

Gulf of Maine Area Program (GoMA)

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July 2006 GoMA Research Cruise, *RV Galatea*, "Oceanography and Pelagic Community Structure of Platts Bank, Gulf of Maine," Lewis Incze, PI (photo by Adam Baukus, USM)

1. 2006 ACCOMPLISHMENTS

Gulf of Maine Register of Marine Species: In January 2006, the Gulf of Maine area program with the Huntsman Marine Science Centre released the first GoM Register of Marine Species. The register, which includes 3,317 species, is still being refined and expanded to include additional species lists. The news release resulted in a myriad of regional, national and international news coverage, including an interview with Chief Scientist Lew Incze on NPR's *Talk of the Nation – Science Friday* (06 January 2006) and a feature story in the Gulf of Maine Times:

<http://www.gulfofmaine.org/times/spring2006/species2.html>

New remote sensing technology developed at MIT: In February 2006 fellow researchers at MIT announced a new remote sensor system developed by Associate Professor Nicholas Makris of mechanical engineering, along with others at MIT, Northeastern University and the Naval Research Laboratory, allows scientists to track enormous fish populations, or shoals, as well as small schools, over a 10,000-square-kilometer area -- a vast improvement over conventional technology that can survey only about 100 square meters at a time. The research was featured in the February 3 issue of *Science* and was funded by the Office of Naval Research, the Alfred P. Sloan Foundation and the National Oceanographic Partnership Program, and is a contribution to the Census of Marine Life (excerpts from MIT website: <http://web.mit.edu/newsoffice/2006/fish.html>)

Bay of Fundy Ecosystem Partnership: The Huntsman Marine Science Centre's BoFEP conference will be held in St. Andrew's on October 25-27, 2006 (with partial funding from GoMA). The theme of this workshop involves the "Challenges in environmental management in the Bay of Fundy - Gulf of Maine". The inclusion of the Gulf of Maine is deliberate as the Bay of Fundy is a complex and interlinked component, with both bodies of water facing similar environmental challenges, www.bofep.org/workshop2006.htm

Gulf of Maine research from intertidal to deep-sea zones: GoMA has results from intertidal zone region: a comparative study of biodiversity of macroinvertebrates at six sites along coast of Maine; and continued research of off-shore sites including Platts Bank and Three Dory Ridge (off-shore banks in western Gulf region), Cashes Ledge, and the Discovery Corridor, Canada, extending from the shallow coastal zone to the continental slope (see report for more details).

2. PROGRAM GOALS

The goal of the Gulf of Maine Census is to gain enough knowledge to enable ecosystem-based management (EBM) in a large marine environment within ten years. The Program is designed to advance knowledge of biodiversity and ecological processes over a range of trophic levels and habitats, and will address the application of this knowledge in management strategies.

EBM is an approach to regulatory decision-making that explicitly includes the direct, indirect and cumulative effects of human activities on natural communities and ecosystem function. Ecosystems, which include human systems, are complex and dynamic, presenting many intellectual and practical challenges that must be met over time and incrementally. To enable ecosystem-based management is to establish a direction, framework, systems and interest that will extend beyond 2010.

The Gulf of Maine Area Program will enable EBM in this region by doing the following. (1) Create a framework that links basic understanding of biodiversity and ecological processes to management

strategies and applications. (2) Lead and support the development of information systems that facilitate the use of existing data for biogeographical analysis of the Gulf of Maine and for identifying critical gaps in knowledge needed for EBM. (3) Stimulate scientific interest and public/agency support and funding for critical studies, including basic exploration of the ocean environment as it relates to biodiversity and biogeography. (4) Fund selected projects that help advance over-all program goals.

Ultimately, a very large cast of players will be needed, and many are already involved in many aspects of this work through their own research and other initiatives. The GoM Area Program thus serves as a catalyst and organizer as well as an innovator. Success will be measured by the scope, inertia and individual accomplishments of catalyzed activities in the Gulf of Maine region, as well as the ideas and lessons the program shares with parallel efforts underway elsewhere.

3. OBJECTIVES FOR PHASE II: 2006-07 FUNDING PERIOD

In 2006, the Gulf of Maine Area program has experienced a year of transition from Phase I, the initial or foundation phase to Phase II, the intermediate or synthesis phase of the program. The first phase with Program Director Evan Richert as lead PI from 2003-05 formed the partnerships, identified gaps and laid the foundation for building the framework for ecosystem-based management in the Gulf of Maine. Some cornerstones established include the Register of Marine Species, formation of the Ocean Data Partnership, the development of the Gulf of Maine Biogeographic Information System and the Dynamic Atlas, among others.

In addition to completing the work from the first phase, GoMA is beginning the next phase of the program with Chief Scientist, Dr. Lewis Incze leading the project toward synthesis of current scientific knowledge, formation of ecosystem-based approaches to management, and linking the science to the resource managers, educators and the public at large.

Phase II of the program will focus on developing answers to the following questions:

- What is the distribution and diversity of species in the Gulf of Maine area by major habitat types (biogeography and communities)?
- How does diversity (of genes and species) contribute to community structure and function?
- How do various communities contribute to the functioning of the Gulf of Maine Area ecosystem?
- How important are keystone species to the relationships described in questions #2 and #3 (i.e., what are the system-wide effects, including biodiversity, of strongly-interacting species)?
- How can this information be used to better manage human activities in the region?

In Phase I we collected information and ideas from experts by focusing on trophic/ecological groupings where most of the work has traditionally been done. In Phase II we will focus on integration of ideas and information at the ecosystem level. We will rely on many of the same individuals who participated in Phase I, but in more open-meeting settings with new participants. The questions we ask above are far-ranging and we do not anticipate answering any of them completely within the next two years. However, they are so fundamental that we cannot leave them entirely to a final synthesis

phase. We anticipate that Phase III will begin with a modeling effort in the first two years (2008-09), and we have a lot of preparation to get to a point where that can be done constructively.

We also will continue work on: (1) Gulf of Maine Biogeographic System; (2) Gulf of Maine Ocean Data partnership; (3) data analysis and publications from Phase I field projects; (4) new and continuing field studies; (5) outreach through our website and other means; and (6) participation in scientific meetings, workshops and publications.

Conferences, Workshops and Study Groups

GoMA is in the process of organizing regional workshops on the following themes: (1) Biogeography and the Distribution, Structure, and Function of Communities in the Gulf of Maine; (2) The Role of Taxonomic and Genetic Diversity in Determining Community Structure and Function; and (3) Application of GoMA-CoML information to Ecosystem-Based Management. The first will be collaborative with the Canadian “Discovery Corridor” program led by Peter Lawton (DFO Canada) and Paul Snelgrove (Memorial University); the second with the Center for Marine Biodiversity, led by Ellen Kenchington (DFO); and the third with fisheries ecosystem and integrated management efforts led by Michael Fogarty (NEFSC) and Michael Sinclair (DFO). Timing and locations are yet to be determined. The Regional Association for Research on the Gulf of Maine will likely participate as co-sponsors of themes 1 and 3. These groups and the GoMA Working Group chairs (all U.S.) will be involved in setting the agendas and synthesizing results. A post-doctoral fellow in an appropriate discipline will be hired by GoMA to help organize meetings and prepare results for reports and primary publications.

These formal workshops hosted by CoML are only part of the relevant meeting activity. Our program spends considerable time working with colleagues in meetings where CoML is a partner, but not the lead. The extent of shared community interest in this subject is key to the over-all progress that the Census can make in this region.

New Field Work Committed

The Discovery Corridor. Cruises in 2006 and 2007 aboard Canadian Coast Guard Ship (CCGS) Hudson, generally within a broad (and somewhat figurative) corridor extending from the shallow coastal zone to the continental slope (Fig. 1). The objective is to understand community structures in a variety of benthic landscapes and depths. Lead organization: The Centre for Marine Biodiversity, with funding from DFO-Canada and potentially from Natural Resources-Canada. Estimated Canadian contribution of ship and scientific personnel (CAN\$500K/yr) Two U.S. researchers have applied to NOAA’s Ocean Exploration program to join the cruises (see below) and the U.S. National Undersea Research Program has offered to collaborate if the OE benthic proposal is funded (total additional funds for both proposals (> \$300K/yr).

Georges Bank. Nicholas Makris (MIT) and co-workers are beginning a 3-year project funded by the Sloan Foundation and the National Ocean Partnership Program to test a low-frequency, long-range Ocean Acoustics Remote Sensing (OARS) system for detecting, monitoring, and imaging fish populations and behaviours synoptically over large areas on and near Georges Bank. Cruises are planned for 2006 and 2007. The total value of the project is \$2.475 million from Sloan (\$926,000), NOPP (\$236,583), ONRship time (\$864,805) and the work of government researchers (\$448,000).

Cashes Ledge. Jon Witman (Brown University) will resurvey sections of Cashes Ledge using diver-operated video to evaluate changes in the community of this prominent, offshore rocky system since his original studies in the 1980s. Funding (\$32K) will come from this proposal, and field work will be conducted in 2007.

Platts Bank. Lew Incze, Peter Stevick (both at USM) and Scott Kraus (New England Aquarium) began the second year census of upper trophic level usage of Platts Bank (by plane) and euphausiid populations and distributions (by boat). \$53K is allotted from this proposal. Our first cruise in 2005 provided extremely interesting results with intense feeding activity of humpback whales dependent on euphausiids, herring and highly localized physical processes. Other marine mammals used different parts of the bank system, and bird feeding patterns are being analysed. A second year with a focus on birds, large pelagics and euphausiids (vs. the many types of measurements made in 2005) will provide important information on possible variations in the functioning of offshore banks for highly migratory populations of fish, marine mammals and birds.

4. WORK COMPLETED AND UNDERWAY

Research Highlights

Intertidal Biodiversity in the Gulf of Maine – Macroinvertebrate researcher Thomas Trott of Suffolk University completed his follow-up report entitled *Gulf of Maine Study of Intertidal Communities*. The goal of his intertidal study was to detect change in macroinvertebrate diversity through the comparison of species lists from the Critical Areas Program of the Maine State Planning Office that date back to the 1970's to species lists assembled in 2004-2005 by Trott. Six sample sites were selected from a pool of the 22 Critical Invertebrate Areas in Maine. Although the causes for changes in coastal diversity are complex, the researcher reports that the diversity in two of six locations, Sea Point and Bailey Island, has changed significantly from baselines established 30 years ago. The other four sites, Pemaquid Point, Schoodic Point, Red Head and West Quoddy Head, did not show any significant change according to the measure of biodiversity used in Trott's study.

The researcher was also looking for patterns of diversity along the coast and found that Penobscot Bay may represent a breakpoint in coastal diversity since the three sites southwest (Sea Point, Bailey Island, Pemaquid Point) clustered together and were significantly different that the three sites (Schoodic Point, Red Head, West Quoddy Head) northeast of the bay that also clustered together (clustering means they were not significantly different from each other). These two regions are different geologically and in respect to temperature regimes, probable reasons for the difference. This difference in intertidal communities has not been reported before. Trott plans to investigate further in the very near future.

The metric Trott used for estimating diversity and detecting change is the subject of a poster developed for the NaGISA Worldwide Conference to be held in Kobe, Japan, October 15 - 18. The full report is in final review and will be offered for publication in a peer reviewed journal. Also, a synopsis of the report will be presented by Trott at the 7th Bay of Fundy Workshop, held at the Huntsman Marine Science Centre, St. Andrews, New Brunswick, October 25 - 27. A version of the final report will be published by Environment Canada in the proceedings of that meeting. The poster, initially presented at the NaGISA Worldwide Conference, will be presented at the workshop also.

Platts Bank Results and analysis of data from the first year of research at Platts Bank in the Gulf of Maine was underway from the fall of 2005 through spring 2006. As a result second year of cruise research was planned to fill in the gaps in knowledge and data in 2006. Additional collaboration with physical oceanographer Dr. James Lerczak of WHOI began in 2006, to understand the effects of internal waves on the community under study. A funding proposal to the U.S. Department of Navy for continued research is in progress.

Platts Bank was chosen for study because it is thought to be a “hotspot,” an area where the biomass of organisms is at times notably elevated in contrast to the ambient productivity of surrounding waters. “Hotspots” are typically fairly well defined spatially, and are frequently characterized by the presence of higher trophic level vertebrates, such as birds, migratory fishes, cetaceans, and pinnipeds. Small, isolated features such as Platts Bank are anticipated to be occupied more variably and for shorter periods of time than are larger features. Predators thus must exploit a network of such sites, foraging at each while conditions are favorable, and then moving on. The predictability and temporal dynamics of these hotspots therefore become an important part of how populations of upper trophic level organisms utilize a variable environment. The study area is located 50 km offshore of Cape Elizabeth, Maine and covers 1672 km², including Platts Bank, Three Dory Ridge and surrounding deep water. (Platts Bank 2005: Lewis S. Incze, PI, Peter T. Stevick, PI, Nicholas Wolff, Adam Baukus, USM GoMA program, with Scott D. Kraus, PI, NEAq, Shale Rosen, GMRI)

During July 2005 dense swarms of euphausiids (*Meganyctiphanes norvegica*) along with schools of Atlantic herring (*Clupea harengus*), and substantial numbers of seabirds, whales and dolphins occurred in the vicinity of Platts Bank. Often whales were observed feeding on the surface swarms of euphausiids. We conducted synoptic, physical oceanographic and multi-trophic biological sampling surveys of the bank during a 20 day period to investigate the relationships between physical processes and the distribution and diversity of a variety of predators and their principal prey. (Platts Bank 2006: Incze, Wolff, Baukus, and Rosen with David Fields of Bigelow and Jim Lerczak of WHOI).

During 2006, we focused our efforts on sampling internal waves, which likely played an important role in forming the dense swarms of euphausiids seen during 2005. In addition to collecting an excellent time series of ADCP data, used to measure internal waves, we collected CTD and acoustic data. These data, combined with data collected in 2005, will help us understand the coupled physical-biological processes that lead to good or excellent feeding conditions for highly mobile predators on this bank, and the temporal dynamics of those processes.

Data Management and Access

Throughout 2006, work continued from Phase 1 on the further development of the Ocean Data Partnership, Gulf of Maine Biogeographic Information System and the Dynamic Atlas website. In 2006, GoMA has used the database to create mapping products to further the work of resource managers and researchers in the Gulf region (see attached “GMBIS Mapping Products for Website”).

Ocean Data Partnership

The Gulf of Maine Ocean Data Partnership continues to promote and coordinate the sharing, linking, electronic dissemination, and use of data on the Gulf of Maine region. During 2005-2006, GoMODP grew to 22 members.

Fourth Quarter, 2005 Activities:

- Executive Committee - Met for four times, produced 2006 Work Plan with Technical Committee
- Technical Committee - Met twice and produced the 2005 Technical Committee Report, Technical Guidance Version 1.0 and 2006 Work Plan
- Metadata Training Workshop - Held at Gulf of Maine Research Institute, Oct. 19-20, 2005
- Partnership Data Survey - Used to determine available data sets, and extent of metadata
- Metadata Pilot Project - Helped partners develop and post FGDC compliant metadata for selected datasets
- Data Partnership Meeting - Discussed future goals, December 13, 2005
- 2006 activities - will be submitted separately by Gulf of Maine Ocean Observing System report.

Gulf of Maine Biogeographic Information System/Dynamic Atlas

- GoMA worked with Northeast Fisheries Science Center (NOAA's National Marine Fisheries Service), guiding them through the installation of DiGIR. Soon they will be posting most of their biological data to OBIS.

- We have also been working with Maine's Department of Marine Resources to connect our database with theirs and will be publishing trawl survey data to OBIS using our DiGIR installation. This expected to be completed during November 2006.

- During the fall of 2005 we released an updated version of Dynamic Atlas, allowing website users to map and download Gulf of Maine biological data.

- We are discussing with OBIS-SEMAP about collaborating on the development of a new online portal for GMBIS. This portal would combine Gulf of Maine data from OBIS, environmental data from us and GoMOOS and the extensive mapping and data delivery capabilities developed at OBIS-SEMAP. Lew and Nick are meeting with Patrick Halpin and his team at the end of November 2006.

Synthesis and Analysis

Measuring Biodiversity in the Gulf of Maine (Cooper, Solow)

Sponsored by grants from CoML's Gulf of Maine Area Program and Future of Marine Animal Populations Program, Dr. Andrew Cooper and colleagues at the University of New Hampshire performed a preliminary exploration of the spatial and temporal patterns for biodiversity for the Gulf of Maine based on the NEFSC groundfish trawl survey portion of the Gulf of Maine Biogeographic Information System (GMBIS).

Two separate approaches were taken for this work. The first assumed that the trawl was adequately sampling the biodiversity of the area swept. Under this assumption, a biodiversity index was calculated for each trawl, separately. We then estimated the biodiversity across the entire GoM by smoothing between trawl locations using local regression. The second assumed that the trawl adequately sampled the distribution of the individual species. Under this assumption, we used the trawl data to estimate the spatial distribution of each species separately using local regression, and then calculated the

biodiversity indices based on the predicted distributions. This second method, unbeknownst to us at the time is similar, though much less formal, than a hierarchical model developed by Gelfand et al. (2005).

These approaches were applied to a set of 23 species, which included: monkfish, cod, winter flounder, witch flounder, yellowtail flounder, plaice, haddock, red hake, white hake, redfish, pollock, dogfish, silver hake, longhorn sculpin, little skate, winter skate, windowpane flounder, herring, lobster, mackerel, bluefish, longfin squid, and shortfin squid. Very different spatial estimates for biodiversity, as defined by species richness, the Simpson's index, Pielou's J index of evenness, and the Shannon-Weaver index, were found under the two approaches.

Biodiversity, based on indices estimated from each trawl varied spatially over time with biodiversity hotspots moving throughout the Gulf of Maine. These hotspots were, however, frequently encountered on George's Bank and inshore near Cape Ann, Massachusetts, but this was not the case for every year. Models to predict these indices based on oceanographic features such as latitude, longitude, depth, and sea surface temperature generally performed poorly, explaining only a small fraction of the spatial patterns in biodiversity. After accounting for these oceanographic features, additional spatial correlation models did not improve our predictive ability.

When biodiversity indices are estimated based on the expected distribution of survey catch from each species, rather than directly from the trawl, the spatial patterns become much more consistent over time with hotspots occurring along the edges of George's Bank and inshore near Cape Ann, Massachusetts nearly every year.

One potential reason for these differences could be related to the fact that the number of observed species has been shown to be a poor estimator of the actual number of species in an area. The second approach is one relatively ad hoc method to get around this when the total number of species that could potentially be at a location is known a priori. But the second approach completely ignores this problem if the total number of species is unknown. The other pitfall of both of these approaches is that they ignore the heterogeneous capture probabilities across the species. These results were then presented at a meeting at UNH, sponsored by the Gulf of Maine CoML program at the University of Southern Maine, which took place on September 28, 2005. The meeting was attended by Drs. Cooper and Linder, Dr. Lewis Incze (USM), Dr. Evan Richert (USM), Dr. Ken Frank (DFO), Dr. Bob Branton (DFO), and one other DFO representative. Andy Solow (WHOI), Jason Link (NMFS), and Michael Fogarty (NMFS) were also invited, but unable to attend. The presentation generated a great deal of discussion along with suggestions on the directions for future research.

One outcome of this meeting was a new collaborative project funded by GoMA: "Quantitative approaches to assessing the spatial distribution of species richness in the Gulf of Maine," with Dr. Cooper and Dr. Andrew Solow (Woods Hole Oceanographic Institute) as co-PIs that will begin this fall. This new project will develop more formal statistical approaches that overcome some of the pitfalls of the previous methods.

Coastal Working Group - Michelle Dionne and Lew Incze convened the first meeting of the coastal working group Gulf of Maine Research Institute, September 12-13, 2005. The meeting objectives were to identify knowledge gaps, research themes, and hypotheses regarding the ecological elements and processes that create, maintain or benefit from coastal biodiversity in the Gulf of Maine. The discussion and outcomes were framed within the context of ecosystem-based management, in keeping

with the Gulf of Maine Program's theme of *exploring* and *explaining* biodiversity patterns, and *applying* the knowledge gained to support sustainable ecosystem management.

5. EDUCATION & OUTREACH

GoMA COML education video– As a result of the quality footage produced by videographer Matt Cadwallader, who accompanied the Platts Bank Research Cruise in 2005, GoMA produced a 10 minute educational film on the work done by Gulf of Maine scientists, their research methods and objectives, and its relationship to biodiversity and the global Census of Marine Life. The video has been reproduced and distributed in conjunction with the Gulf of Maine Research Institute's educational program which reaches every middle school student in the state of Maine. In 2006-7, over 7,500 fifth-grade students will receive a CD with this video featuring COML's logo and message. The video will be finalized and distributed widely in 2007.

New website development – The GoMA website serves as the primary tool for communication and hosts the products and datasets of multiple contributors, this was determined to be the primary focus of the outreach development for 2006. GoMA formed a small team of staff to identify our goals and objectives, primary audiences and target niche amongst other websites. The new website will allow staff to update the content of the site on a regular basis, and be maintained by a new half-time web designer, Jennifer Ecker, dedicated to the project. The site will be finalized by the end of 2006.

National Marine Educators Conference – In January 2006, GoMA was invited to join the Gulf of Maine Marine Educators Association and planning committee for the national conference to be hosted in Portland in July 2007. Assistance to date has included meeting facilitation, program planning, and inviting COML affiliates, and Ron O'Dor, Chief Scientist to the conference next year.

Other E&O work ongoing or in progress:

- Feature article on Gulf of Maine program by award-winning journalist and *Lobster Coast* author, Colin Woodard, <http://www.colinwoodard.com/index.html>
- Curriculum development – Preliminary discussions with faculty and staff at University of Southern Maine, Southern Maine Community College, Coastal Studies for Girls, Gulf of Maine Research Inst., and Cornell Shoals Marine Lab, .
- COML liaison work – Preparation of news releases, media coverage summaries, how-to guide to news releases, survey for educational tools, photo credits and captions; annual report highlights, milestones, presentations at annual meetings (Frankfurt); phone conferences (e.g., Smithsonian Exhibit); and other E&O projects as needed.
- Gulf of Maine Research Institute liaison – assistance in GMRI's grand opening celebration, Fall 2005, and first public lecture series, Fall 2006
- GoMA Science Plan – preliminary draft for publication in November 2006

Gulf of Maine Biogeographic Information System: Mapping Products for the Website¹

- *Taxa Abundance and Distribution Maps* for select commercial species were mapped according to the catch weight of the Spring and Fall NMFS (National Marine Fisheries Service) NEFSC (Northeast Fisheries Science Center) surveys and were made available through the Dynamic Atlas website. The maps can be viewed as a slideshow by year or decade.

- *Atlantic Cod (*Gadus morhua*) Distribution and Abundance in Relation to Bottom Temperature at the Time of the Fall Survey, 1963-2004* maps and figures were produced and will be available for the public through our new website. Data are from NOAA's Northeast Fisheries Science Center (NEFSC), Woods Hole, MA. Only tows meeting NEFSC criteria for standard tows were included. Staff consulted with Michael Fogarty and David Mountain of the NEFSC.

- *Atlantic Wolffish (*Anarhichas lupus*) Abundance and Distribution in the Gulf of Maine* are a series of maps that illustrate the number of individuals caught by the NMFS survey in relation to the WWF (World Wildlife Fund) substrate layer that was published in their 'Classifying And Mapping Physical Habitat Types (Seascapes) in The Gulf of Maine and The Scotian Shelf: Seascapes Version to May 2003'. Figures of the tows by substrate over time and of the habitat regions will be made available through the new website.

- GIS analysis and display of the Platts Bank data from the 2005 cruise, including 3D modeling of multibeam bathymetry (courtesy of Larry Mayer, Center for Coastal and Ocean Mapping/NOAA – UNH Joint Hydrographic Center), transects of the two peaks to compare depths and shapes in relation to krill concentrations and whale feeding patterns, and mapping acoustic data of herring and krill.

Additional products include:

- **Ocean Research Technologies Page** (Foote) – completed, see website
- **Physiographic regions of the Gulf of Maine** (Hayden) – completed, see website
- Maps of currents in the Gulf of Maine and surrounding waters
- Maps and figures of lobster abundance and distribution over time (in progress).

6. IMPACT AND APPLICATIONS

Marine Ecosystem-Based Resource Management

Helping to enable ecosystem-based resource management is the long-term goal of the Gulf of Maine Census. This will be accomplished by:

- Expanding our knowledge of regional biodiversity and the processes that affect it;
- Understanding how biodiversity affects ecosystem functions such as elemental cycling, food web maintenance and fisheries production;
- Defining linkages between basic information and management applications that have the interest and support of both communities;

¹ <http://www.usm.maine.edu/gulfofmaine-census/>

- Establishing database services, including integrated and ongoing ocean observing collaborations, that provide the information necessary to support EBM (monitoring and research);
- Advocate for the funding necessary to do the above.

Ocean Observing Systems

The Gulf of Maine Census is explicitly recognized as the biological component (upper trophic levels) of the integrated ocean observing system in the Gulf of Maine region. In pursuit of this role, the program is demonstrating:

- How to develop the institutional means for the dynamic sharing and combining of biological and physical oceanographic data bases essential to a truly integrated ocean observing system. With the biological component, the ocean observing system is assisted in meeting two of its overarching goals: protection of coastal marine habitats and sustained use of marine resources.
- How to take advantage of the evolving integrated ocean observing system in the region to build a long-term home for the Gulf of Maine Census’s biogeographic information system and a capable data access and integration system.

7. PARTNERSHIPS

a. Related projects

Project Name	Principal Investigator	Geographic Locale
None at present, although there are discussions of a possible effort in the Gulf of Mexico. We are also sharing ideas with the North Pacific Research Board.		

a. Links Within CoML

Project Name	Principal Investigator	Nature of Relationship
Mid-Atlantic Ridge Ecosystem (MAR-ECO)	Michael Vecchione (participating scientist in MAR-ECO)	Biogeography from Mid-Atlantic Ridge to the New England Seamounts
History of Marine Animal Populations (HMAP)	Andrew Rosenberg, UNH	Gulf of Maine Census assisted in the funding of HMAP research on cod in the Gulf of Maine
Future of Marine Animal Populations (FMAP)	Jeremy Collie, URI (FMAP Steering Committee member)	Gulf of Maine Census maintains an official liaison (through Jeremy Collie, URI) with FMAP
NaGISA	Robin Rigby, Director	Preliminary discussion on linking GoMA and eastern US to NaGISA/HMAP initiative

b. External Projects

Project Name	Principal Investigator	Nature of Relationship
Gulf of Maine Ocean Observing System (GoMOOS)	Philip Bogden, CEO	Partners in developing a system of dynamic data sharing; future home of GMBIS; host of Gulf of Maine Ocean Data Partnership
Gulf of Maine Ocean Data Partnership	David Mountain, Northeast Fisheries Science Center, Chair	Gulf of Maine Census launched and funds the partnership to provide the framework to access the data that will describe and explain diversity and distribution of life in the Gulf.
Discovery Corridor	Peter Lawton, DFO-Canada, Coordinator	Financial supporter and member of Steering Committee
Gulf of Maine Mapping Initiative (GOMMI)	Susan Snow-Cotter, Massachusetts Coastal Zone Management Program, Chair	Formal cooperators in GOMMI