White
Data Assessment Team- Esperanza Stancioff
DMR Lobster Zone Management Committees A and B- Chris Bartlett
Downeast Institute for Applied Marine Sciences and Education Board/Executive Committee- Chris Bartlett
Eastern Association of Veterinarians in Aquaculture(chair)- Mike Opitz
Friends of Medomak Watershed- Sarah Gladu
Georges River Shellfish Management Committee- Sherman Hoyt
Governor's Task Force on Aquaculture (chair)- Paul Anderson
Governor's Task Force on Fishing Vessel Safety- Paul Anderson
Great Works Watershed Coalition- Sarah Gladu
Gulf of Maine Council on the Marine Environment, Habitat Restoration-Kristen Whiting-Grant
Gulf of Maine Council on the Marine Environment, State of the Gulf Summit & Regional Monitoring Strategy- Tracy Hart
Gulf of Maine Expedition Board- Paul Anderson
Gulf of Maine Project of the Census of Marine Life, Policy Advisory Committee - Paul Anderson
Gulf of Maine Research Collaborative- Paul Anderson
Maine Fish Health Technical Committee- Chris Bartlett
Maine Fishermen's Forum Board- Paul Anderson
Maine Phytoplankton Monitoring Program Advisory Board- Sarah Gladu, Esperanza Stancioff
Maine Sea Urchin Zone Council and Lobster Zone Council D (advisor)- Sherman Hoyt
Maine Shore Stewards- Sarah Gladu
Maine Shore Stewards Advisory Board- Esperanza Stancioff

Maine Soft-shell Clam Advisory Council- Sherman Hoyt
Merrymeeting Bay Advisory Committee- Esperanza Stancioff
Microbial Source Tracking Project Advisory Committee- Esperanza Stancioff
National Sea Grant Extension Growth Committee- Paul Anderson
New England Farmed Fish Health Management Workshop Planning Committee (chair)- Chris Bartlett
New England Regional Monitoring Committee- Esperanza Stancioff
NOAA Habitat Restoration Network- Kristen Whiting-Grant
Northeast Aquaculture Conference and Expo (NACE) Planning Committee- Dana Morse
Northeast Consortium- Paul Anderson
Northeast Regional Aquaculture Center, Technical/Industry Advisory Committee - Dana Morse
Orono Land Trust- Cheryl Daigle
Northwest Atlantic Marine Alliance Board of Trustees-Dana Morse
Penobscot Bay Network- Paul Anderson, Ron Beard, Esperanza Stancioff
Penobscot Bay Stewards- Esperanza Stancioff
Preservation Committee- Kristen Whiting-Grant
Professional Employees Advisory Council- Susan White
Sea Grant Association Board (secretary)- Paul Anderson
SLICE INAD Monitor- Mike Opitz
SMS Peer Committee, Aquaculture Representative- Mike Opitz
State-of-Maine's Beaches Conference Steering Committee- Kristen Whiting-Grant
University of Maine Research Council- Paul Anderson
USDA ISA Standards Committee (chair)- Mike Opitz
Wells National Estuarine Research Reserve, Education Advisory Committee- Kristen Whiting-Grant
WNERR Coastal Training Program Advisory Committee- Kristen Whiting-Grant

SCIENTIFIC PUBLICATIONS

Peer-Reviewed Publications (Journal Articles/Books)

Belknap, D.F., J.T. Kelley, and A.M. Gontz, 2002, Evolution of the Glaciated Shelf and Coastline of the Northern Gulf of Maine, USA, *Journal of Coastal Research Special Issue 36*, pp. 37-55.

Chen, Y., Y. Jiao, and L. Chen, 2003, Developing Robust Frequentist and Bayesian Fish Stock Assessment Methods, *Fish and Fisheries*, 4:105-120.

Chen, Y., L. Chen, and K. Stergiou, 2003, Quantity of Fisheries Data and Uncertainty in Stock Assessment, *Aquatic Sciences*, 65:92-98.

Duff, J., Whose Seaweed Is It?, *The Coastal Society Bulletin, Vol 25* (in press).

Feeney, M.W., 2003, Regulating Seaweed Harvesting in Maine: The Public and Private Interests in an Emerging Marine Resource Industry, *Ocean and Coastal Law Journal* (in press).

Gontz, A.M., D.F. Belknap, and J.T. Kelley, 2002, Seafloor Features and Characteristics of the Black Ledges Area, Penobscot Bay, Maine, USA, *Journal of Coastal Research Special Issue 36*, pp. 333-339.

Hill, H.W., J. T. Kelley, D. F. Belknap, and S. M. Dickson, 2003, The Effects of Storms and Storm-generated Currents on the Sand Beaches in Southern Maine. In: *Marine Geology Special Issue: Storms and their Significance in Coastal Morpho-Sedimentary Dynamics* (in press).

Lopez-Anido, R., A. P. Michael, T.C. Sandford, and B. Goodell, 2003, Repair of Wood Piles with Prefabricated FRP Composite Shells, *Journal of Performance of Constructed Facilities* (in press).

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Lopez-Anido, R., A.P. Michael, and T.C. Sandford, 2003, Experimental Characterization of FRP Composite-Wood Pile Structural Response by Bending Tests, Marine Structures, *Elsevier Applied Science*, 16: 257-274.

Malloy, A.P., B.J. Barber, and P.D. Rawson, 2003, Gametogenesis in a Sympatric Population of Blue Mussels, *Mytilus edulis* and *Mytilus trossulus*, from Cobscook Bay, Maine, USA, *Journal of Shellfish Research,* 22:119-123.

Rawson, P.D., C. Slaughter, and P.O. Yund, 2003, Patterns of Gamete Incompatibility Between the Blue Mussels *Mytilus edulis* and *M. trossulus*, *Marine Biology,* 143:317-325.

Scheirer, K., Y. Chen, and C. Wilson, 2003, Comparing two sampling programs for the Maine lobster fishery, *Fisheries Research* (in press).

Zubier, K., V. Panchang, and Z. Demirbilek, 2003, Simulation of Waves at Duck (North Carolina) Using Two Numerical Models, *International Journal of Coastal Engineering* (in press).

Published Abstracts

Belknap, D.F., A.M. Gontz, and J.T. Kelley, 2003, *Pockmarks and Natural Gas in Coastal Maine-The Search for Sources.* Geological Society of America Abstracts with Programs, v. 35, no. 3, p.7.

Berkenpas, E., S. Bitla, P. Millard, and M. Pereira da Cunha, 2003, *A Small, Sensitive, Highly Selective Detector of Bioterrorism Linked Pathogens in Liquids.* International Conference on Advanced Technologies for Homeland Security, University of Connecticut, Storrs, Connecticut.

Berkenpas, E., S. Bitla, P. Millard, and M. Pereira da Cunha, 2003, *LGS Shear Horizontal SAW Devices for Biosensors Applications.* IEEE 2003 International Ultrasonics Symposium.

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Bitla, S., E. Berkenpas, M. P. Da Cunha, and P. Millard, 2003, *Langasite Shear Horizontal Surface Acoustic Wave Devices: An Alternative to the Quartz Crystal Microbalance for Biosensor Development. American Institute of Chemical Engineers.* Fall 2003 Annual Meeting, San Francisco, CA.

Chen, Y., M. Kanaiwa, and C. Wilson, 2003, *Developing an Individual-based Stock Assessment Framework Using Random Bernoulli Trials.* American Society 133rd Annual Meeting, Quebec City, Canada, August 12, 2003.

Dunnington, M.J. and R.A. Wahle, 2003, *Trap-based Methods to Evaluate*

Lobster Population Dynamics. DFO Canada, Fisherman and Scientist Research Society Annual Meeting, Halifax, NS, February 2003.

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Geraldi, N.R., R.A. Wahle, and M.J. Dunnington, 2003, *Trap-based Methods to Evaluate Lobster Population Dynamics: Landscape Related Patterns of Catch and Movement Using GIS*. Benthic Ecology Meetings, University of Connecticut, March 2003.

Gontz, A.M., D.F. Belknap, and J.T Kelley, 2003, *The Relationship Between Pockmarks, Gas-Enhanced Reflectors and Acoustic Wipeout in an Active Estuarine Pockmark Field, Penobscot Bay, Maine*. Geological Society of America Abstracts with Programs, v. 35, no. 3, p. 7.

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Kanaiwa, M., Y. Chen, and C. Wilson, 2003, *Developing a Bayesian Stock Assessment Framework for the American Lobster (*Homarus americanus*) Fishery*. American Society 133rd Annual Meeting, Quebec City, Canada, Aug. 12, 2003.

Kelley, J.T., D.F. Belknap, and A.M. Gontz, 2003, *A Review of Shallow-water Pockmark Distribution and Origins in the Northwestern Gulf of Maine*. Geological Society of America Abstracts with Programs, v. 35, no. 3, p. 7.

O'Donnell, K.P., R.A. Wahle, and M.J. Dunnington, 2003, *Trap-based Methods to Evaluate Lobster Population Dynamics: Impact of Dredge Disposal on Lobster and Crab Abundance*. Benthic Ecology Meetings, University of Connecticut, March 2003.

Tonneson, J.M., R.A. Butler, S.M. Lindsay, G.R. Gardner, and R.J. Van Beneden, 2003, *Growth Inhibition of Early Life Stages of* Mya arenaria *by the Herbicide 2,4-Dichlorophenoxyacetic Acid (2,4-D)*. Senior Research Project, Undergraduate Research Day, Maine State House, Augusta, ME, April 17, 2003.

Tonneson, J.M., R.A. Butler, S.M. Lindsay, G.R. Gardner, and R.J. Van Beneden, 2003, *Exposure of Soft-shell Clams* (Mya arenaria) *during Early Life Stages to the Herbicide 2,4-Dichlorophenoxyacetic Acid (2,4-D*). 12th

International PRIMO meeting (Pollution Responses in Marine Organisms), Tampa, FL, May 8-13, 2003.

Tonneson, J.M., R.A. Butler, S.M. Lindsay, G.R. Gardner, and R.J. Van Beneden, 2003, *Growth inhibition of Early Life Stages of* Mya arenaria *by 2,4-D*. 24th annual SETAC meeting in Austin, TX, Nov. 9-13, 2003.

GRADUATE STUDENTS

Theses

Robert Grabowski, *Population Dynamics and Spatial Analysis of the Maine Sea Urchin (*Strongylocentrotus droebachiensis*) Fishery*. M.S.

John Vavrinec, *Forces Regulating Populations of the Green Sea Urchin (*Strongylocentrotus droebachiensis*) in Gulf of Maine Marine Protected Areas: Anthropogenic Impacts, Larval Ecology and Post-Settlement Survival*. Ph.D.

Fellowships

Dean John A. Knauss Marine Policy Fellowship

Amanda Leland, a master's degree student in marine biology at the University of Maine, was chosen to represent the state in the Knauss Fellowship program last year. Leland won a coveted legislative appointment and has worked for the past year as staff for fisheries and oceans issues in California Senator Sam Farr's office.

For three years prior to her Knauss Fellowship, Leland worked closely with the Maine sea urchin industry as she pursued her graduate research project in which she is trying to determine if sea urchins can be re-established in areas along the Maine coast where they have disappeared. The results of Leland's research could help determine whether replanting urchins in depleted areas is a viable management option.

In 2000, Leland received a Marine Studies Fellowship from the Maine Department of Marine Resources and the University of Maine, which created a fisheries liaison position that began her work with the sea urchin industry. As a liaison, Leland helped to bridge the gap that separates science, industry, and policy by translating science to both harvesters and resource managers. In return, Leland learned much about current fishery issues and concerns from the industry.

According to Leland, the Knauss Fellowship program has provided her with the experience in federal marine policy that will help her become an effective marine conservationist. She also hopes to gain the skills and contacts necessary to work within the political arena while improving her ability to bridge the gap between scientists, policy-makers, and stakeholders.

Coastal Management Fellowship Program

In 2003, Maine Sea Grant was successful in placing Ed Cervone, a master's student in Ecology and Environmental Sciences at the University of Maine, in the prestigious Coastal Management Fellowship Program. Cervone was one of only five candidates chosen to participate in the program, managed by the NOAA Coastal Services Center.

For his thesis, Cervone focused on the role of economics in harbor and beach management in Camp Ellis on the southern end of Saco Bay and in the town of Wells just south of Kennebunkport, Maine. He reviewed cost/benefit studies, beach erosion data, and institutional relationships; and conducted numerous interviews with citizens, government officials, and landowners who are fighting for their homes. In Camp Ellis and Wells, says Cervone, miscommunication and lack of resources, both human and financial, have contributed to ill will and distrust of state and federal agencies among many citizens and municipal officials.

For a comparison, Cervone also studied a coastal community in New Jersey. The state legislature there allocates $20 million a year to a program that adds sand to beaches statewide. Maine, however, lacks the money to put as much emphasis on beach management as its neighbors to the south. According to Joe Kelley, marine geologist at the University of Maine and a member of Cervone's master's thesis committee, "Ed's thesis work on the economics, engineering, politics, history, and geology of three U.S. Army Corps of Engineers' Projects is large in scope and will be a significant contribution to evaluating how we, as a society, solve complex coastal problems."

Cervone began the two-year coastal management fellowship in August. He is working with the Delaware Coastal Programs and Delaware Division of Air and Waste Management on a project entitled, "Development of a Brownfields Restoration and Re-Use Site Description Compendium for Coastal Communities." The goal of this project is to increase the rate and acreage of brownfield restoration and re-use in Delaware's coastal communities, thereby reducing development pressures and associated coastal impacts in undeveloped areas. Cervone is conducting a preliminary information assessment to develop an implementation plan. He is also conducting an inventory of brownfield sites in Delaware's coastal areas and will synthesize the information into a draft document for review.

EXTERNAL GRANT AWARDS

Many members of the Maine Sea Grant/ Cooperative Extension Marine Extension Team participate in projects that are funded externally. With funding levels basically flat and an ever-increasing budgetary obligation to staff salaries, it is important that MET members attract extramural funding to help support extension programming. In the past year, there have been several awards that have provided support for staff salaries and/or programming costs. These include:

Northeast Consortium
Field Trials of 4" Rings in the Inshore Scallop Fishery of the Gulf of Maine- $95,872

Northeast Consortium
Selective Gear Research and Development to Reduce Bycatch: Investigating the Use of Square Mesh Side Panels and Increased Taper in a Groundfish Trawl- $95,751

Northeast Consortium
Building Capacity in the Research Community in Maine for Collaborative Fisheries Research- $40,000

Maine Department of Environmental Protection
MOSAC Administrative Fee-$22,190

Consortium for Oceanographic Research and Education
National Ocean Sciences Bowl, Nor'easter 2003- $15,000

Quebec/Labrador Foundation
Citizen's Guide to Characterizing Marine Areas- $10,540

Maine Coastal Program/State Planning Office
2003 Maine Beaches Conference- $3,500

Maine Aquaculture Innovation Center
Cobscook Bay Nutrient Study (Phase 2)- $2,500

SOS of Maine
2003 Maine Beaches Conference- $1,000

US Coast Guard
2003 Sea Kayakers Guide to Safety and Stewardship in Maine- $600

Stolt Sea Farms
2003 New England Farmed Fish Health Management Workshop- $500

Maine Mountainworks, L.L. Bean, Seaspray Kayaking, Bangor Outfitters, Maine Sport Outfitters, Maine Dept. of Marine Resources, MASKGI, Cadillac Mountain Sports, Kittery Trading Post
2003 Sea Kayakers Guide to Safety and Stewardship in Maine- $300/ each

North American Aquaculture
2003 New England Farmed Fish Health Management Workshop- $260

PROGRAM DEVELOPMENT AWARDS

The Maine Sea Grant Program has a modest pool of funds reserved for program development. Most of these funds are used for small research awards to help scientists prove a concept or collect preliminary data that can then be used in the development of full research proposals to Sea Grant or other funding agencies. These funds are also available for conference and travel support, as well as for other types of programming that is consistent with Maine Sea Grant's mission. Although there is no formal request for proposals and these funds are generally available throughout the year, the Maine Sea Grant Program has recently established a protocol that provides more organizational guidance in the use of these limited funds. For example, proposals submitted to the program via the Project Proposal Form (available at our Web site) are received throughout the year, but are evaluated on three scheduled decision points: June 1, October 1, and February 1. This allows the program to ensure that this type of funding is available throughout the year for issues that require an urgent response. The program allocates these funds in a manner similar to the general Sea Grant budget as follows: research – 50%; extension/education – 30%; workshops/conferences – 10%; and other – 10%.

RESEARCH PROJECTS

Acheson, J. *Co-Management Outreach Project.* $1,500. Provided support for the distribution of the book, *Capturing the Commons: Devising Rules to Manage the Maine Lobster Industry*, to those who provided information for it and to academics concerned with managing common property resources. The book resulted from the Sea Grant –funded project entitled *Case Studies in Co-Management.*

Archambault, L. *Lobster Literacy Curriculum Development Workshop.* $8,100. Supported The Lobster Conservancy in hosting a teacher training workshop to enlist Maine teachers in the development of a multidisciplinary curriculum for Maine 5th through 8th grade students. The workshop built upon a pilot project in which students were involved in raising lobster larvae in the classroom.

Beal, B. *Delegate to ICES Working Group on Marine Shellfish Culture.* $1,000. Provided travel support for Beal to attend and represent Maine at international meetings on shellfish culture and transfer information from

the meetings to Maine's shellfish growers and culturists.

Bonney, F. *Life History, Ecology, and Management of Eastern Brook Trout (*Salvelinus fontinalis*) in Maine.* $3,000. Provided support to prepare the document for publication, which is a compilation of the history of brook trout research, management, and angling in Maine that will serve as a reference for researchers and managers working with brook trout, and educate anglers and the general public about the species and its management.

Calder, B. *Study on Improving Shipping Quality and Survival of North American Lobster (*Homarus americanus*).* $2,536. Supported research to develop a technique that will prolong lobster survival and quality during shipping, potentially allowing lobsters to be shipped to more distant markets.

Chase, J. *Saltwater System for Oyster and Finfish Projects.* $2,800. Supported the development of a saltwater system for the aquaculture program at Herring Gut Learning Center in Port Clyde, Maine. The Center provides an opportunity for children who experience difficulty in the traditional classroom setting to become involved in marine science and real world applications.

Chen, Y. *Developing Research Strategies for the Maine Sea Cucumber Fishery.* $5,050. Supported sea cucumber data analysis and the development of two research funding proposals—one on designing a research plan for understanding sea cucumber biology and population dynamics and another on developing collaborative fishery-dependent and fishery-independent survey programs for the Maine sea cucumber fishery.

Gelder, S. *Determination of "Shipworm" Presence and Level of Commercial Concern along the Coast of Maine.* $1,000. Provided support for research to determine the presence of "shipworms" along the coast of Maine, based on local observations, and to assess the need, as perceived by those people and organizations affected by shipworms, for a detailed scientific study of the problem.

Keeley, D. *Science Translation Project - Year 2.* $3,000. Provided partial salary support for a professional hired by the Gulf of Maine Council on the Marine Environment to translate scientific data into information that can be used by environmental managers and other coastal decision-makers.

Kelley, J. *Mapping Bluff Erosion and Landslide Hazards in Coastal Maine.* $9,000. Supported a project to map landslide hazards and summarize and analyze results from across the state in a geographic information system.

Knedler, T. *Experimental Whitefish,* Coregonus clupeaformis*, Culture Project*. $514. Supported installation of an electric water heater at the Enfield State Fish Hatchery in order to evaluate if the heater allows the incubation and early rearing of lake whitefish—a species prized by recreational anglers—without substantial loss of larvae, developmental effects, or impacts on larval feeding.

Moore, S. *Horseshoe Crabs and Draggers: Predicting Concurrent Use of the Seabed*. $3,700. Supported the purchase of sonic telemetry transmitter tags to track the movements of horseshoe crabs in Taunton Bay in order to identify potential conflicts between dragging activities and crabs.

Olsen, V. *Travel Funding to ISSC 2003*. $1,400. Provided travel support for a representative of the Maine shellfish industry and the state's traditional shellfish harvesting methods to attend the 2003 ISSC.

Riley, J. *Pilot Study on the Underwater Maneuverability of the Gray Whale*. $3,000. Provided support for student salaries and travel costs associated with this effort to deploy data logging tags on gray whales to examine their diving strategies and three-dimensional use of space in the water column, as compared to other species of whales tagged in previous years of the pilot study.

Conference Support

Bucklin, A. *Gadoid Mariculture Symposium*. $1,000. Provided support for a symposium that evaluated options for maintaining a sustainable fishery for gadoid fish.

Garcia, M. *Third Annual Maine Coast Seminar*. $1,500. Supported the second annual Maine Coast Seminar that was designed for professional guides, educators, and concerned citizens to gain a deeper understanding of Maine's coastal environment so that they may educate their clients, students, and fellow citizens about the issues important to the Maine coast.

Morrow, M. *After the Storm: Exploring Our Maritime Heritage through the Loss of the Portland*. $2,195. Sponsored this regional conference which provided a forum for historians, scientists, and those involved in marine technology to hear about the newest research on the shipwreck *Portland* located in a National Marine Sanctuary, and discuss how best to use this information for education in order to improve understanding and sustainability of this very unique maritime resource: shipwrecks that are now habitats.

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MAINE SEA GRANT POLICY ADVISORY COMMITTEE

The Maine Sea Grant Policy Advisory Committee (PAC) meets three times per year and provides programmatic advice to the management team and helps develop policy, strategic planning documents, and program evaluation mechanisms. Currently, the PAC includes 24 members, representing research institutions, state agencies, non-governmental organizations, industry groups, and community-based organizations. In the past year, this group participated in the Maine Sea Grant College Status Review, established priorities for the annual research competition, and helped amend the program's implementation plan for 2003-2005.

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