

Gulf of Maine NEWS

Regional Association for Research on the Gulf of Maine

Winter 1995

Cobscook Bay Ecosystem Study

Bruce Kidman, Maine Chapter, The Nature Conservancy

In the spring of 1995, Cobscook Bay, a macrotidal estuary in the remote eastern part of Washington County, Maine, will be the site of several cruises to collect physical, chemical and biological data. The cruises are one part of a two year study that will ultimately combine a range of variables into an ecosystem model. The research seeks to provide a basis for understanding the bay's commercial productivity and biological diversity, bringing together basic research, computer modeling and outreach to the Bay's citizens and stakeholders.

"This is an opportunity to obtain baseline information on a system that, by most measures, is relatively unpolluted, relatively undeveloped and relatively little-studied - but not without questions that need to be answered", says Robert Vadas, Professor of Botany, Oceanography and Pathology at the University of Maine. "This study represents one of the broadest ecosystem approaches in Maine. Each principal investigator will study one aspect of the processes that drive the system," he explains. Ocean currents, nutrients, convoluted coastlines, light penetration, oxygen levels, salinity, kelp, and phytoplankton productivity are some of the variables under study.

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"Ultimately, we will put all our findings together as an integrated, multilayered model from which we hope to evaluate future impacts and on which we can build the next phase of research. In the process, we will learn how much Cobscook Bay is like other systems where research has been ongoing, but of even greater significance, how it is different."

What ecological factors are responsible for biodiversity in estuarine ecosystems? Dan Campbell describes the basis for biological diversity as "a storehouse of information that can be used to meet ecological contingencies in response to changing external or internal conditions. Ecosystems with more choices for structural and functional configurations may be more stable when confronted by perturbations than those with fewer choices. If we are to protect and manage biodiversity we first need to understand the ecological factors that control it. All the inputs required to maintain a certain storage of biodiversity must be measured in a common unit so that they are comparable. In theory, more required units should result in greater storages of biodiversity. These factors may directly (high productivity) or indirectly (stable physical conditions) support the development of diversity."

According to another project member, Peter Larsen, senior Research Scientist at the Bigelow Laboratory for Ocean Science, the private funding brings together a broad range of research expertise and experience while allowing important flexibility. "Here we can focus our attention on what science needs to know about Cobscook Bay itself," explains Larsen. "We will each study separate fundamental processes that, combined account for the ecological and commercial richness of Cobscook Bay. By combining satellite images, aerial photography, and the on-the-ground and in-the-water sampling in layers, we believe the whole will be greater than the sum of its parts." *(continues on page 2)*

MEMBERS: Bigelow Laboratory for Ocean Sciences <i>Lewis Incze</i>	National Marine Fisheries Service <i>Gregory Lough</i>	University of Massachusetts at Boston <i>Gordon Wallace</i>	Huntsman Marine Science Centre <i>John Allen</i>	Stellwagen Bank National Marine Sanctuary <i>Brad Barr</i>
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Ecosystem Modeling in Cobscook Bay

David A. Brooks, Texas A&M University

Daniel Campbell, University of Rhode Island

(Cobscook Bay continued)

The field operations will be based at Suffolk University's Friedman Field Station in Edmunds and boat operations will be coordinated with the Marine Trades Center in Eastport. Students from many of the participating organizations, as well as some local high schools, will have the opportunity to participate in the cruises and will benefit from the hands-on experience in the bay. Local residents of the Cobscook Bay region will contribute information to the project.

The research team includes one Washington County native, David Brooks, Professor of Oceanography, Texas A&M University. Brooks has applied a computer model of the ocean currents in Cobscook Bay (see adjoining article). For Brooks, the program's commitment to sharing results is a key component of the research plan. In addition to published findings, the plan calls for a two-day workshop that will bring the research team and other scientists together with resource users and managers to discuss the implications of their findings, identify information gaps and determine needs for further study. In this way, users and managers of the bay's resources will have access to information indicating what parts of the bay or which types of habitats may be best suited for different activities. It is anticipated that model output, cruise information, and data sets could be available through a 'Cobscook' entry on the World Wide Web Mosaic RARGOM home page.

This study is also significant because it is the largest privately funded marine research program in Maine history. Researchers from several institutions, working with the Maine Chapter of The Nature Conservancy, secured a 1:1 matching grant of \$175,000 through a competitive, peer-reviewed proposal process administered by the Conservancy's National Ecosystem Research Program. The grant was jointly funded by the Conservancy and the A. W. Mellon Foundation. Currently, there are no further funds available through The Nature Conservancy's National Ecosystem Research Program.

The Cobscook Bay ecosystem study is based on a variety of interlocking models. Among the models is a numerical computer model that simulates the three dimensional circulation in the bay based on initial and boundary data.

Cobscook Bay is noted for an extraordinary diversity of marine invertebrates, concentrations of bald eagles, shorebirds and waterfowl, and commercially valuable fisheries. The biological richness of the bay and surrounding waters depends on the primary productivity of the bay. The extremely high productivity of the bay waters is associated with intense tidal action, which brings offshore nutrients into the bay. The 18-24 foot tidal range for which the bay is well known is part of the nearly resonant response of the Gulf of Maine - Bay of Fundy to the semidiurnal tide in the Atlantic Ocean. Figure 1 shows the rapid eastward increase in tidal amplitude

(continues on page 3)

Figure 1. Map of the Gulf of Maine and Bay of Fundy, showing the interior basins and the offshore banks and the amplitude and phase of the semidiurnal (M-2) tide. Tidal amplitude (solid lines) in cm and Greenwich phase lag in degrees (dashed lines), redrawn from Brown (1984). The boxed inset shows the Cobscook-Passamaquoddy region (Figure 2).

(Cobscook Bay Modeling continued)

from the Gulf of Maine toward the Bay of Fundy. The inset box in the figure outlines the Cobscook-Passamaquoddy region, shown in greater detail in Figure 2.

The circulation model continues and improves on earlier applications of computer models to Cobscook Bay (e.g. Brooks and Churchill, 1991). The field data collected during the cruises will provide initial and boundary data that, together with tidal heights on the model boundaries, are used to start model simulations under different configurations of wind forcing, river run-off and tidal ranges. The computer model uses a discretized version of the three-dimensional hydrodynamic equations of motion to estimate the current speed and direction and the temperature and salinity at many grid points in the model domain, starting from an initial set of conditions and subject to various external forcing factors. By including field measurements of dissolved nutrient concentrations, it may be possible to use the model flow fields to predict nutrient fluxes and exchange rates in the bay. Several model codes have been applied to the bay, and each has different advantages and disadvantages. For the upcoming experiments, a well-documented and tested three dimensional model code developed by Blumberg and Mellor (1987) will be used on a grid with 5 to 10 levels in the vertical and several degrees of horizontal resolution ranging from about 1 km to less than 100 m on the finest scale.

The lines labeled A through D in Figure 2 identify the principal cruise lines that will provide physical data for the model. These lines define natural constrictions or boundaries that divide the bay in several sub-regions, each of which will be sampled for various biological and chemical parameters. Each cruise will require several days to complete, but the physical data (vertical profiles of temperature and salinity) on the four lines will be collected as rapidly as possible during one tidal cycle. It is planned to carry out replicate cruises during the spring and neap cycles of the tide to permit model simulations under those circumstances.

Figure 2. Coastal detail from the inset in Figure 1, showing the mainland, passages and islands defining Cobscook and Passamaquoddy Bays. The international boundary between the United States and Canada is shown by the dashed-dotted line. Solid lines labeled A through D identify sections in Cobscook Bay along which physical data will be collected during the summer cruises in 1995.

(continues on page 4)

Figure 3. Example of a model simulation of the surface circulation in Cobscook Bay (lower left quadrant of Figure 2), under the influence of mean tidal height variations on the open boundary between Eastport and Lubec and the spring freshet from the Pennamaquan and Dennys Rivers. The arrows show the direction and proportionate speed averaged over one tidal cycle after three days of model simulation (i.e. only the tidal-residual currents are shown); the longest vector corresponds to a speed of about 25 cm/sec (about half a knot). The model grid resolution was about 225 m. The solid contours show the surface salinity in parts per thousand.

Cobscook Project investigators and collaborators

The project team leaders are Peter Larsen (207) 633-9600 and Robert Vadas (207) 581-2974. Please contact them or the PI's listed below for additional information.

Ecosystem Model, Daniel Campbell, U.S. EPA
Hydrodynamic Model, David Brooks, Texas A & M Univ.
GIS, Richard Smith, U.S. Fish & Wildlife
Macrophyte Productivity, Robert Vadas, Univ. of Maine
Nutrients, Christopher Garside, Bigelow Laboratory
Phytoplankton & Benthic Microalgae Productivity, Charles Yentsch, Bigelow Laboratory
Remote Image Interpretation, Peter Larsen & Cindy Erickson, Bigelow Laboratory
Cruise Coordination, David Phinney, Bigelow Laboratory
Field Support, Carl Merrill, Friedman Field Station
Grant Coordination, Barbara Vickery, Maine Chapter, The Nature Conservancy

Figure 3 shows the surface circulation in the bay averaged over one tidal cycle (i.e., the tidal-residual circulation) with forcing only from tidal height variations on the Eastport-Lubec open boundary and an approximation of the spring freshet from the Pennamaquan and Dennys Rivers. The river effect is obvious in the averaged flow of freshened surface water toward the open boundary (the contours show surface salinity in parts per thousand). The example in Figure 3 is from an experiment with a slightly simpler computer model known as Mecca (Hess, 1989) on a grid with about 225 m horizontal resolution.

Figure 4 shows a preliminary model of the estuary in diagrammatic form. Ecosystem components are shown as producers (bullets), consumers (hexagons), and storages (tanks). The components are linked to each other and to external forcing functions (circles) by pathways (lines). Producers and consumers in the model represent aggregated groups and each component contains a storage of biomass and a storage of diversity for

Figure 4. A preliminary representation of energy flow through the Cobscook Bay ecosystem (within rectangles) and important external forcing functions. Bullet shaped symbols represent primary producers; hexagons consumers; and tanks important storages of nutrients.

the group (these details are not shown in this version). The physical basis for this diversity is found in the energy signature of the estuary represented by the external forcing function (which will include sun, wind, tide, physical currents, runoff, rain, animal migrations, tidal exchange of nutrients, biomass, and other information). The research projects in this study will provide new information about what are believed to be the most important forcing functions, storages, and fluxes in the ecosystem model. The existing literature on Cobscook Bay and other estuaries will be used to provide information on important aspects of the ecosystem such as bird populations and component diversities which are not directly measured in this research. Any data gaps identified in this process may provide topics and directions for future research. One result of this work will be an evaluated ecosystem model with measured or estimated annual values for all the important forcing functions, storages, and energy, material, and information flows. This information can then be used in further static or dynamic analyses.

References

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25 years of Research on Prehistoric Gulf of Maine Maritime Societies Results in a Comprehensive Volume

Bruce J. Bourque, Maine State Museum and Bates College

Because seacoasts are among the most unstable ecological zones on earth, discussions of human adaptation to the sea have often relied on evidence constructed from composite cultural chronologies made up of numerous samples from disparate locations. Such sequences often fail to reach very far back into the past because earlier sites have been differentially destroyed by coastal erosion. In contrast, data obtained at the Turner Farm provides a record of human coastal adaptation during the entire recent Holocene epoch at a single location. Granted that oceanographic conditions changed significantly in that location during the site's history, we believe that our reconstructions of those changes have allowed us to distinguish simple microadaptational reactions from more basic long-term diachronic trends. This work has been compiled in a book, to be published this spring by Plenum Press, titled *Diversity and Complexity in Prehistoric Maritime Societies: a Gulf of Maine Perspective*.

The Turner Farm site is located on North Haven Island, one of the Fox Island group in Penobscot Bay on the central Maine coast. Large-scale excavations conducted there during the 1970s, followed by over a decade of analysis has produced a body data which, in its age, size, and comprehensiveness, is probably unparalleled among coastal sites in North America. It spans five millennia, from before 5000 B.P. to the early historic period, and includes 6500 catalogued artifacts of stone, bone, and pottery as well as 1800 bone samples from which over twenty thousand vertebrate specimens have been identified.

The site has been known to archaeologists since the late nineteenth century, when amateurs collected artifacts from the beach in front of it and dug pot holes in its eroding scarp. It was not until 1969, however, when I initiated a large-scale and long-term survey of the Fox Islands, that the site's great potential became apparent. The Turner Farm project initially grew directly from my dissertation on the prehistory of the central Maine coast. That research was funded by the National Science Foundation. During the summer of 1969, we began to explore archaeological collections and sites between Deer Isle and Frenchman's Bay, a region where some information on the past 5000 years of prehistory in the region was already in hand. These data had led to the formulation of several models of regional prehistory which I planned to test. Additional support from the Polaroid Corporation enabled me to build an unusually comprehensive photo archive of the Maine collections, several of which include artifacts from the Turner Farm site, which are housed in museums throughout the Northeast.

As we excavated the site during the 1970s, archaeological interest in the Northeast increased dramatically, particularly in northern New England. This revival led to the publication of syntheses which explored relationships among the region's ar-

chaeological cultures as well as their ties to those found elsewhere throughout eastern North America. Although these syntheses made some reference to the Turner Farm site, access to its data was limited to interim reports and personal communications based upon preliminary analyses. The two decades of research on this site that have now elapsed have changed, sometimes radically, the ways in which we view the prehistoric peoples of the Gulf of Maine and, indeed, those who lived throughout a much larger region.

Over the years, the project benefited greatly from collaboration with professionals in ancillary fields. I have been especially fortunate in obtaining assistance regarding paleoenvironmental reconstruction from Harold Borns, Ronald Davis, and especially Daniel Belknap, all of the University of Maine's Institute for Quaternary Studies. That effort was also aided by Dosia Leyendecker, of the Smithsonian Institution, who graciously provided wood identifications from our charcoal samples. Arthur Spiess, ably assisted by Robert Lewis, went far beyond their obligatory involvement in analyzing the huge faunal sample upon which so much of my interpretation of the site is based. Initial support for their efforts came from a 1980 National Science Foundation grant. Robert Stuckenrath, then of the Smithsonian Institution and the Quaternary Institute, generously provided radiocarbon dates. Robert Doyle, formerly Director of the Maine Geological Survey, has provided long term support in helping us define lithic use and procurement patterns. Contributions from many of these individuals appear as appendices to the volume.

This book not only presents the research results but explores implications for eastern North America and for maritime societies in general. It includes many illustrations and has been organized around a series of four stratigraphic "packages" which are referred to as Occupations. The first, Occupation 1, dates between 5000 and 4500 B.P. and pertains to the Small Stemmed Point tradition, which is found throughout much of southern New England and New York, but whose existence in Maine was not even suspected when research began at the site. The second, Occupation 2, applies to the Moorehead phase, the culture which gave rise to Maine's well known red paint cemeteries. Maritime hunters focused upon swordfish and cod and exhibited extensive connections to Newfoundland-Labrador. Apparently the culture disappeared when swordfish left the Gulf of Maine, possibly due to cooling of its waters. The third, Occupation 3, applies to the Susquehanna tradition, representing the northern-most major habitation component of this unusual culture as well as the only cemetery with extensive bone preservation. This population, apparently from the mid-Southeast (Tennessee to Georgia), replaced the Moorehead phase about 3800 B.P. They were relatively much less interested in marine exploitation than any earlier or later population on the central Maine coast. It includes a unique set of burial features which make its intrusive (immigrant) nature quite apparent. The fourth, Occupation 4, is conceptually different from the earlier ones in that the term refers

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New Leadership at the Maine Department of Marine Resources

Two appointments have been announced this winter at the Maine Department of Marine Resources, Robin Alden is the new Commissioner, and Linda Mercer is the new Director of the Marine Resources Laboratory.

Alden's appointment is the culmination of her twenty years of work in fisheries and fisheries management. She graduated from the University of Maine, her academic training focusing on marine resources and economics. As a journalist- the founding editor of *Commercial Fisheries News*- she immersed herself in coastal issues, recognizing the strength and potential of the state's marine resources and the businesses which use them.

In her confirmation statement, Alden expressed her advocacy for the commercial fishing industry as "a proud, economically productive use of this state's legendary coast, a use that depends on preserving the environmental quality of that coast and the waters off our shores. It is this "win-win", "jobs and the environment" combination which makes me honored to be nominated to take charge of management of the state's marine resources." She is positive about the future of the fishing industry, despite the current crisis facing the groundfish. In her editorial capacity, she has recommended improved relationships between federal regulators, the fishing community, and environmental groups as key to the future health of the fish stock.

Alden's optimism is rooted in her belief that there are commonly held principles shared by those who are charged with managing the fish resources and those whose livelihood depends on that resource. She views fishery management as "one positive tool in developing the economic potential of the state's marine resources in a responsible and sustainable manner. The state has a unique position in the nation for developing marine aquaculture, both large and small-scale, because of its coast and waters." Reputed to be consensus builder, Alden intends to "focus on using all of our marine science resources in the state effectively and cooperatively", and bring that expertise to inform the discussion concerning the behavior and abundance of the fisheries resource.

Dr. Linda Mercer, a Colby College graduate, returns to Maine after twelve years with the North Carolina Division of Marine Fisheries. During her time at that post, she wrote a number of Atlantic State Marine Fisheries Commission fishery management plans on sciaenids (weakfish, red drum, spotted seatrout, spot, Atlantic croaker) and Spanish mackerel. She also conducted studies on the commercial reef fish fishery, king mackerel and Spanish mackerel, coordinated biological sampling programs, and participated in interstate and federal stock assessment and management activities. Mercer brings additional expertise in the life history and population dynamics of the black sea bass and the comparative ecology of pipefishes. As the new representative to the Association, she looks forward to working with the scientific community and the fishing industry in Maine to integrate research with management issues.

MIT Sea Grant College Program Appoints Manager of Coastal Processes and Commonwealth Relations

The MIT Sea Grant College Program announced that Dr. Judith Pederson will serve as a liaison between scientists and coastal managers. Her responsibilities include identifying areas where MIT Sea Grant, researchers and students can work towards understanding and resolving complex management issues. Prior to this position, Judy worked with the Massachusetts Coastal Zone Management program. She expects to continue to "work towards common goals of environmental protection through good science, good policy, and wise use of resources". Judy can be reached by telephone at (617) 252-1741, or by e-mail: jpeterso@mit.edu.

Wetland Conservation at Cobscook Bay Estuary

The North American Wetlands Conservation Act Grants Program has provided a second round of funding to protect the most critical intertidal wetland areas and associated uplands of Cobscook Bay. This project, (where willing landowners sell their property, or a conservation easement deed on it, at fair market value, thus preventing future development), was completed in partnership with the Maine Department of Inland Fisheries, the Quoddy Regional Land Trust, the Maine Coast Heritage Trust, The Nature Conservancy, and other private donors. The groups began to work together in the late 1980's, receiving an initial grant in 1991.

This effort ties in directly to the North American Waterfowl Management Plan: Cobscook Bay is the highest priority focus area in Maine because of the diversity of species supported by the Bay's ecosystem, the large concentration, the importance, or variety of species found in the Bay, and the relatively pristine and high quality habitats within the Bay. Unique resources include: 25% of the total wintering population of Black Ducks; 17 breeding pairs and 300-400 wintering Bald Eagles; an internationally important staging area for over 20 species of shorebirds; marine mammals (seals and porpoises); and Atlantic Salmon. The research project described in this newsletter should increase the understanding of this region. For more information about the North American Wetlands Conservation Act Grants Program, contact: Dr. David Weaver, (703) 358-1784. For information about the Cobscook Bay Project, contact Jim Dow (207) 374-2998.

(Prehistoric GoM continued)

to an uncertain number of occupational episodes that apparently occurred in rapid succession after about 3000 B.P. which we could not reliably isolate stratigraphically and which were therefore analyzed somewhat differently from earlier occupations. During this period, marine orientation returns, but it is no longer pelagic in orientation; coastal marine resources (fish and seals) are more important.

Several Coastal America Program Projects in the Gulf of Maine

William Hubbard, U.S. Army Corps of Engineers

The Coastal America Program is a collaborative interagency problem solving structure that enables national policy issues to be identified and resolved, regional plans and strategies to be developed, and local projects to be implemented. This partnership has been forged between federal, state, local agencies, and private citizens groups, to address environmental problems along the U.S. coasts. The process is guided by the concepts of ecosystem management and sustainable development, seeking to incorporate environmental objectives into major development plans. Exchanging information on agency plans encourages early identification of collaborative opportunities to restore the environment while moving forward with vital economic development. To date, the program has initiated over 90 projects in 23 states, committed approximately \$30 million dollars, involved 22 federal and over 200 non-federal partnerships, and written consensus reports on wetlands, watersheds, and coastal issues. As a result, over 70,000 acres of wetland habitat will be restored, more than 500 miles of spawning streams will be reestablished, at least 50 farms will implement non-point source controls, and 20 + species of endangered fish, birds, and mammals will be protected.

Local project implementation is expedited by the partnership process. Within each region, site-specific coastal problems are identified and a working list of priority projects is maintained. The Northeast Regional Implementation Team (NERIT) currently has several projects underway in the Gulf of Maine. There are three focus areas, contaminated sediments, non-point source reduction, and habitat restoration.

- New England Coastal Contaminated Sediments: New England ports and harbors predominantly have fine grained sediments underlying their urbanized waterfronts. Historical dredging and disposal operations have relocated these potentially contaminated sediments to many aquatic disposal sites. NERIT has various efforts underway to map existing contaminated sediments in an interagency compatible GIS format.
- Sediment GIS, Boston Harbor, Massachusetts, Casco Bay, Maine: In 1993, the NERIT published a GIS mapping and database of all recent Boston Harbor aquatic sediment chemistry. This collaboration produced an agreed data format to manage contaminated sediments by spatial mapping. In 1994, a database for recent sediment chemistry in the Casco Bay National Estuary Program focus area was published.
- Abandoned Dredged Material Disposal Site: The Boston Lightship Disposal Site, Massachusetts is now under study to determine the residual chemical signature and the level of biological productivity. This and other abandoned dredged material disposal sites are being examined to decide if future disposal of clean dredged material should be directed to cap these sites, reducing the overall regional exposure of biota to

contaminants.

- Rye Harbor, New Hampshire: The F&WS has completed restoration of this previously used state dredged material disposal site. The restoration activity reintroduced saline tidal flushing to a significant portion of this saltmarsh.
- Sagamore, Massachusetts: This large marsh also has reduced tidal flushing. NERIT is participating in an Army Corps of Engineers Environmental Restoration Project in conjunction with MA Executive Office of Environmental Affairs.
- Cape Cod Saltmarshes: The tidal hydrology of all Cape Cod saltmarshes is being examined; those that are found to be tidally constricted will be restored as the routine transportation corridor maintenance occurs.
- Cherryfield Dam Fish Ladder, Maine: Modifications to the fish ladder will greatly enhance upstream movement of juvenile salmon. The U. S. Army Corps of Engineers and the Maine Atlantic Salmon Commission have agreed on a beneficial modification to this important salmon migration corridor, and are seeking a local funding match.
- Clark Island, Portsmouth Naval Shipyard, Portsmouth, New Hampshire: This coastal island and adjacent habitats is being studied for an ecological reserve by the Navy. Technical assistance is being provided by all NERIT participants. Univ. New Hampshire experts conducted a workshop to provide the Navy with recommendations to aide in its planning efforts.
- Boston Harbor Eelgrass Restoration, Massachusetts: The EPA Water Management Division of Region I has been conducting studies and will now implement a major reintroduction of eelgrass (*Zostera* sp.) in Boston Harbor. The NERIT is currently coordinating with the Navy to obtain the support of Navy divers to conduct the plantings as a training exercise.

Northeast Region Implementation Team (NERIT)

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National Habitat Program Review Underway

Michael Ludwig, National Marine Fisheries Service

A comprehensive reassessment of the National Habitat Program is underway at the NMFS Habitat and Protected Resources Division. An internal review of the program has been completed. Comments are now being solicited from a diverse audience to identify methods by which the Habitat Program can be strengthened and streamlined.

Under the authorization of such legislation as the Fish & Wildlife Coordination Act, Clean Water Act, Marine Protection, Research and Sanctuaries Act, Federal Power Act, and Endangered Species Act, the NMFS is responsible for the protection and enhancement of fishery resources. The National Habitat Program is the principal unit within NMFS that is responsible for evaluating and commenting on the impact of development in the aquatic zone that require federal authorization or are federally funded. Decentralized, to operate within the Regional Headquarters and associated field offices of NMFS, the program has not received the attention it requires to perform in a fully satisfactory fashion.

The decision to conduct an integrated program review was made last fall when high level agency officials met with representatives of the Atlantic States Marine Fisheries Commission (ASMFC) and other constituents. A series of outreach workshops will provide an opportunity for open debate on the NMFS role in habitat research, management, regulation and education. NMFS seeks to determine whether there are partnerships that can reduce or relieve state or federal staff from duplication of effort, while maintaining and expanding a collective understanding of habitat, and management of those resources. The role that the Habitat Program might have on reversing the decline in ground-fish stocks will also be discussed.

Improving the effectiveness of the National Habitat Program in protecting and enhancing those habitats is one of the highest priorities of Roland Schmitt, Director of the NMFS. In his capacity as Assistant Administrator for Fisheries at NOAA, Schmitt has directed that the NMFS Habitat Program combine insights obtained from the outreach effort with results of the in-house programmatic evaluations and develop a strategic plan that will address the relevant issues as well as improve NMFS partnerships into the 21st century.

Stakeholders from diverse backgrounds, ranging from commercial and recreational fishing interests to state resource agencies have been asked to participate. Involvement opportunities are planned throughout the nation, two will take place in the Northeast region. The first workshop was held at Waltham, Massachusetts on February 28th. A second meeting is scheduled for April 11th in Annapolis, Maryland. If you are interested in becoming involved in the effort, contact Tom Bigford at (301) 713-2325 at NMFS Headquarters in Silver Spring, Maryland.

Habitat Quality in the Gulf Ecosystem Workshop & Conference

The 1994 reauthorization of the Marine Mammals Protection Act requires a regional workshop to assess human-caused factors affecting the GoM marine ecosystem, with a report due to Congress by Dec. 31, 1995. The Association has agreed to assist in organizing this activity. The dates for convening the conference have shifted from this spring to September 18-20, at Dartmouth College, Hanover, NH. An agenda for the September conference has been drafted and the speakers are being confirmed. Three working group topics have been selected: natural environment/anthropogenic impacts; fisheries harvesting; and protected species/marine mammal issues. A workshop to finalize the conference plans will be held in Woods Hole on May 3rd; invited participants will include the Steering Committee, staff of NEFSC, state, federal, and NGO representatives. Contact David Dow or Jack Pearce at NMFS, Woods Hole, MA (508) 548-5123 or RARGOM headquarters for more information.

U.S. GLOBEC Georges Bank Program Update

Robert C. Groman, Woods Hole Oceanographic Institution

The U.S. GLOBEC Georges Bank program is well into its 1995 field work with eight of its 23 cruises scheduled for 1995 completed. Information and data from these cruises are being added to the on-line database as they become available. With your favorite World Wide Web browser point to our home page at <http://globec.who.edu>. Plotting capabilities, selection options and data transformation capabilities have been added, expanded or enhanced.

Training workshop planned

The U.S. GLOBEC Georges Bank program uses the JGOFS/GLOBEC Distributed Data Management System to make its data and information available to scientific investigators and others. Since a number of groups in the Northeast are beginning to think seriously about putting data on the JGOFS/GLOBEC distributed data management system, we plan to have a 2-3 day training session at MIT in (probably) May. The session would cover:

- 1) Basic concepts and structure of the system
 - a) data objects: methods (or translators) / data
 - b) data serving through NCSA's httpd
 - c) WWW interfacing
 - d) program interfacing
- 2) Organizing data and developing methods
 - a) using preexisting "outer" shell
 - b) other techniques/ protocol
- 3) Developing scripts/ programs for httpd
- 4) Interfacing to programs - examples

We'll include as much hands-on experience as we can.

Discussions among participants about data they're concerned with and new techniques welcomed. Space may be limited so if you are interested please contact Glenn Flierl, glenn@lake.mit.edu.

Resources

The National Undersea Research Program Announces 1995 Research Projects

Ivar Babb, NURP, UConn at Avery Point

The National Undersea Research Program has recommended ten research projects in the Gulf of Maine for 1995. The projects listed below are grouped within NOAA's Strategic Plan research categories.

Build Sustainable Fisheries

"Predation by the Physonect Siphonophore *Nanomia Cara*"
Youngbluth, Harbor Branch Oceanographic Institution

"Ecology of Deep Water American Lobsters (*Homarus americanus*): Patterns of Body Size, Distribution, Abundance & Habitat Utilization & Processes of Settlement & Recruitment" (Year 2 of a two year project)
Steneck, University of Maine

"Assessment of Benthic and Benthopelagic Predator Fauna on Georges Bank"
Madin, Woods Hole Oceanographic Institution

"NURC-USGS Stellwagen Bank National Marine Sanctuaries Habitat Mapping and Distribution of Living Marine Resources"
Auster & Valentine, NURP & USGS

"*In situ* Quantification of Zooplankton Aggregation Mechanisms using the Jason ROV on Georges Bank"
Davis, Woods Hole Oceanographic Institution

"Secondary Production Studies in Cooperation with Stellwagen Bank National Marine Sanctuary Cooperative Research Program"
Cahoon, University of North Carolina, Wilmington

Coastal Ecosystem Health

"Investigations of the Impact of Light Penetration and Water Column Stratification on the Community Structure in the Gulf of Maine/Georges Bank"
Frank, Harbor Branch Oceanographic Institution

"Patch Dynamics of Cerianthids and its Consequences in Structuring Benthic Communities in the Gulf of Maine"
Watling, University of Maine

Decadal Centennial Change

"*In situ* Sampling of Outcropping Glacial and Glaciomarine Sediments and Sedimentary Bedforms in the Gulf of Maine"
Belknap, University of Maine

Rovering Protected Species

"Determination of Acoustic Signatures of Gill-Net Deployed Pingers"
Babb, NURP

Publications Noted

Reports Received

The following reports have been received at the Association office and are available for distribution by contacting the author.

"*Atmospheric Deposition to the Gulf of Maine Interim Report August 1994*", Dr. H.G. McAdie, Workshop June, 1994, Huntsman Marine Science Centre, St. Andrews, New Brunswick, International Joint Commission, 47 pgs. Contact: H.G. McAdie Associates, Suite 340, 245 Eglinton Ave. East, Toronto, ON Canada M4P 3B7

"*NOAA 1995-2005 Strategic Plan*", July 15, 1993. Contact: Diana Josephson, Deputy Under Secretary, NOAA, Rm. 5810 Herbert Hoover Building, 14th & Constitution Ave. N.W., Wash. D.C. 20230.

"R/V Albatross IV Cruise 9410 Part II Woods Hole to Georges Bank to Woods Hole": *U.S. GLOBEC NW Atlantic Georges Bank Study*, November 8-18, 1994

"*Science Review 1992 & '93 of the Bedford Institute of Oceanography, Halifax Fisheries Research Laboratory, St. Andrews Biological Station*", A. Fiander, editor, Dept. of Fisheries and Oceans, Scotia-Fundy Region, 1994. Contact: Marine Assessment and Liaison Div., DFO, BIO, P.O. Box 1006, Dartmouth, NS Canada B2Y 4A2

Also of Note:

Peter Larsen, Bigelow Laboratory, funded by The Nature Conservancy, has produced an annotated bibliography of over 600 references about Cobscook Bay. It will be available as a computer database in late May; plans are to continue to update this list. Contact Bruce Kidman, Maine Chapter, The Nature Conservancy to obtain a copy (207) 729-5181.

Rich Langton, MDMR, and his colleagues have revised their contributions to the RARGOM Habitat Workshop Proceedings; two articles will be published in the fall: "A Spatial & Temporal Perspective on Research and Management of Groundfish in the NorthWest Atlantic", *Rev. in Fisheries Science*; and "Interface between Fisheries Research & Habitat Management", *N. Am. J. Fish. Mngmt.*

Gulf of Maine Point Source Inventory

An inventory of point source discharges in the Gulf of Maine watershed is now available for researchers. The inventory was compiled by a project team in NOAA's SEA division headed by Percy Pacheco. The inventory includes structural data and pollutant discharge estimates for 273 major and 1,751 minor direct discharging point source facilities located in the U.S. and Canadian watersheds draining into the Gulf of Maine. Estimates of annual and seasonal discharges are made for 15 pollutants for a base year of 1991, using a combination of monitoring data, permit limits and typical engineering values. The inventory can be accessed over the Internet by FTP 140.90.161.100, anonymous access, sub-directory public/percy/gomaine. There are seven deliverable files in an ASCII format and a read-me text file. For further information, please contact Jim Doyle, Maine State Planning Office, (207) 287-1492.

Internet Corner: Information Services Overview

Jim Waugh, Dartmouth College, jim.waugh@dartmouth.edu

People use databases and documents which are electronically distributed to them through Internet information services. The technical details allowing this to happen have enabled non-technically trained individuals to manage information that was recently only accessible to computer wizards. In this time of rapid acceleration of computer technology, these services will provide critical support for researchers in the future. Some of the currently popular services are described here, arranged in increasing capability and complexity of use.

Electronic mail-based services distribute text information to the largest group of people. Internet-connected machines can be served, as well as dial-in hosts and users of commercial networks. There are two basic types of email services: mailing lists and archive servers. A mailing list is a collection of people's email addresses. People who wish to join a mailing list send email to the list server computer and are automatically added. An example of an email list service is Educom, an organization which distributes Edupage, an electronic news summary on information technology, three times each week. To join the Edupage list, send a message to `listproc@educom.edu` and in the body of the message key-in "subscribe edupage AbrahamLincoln" (minus the quotes, and assuming you are Abe Lincoln; if you're not, substitute your own name). To remove your entry from the mailing list, send a message to `listproc@educom.edu` and in the body of the message key-in "unsubscribe edupage". An archive server is a computer that uses electronic mail as a means of distributing datasets. Archive servers transmit files via email after receiving an email request from a user as follows: a user emails an archive server for an index of files available. The server emails the index. The user examines the index, selects file(s) desired, emails another request for the chosen dataset(s) and the archive server emails them back. An example of an archive server machine is `netlib@ornl.gov`, a machine at Oak Ridge National Laboratory in Oak Ridge, Tennessee. Netlib maintains collections of public domain mathematical applications software. To retrieve an index of the software that is available, send mail to `netlib@ornl.gov` and in the body of the first message key-in "sendindex". Return mail will contain an itemization of the software packages present and instructions on how to mail additional directives to retrieve the datasets.

Next to email, FTP, or "File Transfer Protocol", is the most often used Internet service. Internet users employ FTP to transfer all types of files between machines. FTP programs are available for almost all computers from their manufacturers or third-party sources. There are two ways to use FTP: on a specific, one-to-one basis, when a user on one Internet machine FTP "logs into" a destination Internet machine to copy files to or from a private user account; or, on a generally accessible basis, called "anonymous FTP", when a host Internet machine is configured to allow anyone restricted access to selected files. FTP's weaknesses are slowness while browsing through directories, and FTP cannot

automatically provide descriptions of files.

Gopher is like FTP in that it distributes files off a machine to users. However, unlike FTP, Gopher is easier to use with hierarchical menus facilitating convenient access. Menu items can be files, searchable indexes or even links to other Gopher servers or FTP archive sites. Compared to FTP, a Gopher host requires more effort to organize and maintain so that information is well structured, data is up-to-date, subdirectories are recognizably named, and other servers' links are current. Gopher can display only text data, but binary files are transferable. Gopher functions well for users with slow dial-up access to Internet machines.

The Telnet service allows a user to log into a remote machine over a network as though keying into a terminal directly attached to the system.

The newest and most fully-functional Internet service is the World Wide Web (or WWW or the Web). WWW has its own handy features, but also integrates many of the services previously discussed in a manner that is both very useful and understandable. Users interact with the Web through WWW client programs, called browsers because they are used to navigate the Internet. Mosaic is the most popular graphical browser, while Netscape is increasingly used. Mosaic runs on Unix workstations, Windows PCs and Macs. Current estimates give Mosaic's usage at one million. Mosaic was developed at the National Center for Supercomputer Applications (NCSA), in Champaign, Illinois. Mosaic for Mac, Windows and Unix computers can be obtained at no charge through anonymous FTP service at the machine `ftp.ncsa.uiuc.edu`. Netscape is a product of Netscape Communications Corp., (415) 254-1900, and is free for academic and noncommercial organizations; governmental agencies do not fall into the noncommercial category. Netscape can be obtained through anonymous FTP service at the machine `ftp.netscape.com`. Lynx is a text-only browser for use on alphanumeric terminals. Lynx was developed at the University of Kansas and is available for anonymous FTP access at `ftp2.cc.ukans.edu`. Mosaic and Netscape can display text and graphics intermingled, automatically invoke ancillary programs for high-resolution image display, and play video/audio clips.

While possibly perplexing to the new user, the Internet provides access to a valuable, worldwide collection of information resources and services. For further information, a good introductory reading on these topics is "The Internet Via Mosaic and World Wide Web", by Steve Browne, published by Ziff-Davis Press. The National Center for Supercomputer Applications can be telephoned at (217) 244-0072. An excellent guide to the mysteries of networks and address syntax is "%@: A Directory of Electronic Mail Addressing and Networks", by Donnalyn Frey and Rick Adams, published by O'Reilly & Associates. 11

Calendar

April

- 6-7 Council on the Marine Environment meeting
Portsmouth, NH
contact: Carol Barleon (603) 271-2155
- 7 American Fisheries Society, S. New England
Chapter, Abstracts Due for May 25th meeting
contact: Rick Jacobson (203) 424-3474
- 11 Water Quality in Massachusetts Bay
Research Updates Workshop - MIT and WHOI
Sea Grant Programs
contact: Judith McDowell (508) 289-2398
- 27-29 Symposium on Estuarine Management,
NEERS 25th Anniversary meeting
Yoken's Comfort Inn, Portsmouth, NH
contact: Marshall Pregnal, fax: 914/437-7315,
or email Pregnal@Vassar.Vassar.edu

May

- 3 Habitat Quality in the GoM Ecosystem
Planning Workshop
NEFSC, Woods Hole, MA
contact: Genie Braasch, (603) 646-3480
- 8-12 JGOFS International Scientific Symposium
Villefranche-sur-Mer, France
contact: Dr. Trevor Platt (902) 426-3793
- 25 American Fisheries Society 1995 Summer
Meeting
UMass Amherst
contact: Rick Jacobson (203) 424-3474

June

- 9 **RARGOM meeting**
Darling Marine Center, Walpole, Maine
contact: Genie Braasch (603) 646-3480

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Gulf of Maine NEWS

Winter 1995
Volume 3 Number 1
Issued four times a year
Editor: Eugenia F. Braasch

printed on recycled paper

Gulf of Maine Scientific Symposium set for September 1996, Topics Solicited

Mark your calendars! The next Gulf of Maine Scientific Symposium will be held September 16-19, 1996. This symposium is the successor to the first one, held in Woods Hole, MA during January 1991, whose proceedings* constitute a major comprehensive scientific benchmark for the Gulf. This symposium will be a forum to present scientific advances made since that time, then to use the new knowledge to review and adjust research priorities for the future.

St. Andrews, a picturesque coastal town, has been selected as the host location for the Symposium. We have reserved space at the Algonquin resort, a wonderful historic place, beautifully maintained with modern facilities, with commanding views of the ocean and easy access to other local attractions.

Steering committee members for planning the symposium are: Gordon Wallace (chair), John Allen, Bob Beardsley, Wendell Brown, Lew Incze, Greg Lough, Dan Lynch, Judy Pederson, Ron Schlitz, David Stevenson, and Bruce Tripp. An email address has been established for contact with that group: rargom2@mac.dartmouth.edu.

Topic proposals are solicited (1-2 paragraphs) and should be directed to the Steering Committee for consideration by the end of May.

*Wiggin, J. and C.N.K. Mooers, *Proc. of the Gulf of Maine Scientific Workshop*, Urban Harbors Institute, UMass Boston, 1992.

**We welcome the New England Aquarium,
which joins RARGOM as an Associate member.
Scott Kraus will serve as the representative.**