Out of the Fog: Furthering the Establishment of an Electronic Environmental Information Exchange for the Gulf of Maine

A New England Aquarium Aquatic Forum in partnership with
the Gulf of Maine Council on the Marine Environment

Wednesday, November 4, Thursday, November 5, and Friday, November 6, 1998
Conference Center, New England Aquarium
Boston, Massachusetts

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For information on how to receive copies of this publication, please contact the New England Aquarium, Conservation Department, Central Wharf, Boston, MA 02110 or email conserve@neaq.org.

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We would also like to thank our other sponsors who provided in-kind support: the Atlantic Coastal Zone Information Steering Committee (ACZISC), Coastal Network of the Gulf of Maine, Collaboration of Community Foundations for the Gulf of Maine, Conservation Law Foundation, Department of Fisheries and Oceans, Canada, Environment Canada, Global Programme of Action Coalition for the Gulf of Maine, Gulf of Maine Marine Educator's Association, Maine Department of Marine Resources, Maine State Planning Office, Massachusetts Coastal Zone Management Program, MIT Sea Grant College Program, and the Regional Association for Research on the Gulf of Maine.

We are extremely grateful to our speakers for sharing their expertise and setting the stage for useful and interesting discussions: Paul Boudreau, Michael Butler, Dean Meggison, Bruce Tripp, Lissa Widoff, John Evans, David Keeley, Richard Signell, Elaine Brown, Paul Orlando, Christine Manninen, Drew Parkin, Robbin Peach, Thomas Siegel, Peter Shelley, Rob Stuart, and Jed Wright.

We thank the New England Aquarium staff who made the workshop run smoothly, from beginning to end: Elizabeth Coleman, Tracy Cassidy, John Hurley, Tim Kannally and Hal Wagner. Cynthia Nichols and Michelle Sweeney of the Conservation Department were instrumental in keeping the workshop running smoothly, and Margie Kelly provided support in the preparation of the Final Report.

Finally, we would like to sincerely thank all of the participants who took time out of their busy schedules to attend, as their extensive knowledge, interest and insights into the various issues under discussion was what made this a successful workshop and, we hope, a valuable contribution to furthering communication and information exchange in the Gulf of Maine.

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Executive Summary

The *Out of the Fog: Furthering the Establishment of an Electronic Environmental Information Exchange for the Gulf of Maine* workshop, a collaborative effort between the New England Aquarium and the Gulf of Maine Council on the Marine Environment (GOMC) was held on November 4-6, 1998 at the New England Aquarium. This bilateral meeting between the United States and Canada attracted 55 participants from a variety of backgrounds, including, commercial fisheries, watershed management, aquatic science and education.

Much progress has been made towards establishing a vision for the Gulf of Maine through the work of the GOMC, the Global Programme of Action Coalition for the Gulf of Maine (GPAC), the Regional Association for Research on the Gulf of Maine (RARGOM) and other regional efforts. As a result, a number of priority areas have been identified. With input from the GOMC's Working Group and the Data and Information Management Committee (DIMC) an immediate need to improve data and information exchange among interest groups was determined. A Steering Committee was formed consisting of federal, state and provincial managers, scientists, environmentalists and marine educators to plan a workshop to address this issue.

Recognizing that a number of independent efforts to develop a data and information exchange are at various stages in the Gulf of Maine, the purpose of this workshop was threefold: 1) to explore interest in and the feasibility of establishing a more unified network for exchanging information and data about the Gulf of Maine; 2) to examine regional initiatives from other areas of the country; and 3) to identify the best approach and develop an action plan for establishing a regional network for the Gulf of Maine, should the group agree that it was needed.

Over what amounted to two-full days of discussions, participants shared their experiences about local initiatives to establish electronic information exchange systems via the Internet. Participants had been involved in a variety of initiatives aimed at specific user groups including the NGO community, state and federal environmental managers and scientists. Participants also took part in a hands-on computer session to familiarize themselves with various Internet search tools and existing information systems. Several speakers from around the country shared their challenges and successes in establishing regional information and data systems. Possible funding opportunities and approaches for promoting electronic information exchange in this region also were discussed.

Prior to the workshop, a regional survey was administered to gather input from various interest groups about their values, concerns and information and data needs. The survey targeted the NGO and education communities, in particular, because these were identified by the GOMC and RARGOM as target user groups in expanding their existing efforts. Preliminary findings from the survey, which continued to be distributed and tallied through December 1998, were presented as part of the workshop. In addition, a one-page Vision Statement was crafted, based on survey findings and a review of existing literature prepared by active regional interest groups.

WORKSHOP FINDINGS

There was overwhelming consensus that access to and sharing of Gulf of Maine information and data should be maximized through linkages among local initiatives. Most participants supported the notion of centralized access (i.e., a portal or a front door) to information. However, ultimate responsibility for compiling, posting and maintaining information and data should lie with respective interest groups. A large majority of participants stressed the need for a two-way exchange of information, adequate training for network users and a bottoms-up approach to network development. While a number of people seemed to favor adoption of a system like the Great Lakes Information Network (GLIN), it was recognized that GLIN had enormous set up and maintenance costs. The group favored an incremental approach to build on the progress made by existing initiatives and to minimize costs. This type of approach was favored, however the group recognized the inherent problems of systems sequencing that can occur.

A concern was expressed that creating a portal or front door with options for people seeking information and/or data, would require some synthesis, which is subject to misinterpretation. It was decided that some of the burden of synthesis would be diminished with a bottoms-up approach, whereby interest groups would be instrumental in generating and maintaining their own information and data. In addition, it became clear through a number of discussions that, due to limited government and foundation moneys, a regional network must be self-sustaining.

Ultimately, the group felt that a regional electronic information and data exchange would help improve resource management decisions by empowering people through increased efficiency in information and data distribution.

The group adopted two overarching goals, should an electronic Gulf of Maine information exchange be promoted:

1. To provide a mechanism for communication and information (possibly data) exchange among existing efforts in the Gulf of Maine; and

2. To make Gulf of Maine information and, at some level, data more accessible to a diversity of user groups.

In addition, the following points were identified as important elements of a regional network:

- Post useful information and use disclaimers;
- Encourage data holders to post and describe products, information and data that is available;
- Limit data sets and links to Gulf of Maine;
- Be adaptable;
- Never have “under constructions;”
- Give contributors format flexibility;
- Make it user-friendly for all interest groups (especially fishermen, managers and communities);

- Create an intuitive interest/issue roadmap on the “front door” that allows users to quickly head down their path of interest/expertise;
- Do not be afraid to experiment;
- Use technology that can degrade gracefully for alternate accessibility (e.g., web-TV, box-phone system-printed material);
- Use XML for data/content interdependence - create tools that lead to open interfaces;
- Empower users to ask better questions; and
- Balance technology with ease of accessibility (good content versus bells and whistles).

ACTION STEPS

A number of possible action steps were identified as a follow up to this workshop including:

- Identify interested partners – those who are willing to leverage resources to provide initial support for an information/data exchange network.
- Efforts must be undertaken to gain management level buy-in within respective organizations to ensure their willingness to share information and data. Perhaps a Memorandum of Understanding (MOU) should be generated to solidify participation in network.
- Establish an Action Committee, representing relevant user groups, to further the effort resulting from this workshop towards the establishment of a regional electronic information and data exchange.
- Involve designers, programmers and system architects in strategic planning.
- Identify an institutional leader to get things rolling.
- Create an *Out of the Fog* listserv, or alternatively, use an existing listserv such as Gulftalk as a forum for continued communication on this topic.
- Create a mailing list for all participants who have websites; include webmasters' contact information.
- Review existing web links and annotate for different users.
- Assess strengths and weaknesses of current databases.
- Survey potential partners for useful sites to link.
- Begin to link existing Gulf of Maine initiatives through low cost means.
- Incorporate a "silly-word" metatag for *Out of the Fog*, such as "*OOTF*," to help search and to articulate partners.
- Conduct a gap analysis of existing data/information on the Gulf of Maine based on an initial identification of user groups.
- Consider focusing initially on major nodes.
- Conduct an analysis of the quality of existing tools or search engines for Gulf of Maine.
- Conduct a more extensive user group survey to include fishermen and marine educators.
- Consider establishing a webring.
- Conduct an in-depth review of regional efforts, particularly those that were represented at the conference, to evaluate their application to Gulf of Maine.

- Ask participants who are involved in the establishment of information/data networks/systems to characterize their users.

- Prepare a strategic plan:
  - Define goals and objectives and prioritize action steps generated during the workshop;
  - Consider issue-specific applications for this system in order to make it more attractive to potential funders; consider one of the three issues identified during user group survey: overfishing, loss of regionally significant coastal/marine habitat and coastal development;
  - Identify ways to link people with people.

- Conduct on-site assessments of user groups' computer literacy/how they use the Internet, their needs and make them aware of what is available on the Internet (e.g., training). Plan and implement workshops for identified user groups to be run by nonprofit organizations.

- Develop quality control criteria/standards.

- Develop a plan for sustainable funding:
  - Conduct a market survey to assess people's willingness to pay, once the level of service being offered has been determined;
  - Define tasks incrementally and fund each task separately in the beginning;
  - Conduct a cost analysis. Be realistic and include all real costs. Core costs need committed funding for 3-5 years minimum;
  - If a fee-based system is chosen, consider developing a scale of costs depending on the level of information that the data user is seeking. Reasonable supporter fees including a sliding scale and in-kind support should be stipulated.
  - Leverage in-kind contributions from users to reduce costs;
  - Encourage participants to include support in project funding budget overhead;
  - If advertising is considered as a revenue model, get feedback from commercial efforts that rely on online advertising revenue;
  - Look into taxpayers funding (i.e., the Library of Congress and local libraries are funded - why not this?); and
  - Earmark some funding for technology dreaming (e.g., prototype ideas, testing, and implementation), solicit feedback, and repeat efforts, realizing that this could be at a considerable cost.

- Develop a seal of approval that is used by all network members to aid in quality control.

- Centralize search utility and indexing (AltaVista, e.g., 4NR).

In subsequent correspondence with workshop participants, an Action Plan was finalized and the following priorities and deadlines were proposed:

Action Items for Gulf of Maine Information Exchange				
#	***Task***	***Lead Responsibility***	***Proposed Deadline***	***Objective***
1	Outreach and education	All	Ongoing	Contact librarians, retirees, community groups not presently included
2	Run workshops, circuit riders, communicate	Various	On-going	Build capacity and awareness for electronic information exchange
3	Establish/promote listservers, discussion groups, etc.	All	On-going	Promote awareness of web tools to link people with people
4	Publish *OOTF* report	New England Aquarium	March 1999	Provide information and invite discussion from a wider audience
5	Distribute *OOTF* results	All agencies	March 1999	Promote participation from a wider audience
6	Develop terms of reference for Action Committee	Action Committee	March 1999	Get limited agreed set of tasks for Committee
7	Carry out a strategic planning exercise for information exchange	Action Committee	June 1999	Develop agreed vision, principals, objectives, and coordinated action among participants
8	Articulate: Valued sites, users, tools, requirements	All	June 1999	Answer outstanding questions about need for information exchange and existing resources
9	Identify an institutional leader	All	June 1999	A champion that is acceptable to participants
10	“Silly-Word” proposal	Paul Boudreau	June 1999	Investigate methods for using existing web tools to meet user needs and test concept
11	Carry out cost/benefit analysis	Action Committee	December 1999	Discover the costs and benefits of action versus no action
12	Develop “Seal-of-Approval” mechanism	????	December 1999	Identify useful and well-designed Gulf of Maine websites
13	Implement central search facility	Action Committee	December 2001	Provide single entrance to Gulf of Maine information

In addition, the Action Committee was organized and charged with implementing some of the immediate recommendations generated as a result of this workshop and subsequent correspondence among participants. The Action Committee consists of the following individuals:

Paul Boudreau, GOMC Data and Information Management Committee
Chris Brehme, Island Institute
Norval Collins, CEF Consultants Ltd.
Patrice Farrey, New England Aquarium
Will Hopkins, Cobscook Bay Clam Restoration Project
David Keeley, Maine State Planning Office
David Lincoln, Massachusetts Fishermen's Partnership
Massachusetts Coastal Zone Management Office representative
Dean Meggison, Gulf of Maine Marine Educator's Association
Jeannie Meggison, Gulf of Maine Marine Educator's Association
Marjorie Mooney-Seus, New England Aquarium
Aviva Rahmani, artist
Katie Ries, Global Programme of Action Coalition for the Gulf of Maine
David Sewall, Sewall Holdings, Inc.
Peter Shelley, Conservation Law Foundation
Billy Spitzer, New England Aquarium
Nils Stolpe, New Jersey Seafood Harvesters' Association
Bruce Tripp, Regional Association for Research on the Gulf of Maine
Jim Wilson, University of Maine
Bruce Wyman, New England Aquarium

Vision Statement

VISION STATEMENT AND PRINCIPLES FOR THE GULF OF MAINE

In consultation with the Gulf of Maine Council on the Marine Environment, it was recognized that a number of organizations with a long history of management, advocacy and/or economic development, have already invested considerable energy in developing goals and objectives for preserving and enhancing the ecological integrity and economic value of the Gulf of Maine. As a result, a Vision Statement and set of principles were crafted based on a review of existing literature prepared by various organizations including the Gulf of Maine Council (GOMC), the Global Program of Action Coalition for the Gulf of Maine (GPAC) and from polling diverse interest groups through value and issue-oriented survey questions (Appendix 2). In fact, the first five principles are action plan goals of the GOMC.

The rationale for developing a Vision Statement and corresponding principles was to provide some common ground and a context for future activities to better preserve the watershed. Enhanced communication, information and data exchange within the region was viewed as critical to achieving success in this effort.

The following Vision Statement and corresponding principles were reviewed and revised based on input from the 55 attendees to the *Out of the Fog* workshop.

Vision Statement and Supporting Principles for the Gulf of Maine
The Gulf of Maine sustains a healthy marine and coastal environment with biological diversity and abundance together with a strong economic and cultural base.

Supporting Principles (not prioritized)

- Coastal habitats throughout the Gulf of Maine are healthy and support an appropriate abundance and range of plant and animal species.
- The Gulf of Maine is known for its clean marine environment. Its shoreline and waters are free of marine debris, and are healthy for people and wildlife.
- The Gulf of Maine has productive fishery resources that meet human needs and maintain ecological integrity.
- Toxic contaminants in the marine food chain of the Gulf of Maine are at levels such that public health is protected and ecosystem integrity is maintained.
- Gulf of Maine shellfish habitats produce shellfish safe for human consumption.
- Public education and involvement is assured by timely, accurate, and accessible information and data on all activities that may significantly affect the watershed and its resources, habitats and ecological processes.
- Public access to the Gulf of Maine shoreline, water, and its resources is assured and sufficient.

- The Gulf of Maine is a prosperous, diversified region of sustainable coastal communities retaining viable expressions of indigenous coastal and maritime culture and industry.
- The scientific monitoring processes of the Gulf of Maine are adaptable enough to identify and provide scientifically-based recommendations to address anticipated and unanticipated long-term change, such as the effects of overfishing, global climate change, establishment of non-indigenous organisms, human population growth and changes in coastal settlement patterns.
- The environmental management infrastructure of the Gulf of Maine is prepared to recognize change and respond proactively to protect the watershed.
- Coastal development patterns in the Gulf of Maine are managed to protect ecosystem stability in the long-term by anticipating shoreline changes due to sea level rise, global warming, and other changes in social, economic, environmental patterns.
- Representatives from all user groups respect one another and are willing to work together for the long-term benefit of the Gulf of Maine.

Following this workshop, the New England Aquarium Executive Department intends to more widely distribute the overarching Vision Statement and its corresponding principles for further refinement.

OUT OF THE FOG WORKSHOP VISION STATEMENT

While there was no objection to maintaining idealistic goals and objectives for what stakeholders want the Gulf of Maine to look like in the future, there was agreement that an achievable vision statement was needed specifically for the *Out of the Fog* workshop. The following was crafted to capture the breadth of discussions over the three days of the workshop:

"To create a framework within which a variety of interest groups can work on their own issues (semi-independently), while drawing upon the expertise of other groups as needed to enhance data and information sharing within the Gulf of Maine."

Workshop Proceedings

WELCOME

Jerry Schubel
president, New England Aquarium

I am going to welcome you and acknowledge many people. On behalf of the New England Aquarium, and the Gulf of Maine Council on the Marine Environment, I want to welcome all of you to the New England Aquarium, and to this workshop.

We are delighted to host this discussion. First, I want to thank the Cabot Family Charitable Trust, and NOAA, both of whom have provided funding for this workshop. Then, there are many organizations who have provided technical and financial support which led up to this workshop: Atlantic Coastal Zone Information Steering Committee (ACZISC), Coastal Network of the Gulf of Maine, Collaboration of Community Foundations for the Gulf of Maine, Conservation Law Foundation, Department of Fisheries and Oceans, Canada, Environment Canada, Global Programme of Action Coalition for the Gulf of Maine, Gulf of Maine Marine Educator's Association, Maine Department of Marine Resources, Maine State Planning Office, Massachusetts Coastal Zone Management Program, MIT Sea Grant College Program, and Regional Association for Research on the Gulf of Maine.

We have also had the benefit of a very dedicated Steering Committee who helped shape the content, goals and objectives for the workshop. They also assisted in the distribution of the survey, which is very important, because we are trying to find out what stakeholders value in the Gulf of Maine, the values and uses that they want to protect, and what the information and data needs are from their perspective in order to conserve these important values and uses. The members of the Steering Committee were Seth Barker, Paul Boudreau, Genie Braasch, Michael Butler, Alison Evans, David Keeley, Carolyn Levi, Dean Meggison, Marjorie L. Mooney-Seus, Cynthia Nichols, Judith Pederson, Rob Rainer, Katie Ries, Peter Shelley, Susan Snow-Cotter, Bruce Tripp, and Lissa Widoff.

It was just about a year ago when we at the Aquarium wrote a proposal to the Cabot Family Charitable Trust to work with the Gulf of Maine Council, to try to identify opportunities for getting greater stakeholder input on values and uses that were important to them, as well as to enhance the Vision Statement and all of those things that turn out to be terribly important. If you want to conserve things, it is far better to have values and uses that people attach some importance to, than it is to try to manage quality objectives in the absence of the value and the uses that they support. That has been a large part of what we have tried to do to get ready for this workshop.

Now the discussion here is going to concentrate in large measure on the need to improve data and information sharing within the region. There have been many independent efforts that have gone on among scientists, between scientists and managers, and there have been others that have

involved fishermen, government agencies and the NGO community. Somehow we have all of these independent activities but we have not been very successful in bringing them together in any kind of a coherent manner. That is what we are hoping you are going to do over the next day and a half -- to develop strategies that will build on the considerable and important work that has already been done.

Now I want to introduce Peg Brady. Peg is here representing the Gulf of Maine Council, our partner in this effort and she is also the Director of the Massachusetts Coastal Zone Management Program. During the early stages of this project, she was very helpful to us, because at that time, her office served as the secretariat for the Gulf of Maine Council. Much of what has happened is because of Peg's leadership. Peg is a long time friend and colleague of mine. Peg, welcome.

Peg Brady
director, Massachusetts Coastal Zone Management Program and
Gulf of Maine Council on the Marine Environment

Thank you very much, Jerry, for the warm remarks, and welcome everyone. I think this is an outstanding group. I hear it is a very diverse mix. I see some faces that I have met in the past. It is good to see that the New England Aquarium and the Steering Committee were so successful in bringing together this group. Again, being a representative from the Council, I would like to offer a challenge to the folks here for the next couple of days.

As you know the Council has been in existence since 1989. Its representatives come from the five jurisdictions that border the Gulf of Maine. These are representatives of the provincial and state governments that border the Gulf of Maine, along with some private sector representatives. We have a new poster that was created and is available here if anyone wants to take a look.

We have honed our action plan to focus in on a couple of areas that I think will be encompassed in the themes over the next few days. We have been successful in securing some funds to finance these initiatives, both through funds that were awarded to the Council as a group, and also by leveraging our own dollars. The Coastal Zone Management Program has leveraged a number of dollars out of our own federal grants towards these collaborative initiatives. I am happy to say that we learned recently that with the budget passed by Congress just a few weeks ago, the Council has been awarded another half a million dollars through the NOAA budget.

The money is targeted at some very specific initiatives that the Council has all agreed on, and I just want to cite some of those projects that we have been working on collectively, such as The Gulf of Maine Times. Some of you, I hope, are reading this publication. If you are not, please get on that mailing list. It is an extraordinary newspaper that has been developed over the last year and a half. I think it is, again, an opportunity to share information on issues that decision makers are dealing with around the Gulf. We also developed a very successful mini-grant program that helped citizen's groups either to develop monitoring initiatives, or assist their outreach activities at the grassroots level. We would like to reinstate that program again with these new funds from Congress.

We have also had the Gulf Watch program in place. Some of you have been participating in this program within your own jurisdictions, and have been extremely supportive. This is an example of jurisdictions leveraging their own dollars to support a program. The Council will continue to assist with these new funds that were recently made available. Again, of course, we will support the data management piece of what the Gulf of Maine Council has been developing over the last six years as well.

So we are very happy and we want to acknowledge a strong supporter, who actually was Governor of New Hampshire at the time the Council was formed, and signed that contract among the Premiers and the three Governors. He is now Senator Judd Gregg, who was essentially the leader in Congress and who was very effective in securing these dollars for the Gulf of Maine Council.

So again, the Council is looking for your input. We do not necessarily feel that these programs as they are designed are locked in stone. We look for your input in improving information sharing. We can always improve that. Obviously that is a part of the business and I think there is always plenty of room for improvement, so we look for the outcome that you develop here over the next few days. Again, I thank you, and I welcome you here to Boston, and Massachusetts.

WORKSHOP GOALS AND OBJECTIVES

Marjorie L. Mooney-Seus
manager, Conservation Department, New England Aquarium

Good afternoon. I want to extend a warm welcome to everyone. I am Maggie Mooney-Seus of the Conservation Department of the New England Aquarium. Before I introduce our first speaker this morning, I want to provide you with a quick overview of what we hope to accomplish over the next couple of days.

First, I want to start with our primary objective for why we are conducting this workshop, that is basically to develop an Action Plan which builds on the work that has been undertaken in the Gulf of Maine for a number a years by several groups to enhance data and information sharing via the Internet. Many of the groups that are involved in these activities are going to be presenting information over the next day or so, and sharing with us their experiences and the challenges they have encountered in setting up their respective systems.

The purpose here for Day One is to discuss these local initiatives. We hope that today's presenters will share their experiences about existing system capabilities, the limitations of their respective systems, the funding challenges that they faced, the respective client user groups who they are servicing, and the type of information that their client groups are trying to obtain through their respective systems.

This afternoon, we are going to review the results of a user group survey that was distributed to marine educators, scientists, federal and state managers, environmental organizations, and other members of the general public to learn more about what issues they think are really important for the Gulf of Maine, and the challenges that they have encountered in trying to obtain information via the Internet about these and other issues.

This evening we are going to hold a computer session at MIT. Dr. Bruce Tripp of RARGOM and Dr. John Evans of MIT are going to explore the existing mechanisms for obtaining information via the Internet, and they are going to look at coastal development, which is one of three issues identified through the survey as important to various interest groups.

Tomorrow we will review the findings of this computer session and examine what obstacles, if any, we encountered. This will be followed by a series of presentations by individuals from outside the region who will explain the challenges and successes that they have had in setting up information systems throughout the country. The rest of the day is going to be spent determining a course of action for the Gulf of Maine region. Should we try to link existing regional efforts? Should we try to create an issue-based prototype system for the region where numerous user groups can access various levels of information and data about a given topic? Should we do nothing, allowing the systems that are currently in place to develop independently of each other, or should we undertake a variety of activities and create a hybrid approach? Our remaining time on Day Two will be devoted to creating this forward thinking Action Plan based on what we have heard from our speakers and on discussions over the previous day and a half. On Friday,

we will finalize the Action Plan, and try to create a funding strategy with input from members of the NGO and funding communities. That is basically the directive for the next couple of days.

In your registration package, there is a survey, which we have referenced a few times. For those of you who have not filled it out, we would appreciate it if you would fill it out, because we are still compiling the information.

We are also going to be administering the survey in a couple of different workshops and other venues over the next couple of weeks, through the end of December. The final results will be tallied and incorporated in the final report of the proceedings with this workshop.

I want to thank the Conservation Department Staff including Cynthia Nichols, Patrice Farrey, Heather Tausig and Michelle Sweeney. They have all put in a considerable amount of time and energy over the past couple of months coordinating the logistics for this workshop. I think they definitely deserve a word of praise. I would also like to echo Jerry's earlier comments and thank the Gulf of Maine Council for their support in putting this event together. In addition, I want to thank our Steering Committee who helped to develop the content and identified speakers.

OVERVIEW OF GULF OF MAINE INFORMATION SYSTEMS

Paul Boudreau
Canadian co-chair, Data Information Management Committee, Gulf of Maine Council on the Marine Environment

I am a habitat ecologist with the Canadian Department of Fisheries and Oceans. My primary activity is to carry out environmental impact assessments on coastal and marine ecosystems. This task has a high demand for data and information that is most often held by other researchers, requires special expertise and often requires summarization. It is from this point of view that I am interested in exchanging environmental information about the Gulf of Maine and from which I will speak today. I am very optimistic about this workshop, and very much look forward to these next couple of days to find ways to access data and to provide information to people within the Gulf of Maine region who are addressing similar types of questions.

Let us start with by imagining a person on a wharf looking out into a fog. This "electronic fog" is the result of too many technical details and terms. Such things as "ISP", "WWW", "FTP", etc. I say a person because it could be a fisherman, but equally he/she could be a governor, a councilor, a manager, a tourist, or any one of a very large number of people that have an interest in environmental information on the Gulf of Maine. This person typifies the problem that the Data and Information Management Committee of the Gulf of Maine Council (DIMC) has tried to address over the past decade and what I think should be the focus of the next couple of days. This person is not a techie or else he would not be out there, rather he/she would be home checking the Web for the weather forecast for fog before making the journey to the seashore. The challenge is to provide the non-techie with tools that allow him or her to access the relevant environmental information without having to spend months learning protocols, data standards, programming tools, etc.

Specifically, regarding the DIMC, this Committee began seven or eight years ago. This is a relatively long time in the field of electronic data and information management. At that time, the "man on the wharf" was analogous with the Working Group and Council members. The Committee was set up to try to meet their needs in information exchange and to support the production and maintenance of the Council's data and information system. The Council is primarily a governmental body, and as such, has no lack of data. It represents various departments of the state, provincial and federal governments that have a lot of data as well as interested clients. The problem often has been how to provide it in a useful manner.

When the DIMC was started, it was in the years when the Internet was just beginning. The techies and scientists at research institutes such as my own, the Bedford Institute of Oceanography in Canada, were already sending emails around the world, co-authoring papers online with colleagues in far off places such as Europe, Australia, etc. The Internet was there, but it certainly was nowhere near the tool that it is today. Nor was its potential for communication and information exchange fully recognized.

When we began, the DIMC members used an email system provided through the Massachusetts Coastal Zone Management Program office here in Boston. Committee members in Nova Scotia and New Brunswick were making long distance phone calls to Boston to check their email. It did work, but it certainly was awkward compared to what is now available on everyone's desk. In hindsight, so much of the early efforts were just prototypes of the present, easy-to-use browsers. We were struggling with things that no one could easily answer.

One task that we addressed was the feasibility of data directories and the question, "How do you make a list of data, put it online, make it useful to people?" The people that had the data knew what they had, they knew their needs and they knew where to find it. It was the people who did not have direct access to other's data that was a real challenge.

Another effort carried out by the DIMC was a users-need survey. There was a question about who needs what. It is an on-going task to know who the clients are and what will meet their needs.

In terms of an actual information system, another initiative of the DIMC was the Environmental Data Information System, known as EDIMS. EDIMS was an initiative to try to put some data online, work out some of the bugs, and see if it would work. I am proud to say that much of the data that originally went into the EDIMS system still exists online, either at the original site at the University of New Hampshire (http://rossby.unh.edu/edims/) or at the Gulf of Maine Council's homepage (http://www.gulfofmaine.org/index.html). It has shown continuity over the years. This experience highlights a point that will come up later in this workshop, that is, the difficulty of maintaining data in a useful form when technology is changing at a very rapid pace.

One thing that we have learned over the history of the DIMC is that there is a lot of data out there, and it is possible to provide easier access. Before I left my office to come to this workshop, I was able to check today's sea surface temperature for the Gulf of Maine that is still being updated daily on the Web (http://rossby.unh.edu/datasets/sst/sst.html). I can access this information without having to invest in anything more than a few minutes on the Internet. The ease with which it can now be done does not properly reflect the steep learning curve that went into setting this feature up in EDIMS.

The effort of the Committee was supported financially by the Council and NOAA to a level of about a couple of hundred thousand dollars in direct funds. As important, and possible more important, the members of Committee contributed time and effort to review proposals, collect, compile and provide data, and spent time reviewing and commenting on the results. I will return later to the essential contribution of people's time and effort in the success of the DIMC's work.

In terms of obstacles to the DIMC and its work, in the early 1990s there was limited technology. The Internet was just beginning. Mosaic browsers were just becoming popular. Research institutes had very good connectivity, but there was no such thing as a connection from your home. Another difficulty was making data information management and the Internet technologies relevant to our Council and Working Group members. It was difficult to provide tools that were sufficiently relevant and easy to use. As a result, many thought that work on

information exchange was a task for the techies, not something that they could do on a daily basis from their own desks.

As we all know, we are all busy. Very often it is difficult to take the time to sit back and just learn a new skill. In most cases web users spend their time looking around to see what the Web has to offer, without having it relate to a specific task that is required for your job. When one does have the time and an appropriate question, another difficulty that is often encountered is the problem of too much information. For example, I can readily find out about shrimp aquaculture in Thailand. The search will give it to me and I can investigate it. It is even in English, so I do not have to learn Thai. If I want to find out about shrimp aquaculture in another area, that tends to be a slightly different task. I have tried and been successful, but it can take a significant amount of time to weed through all the irrelevant links to get the information you want.

Of course, the Committee has had some successes. The most important success relates to both the Council's work, and that of the DIMC, in developing cooperation among agencies. When the Council began, there really was not a forum for various agencies to discuss issues on the environment. This was true to some extent both within provincial, state and federal agencies and between the agencies and particularly across international boundaries. The Council has provided an excellent forum to meet, talk and share. I think it has helped foster a very good working climate.

In many ways, the work of the Council has allowed individuals to access data that is publicly available but not very accessible. I have had extensive experience in overcoming organizational hurdles. When I view organizational hurdles, I think of it in the context of my own organization. The Canadian Department of Fisheries and Oceans has 600 employees. There is a lot of data and in general scientists are very protective of their data. Although the data exists it may be very difficult to access. In some cases the work of the Council, and its broader geographic perspective, allowed the data to flow more freely within my own department. The Council's support for the East Coast of North America Strategic Assessment Program (ECNASAP) (http://www-orca.nos.noaa.gov/projects/ecnasap/ecnasap.html) allowed the compilation of data among a number of Canadian and U.S. agencies. The real-time sea surface temperature data available from EDIMS now allows everyone to access a selection of NOAA's data without having to call, fill in a form or anything like that. We are still benefiting from it and will continue to benefit from the cooperation in the future.

Another success of the Council is that there is a well-defined and committed user group. The Working Group and Council members provide a good cross section of people requiring government information that are not usually included in discussions on data and information exchange. As an example I can refer to my own Regional Director General. These people commit to come for a few days and hear about environmental impacts and environmental concerns. We have been able to use that forum to promote the general concept of data use and data sharing.

I think that the challenge is still there from the Council's point of view, to maximize the benefits of government information and data. Government data is publicly supported and there is a lot to

be gained by getting that information and data to the widest audience. There are often multiple uses for any particular data set. I am in favor of expanding those uses. I am in favor of providing as much information as possible to see what innovative ideas and solutions can be generated.

What are the keys to success in the future? In real estate, there is a statement that summarizes success -- location, location, location. I think the key to the future success of information exchange in the Gulf of Maine is people; people, people, people. I cannot stress this enough.

The Gulf of Maine geographic region provides a fairly well defined area with residents sharing some common interests and concerns. This is very useful in identifying a client base and products that will meet a real need. With effort, the people in this room can identify who is required to make this happen. I am very pleased that this meeting includes such a diverse representation from government, education, research, fishers groups and the community groups. This is the kind of broad client base that is needed to support the required work.

All of the ideas that I have presented have been discussed in the past at DIMC meetings. I think the Committee has been generally moving towards a broader goal that fits very nicely into the shared objectives of the *Out of the Fog* workshop. The initiative needs to include the many users groups who share a common interest in environmental information.

In closing, I would like you to imagine our little person standing on the wharf now a little happier. Now, out in the fog there is a lighthouse to provide some guidance on directions forward. There is a lot that I could do with this analogy, but I will not take too much time. I will note that in comparison, what I think we should be striving to provide the “person on the wharf” are things that no one else is providing. That is, direction and guidance. The computer industry is developing new software and new hardware; governments, researchers and community groups are already collecting data and information. What is needed is a way for the broader Gulf of Maine community to use these tools to cooperatively find and usefully exchange information. By analogy, we should build a lighthouse, not boats and fishing gear. The task is to use the technology that is available to maximize benefits. Thank you.

Michael Butler
chair, Atlantic Coastal Zone Information Steering Committee (ACZISC)

Good afternoon. Thank you very much for inviting us. Actually I am slightly surprised to be here because at 2:00 a.m., I and two colleagues, Claudette LeBlanc and Brad Fay were driving around downtown amongst cranes and bulldozers trying to find the hotel.

I am going to tell you about the evolution of the Atlantic Coastal Zone Information Steering Committee, also known as ACZISC. The Atlantic in this context refers to the four Atlantic Provinces, namely, Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick. The ACZISC was born about six years ago under the aegis of the Council of Maritime Premiers.

At that time a number of us sitting in this room were Council staff operating in Amherst, Nova Scotia. We were overwhelmed by the number of coastal zone mapping projects; there were so many. Out of this chaos was organized the ACZISC in 1992. If you can imagine the millions of dollars that have been devoted to coastal resource mapping over the last 20 years, we could probably finance the reconstruction that is going on in this neighborhood. (Editors note: refers to Boston's Central Artery Project).

The mandate of the ACZISC was reasonably clear: to provide a focus and forum for the development and coordination of a regional coastal information infrastructure and more recently the promotion of integrated Coastal Management in Atlantic Canada. It seems reasonably easy to describe, but as you all know, extremely difficult to implement.

In 10 minutes, as you might guess, my presentation will have to be cursory. Hopefully you picked up the ACZISC information sheet on registration (Appendix 3), which provides a reasonably succinct summary of what I will be talking about.

We have a comprehensive membership: seven federal departments, the four Atlantic Provinces, academia, the private sector, First Nations and representation from some community groups. Coordination and leadership is provided by a Secretariat. I have the pleasure, with Claudette LeBlanc, of being part of that Secretariat. To achieve our objectives, we developed a workplan with four focal points. A key element of the workplan was the development of a metadata directory. The directory is searchable, and at the moment, we are in the process of trying to ensure that we can update the directory online. Other components of the workplan relate to data exchange and standards, coastal mapping as a resource management tool and an inventory of coastal mapping in Atlantic Canada. This information is online, and is regularly updated; this takes a tremendous amount of time and dedicated people. Communications are fundamental to this process (Figure 1). Communication tools, as Paul Boudreau has mentioned, were relatively limited until quite recently. A lot of methodology has been developed over the last five or six years, since the introduction of the Internet.

We are very proud of our website; Claudette LeBlanc is our webmistress. To keep in communication with our clientele and members, we also have a monthly email Update which is short, succinct, and to the point.

Atlantic Coastal Zone information sheets, of the sort that you picked up at the registration desk, are distributed at all relevant conferences (Appendix 3). The most recent one was Coastal Zone Canada '98 in Victoria, British Columbia, which I believe some of you attended. A more detailed ACZISC "Project and Program History" is also maintained to ensure that we retain our corporate memory.

The minutes of quarterly meetings, workshop reports, discussion groups, etc. are all important to the information and communication process.

The ACZISC website, has 3,000 hits a month of which 2,000 are ascribed to the metadata directory. We monitor this very closely. The inventory of the Atlantic Coastal mapping projects is also extremely popular. We link to numerous other websites.

We believe that the coastal communities are absolutely critical to the economy of Atlantic Canada. We are now providing them with a venue through the Atlantic Coastal Community Update, where they can post information on the ACZISC website.

We have encountered many obstacles in pursuing our mandate. Paul Boudreau spoke about some of them. In terms of successes, we are extremely pleased with the mix of people, expertise and disciplines that are participating in the activities of the ACZISC. Communication between the various disciplines and sectors has been increasing over the past years; this is an important component of our success.

Our time scale is six years and counting. The precise financial investment associated with the ACZISC is difficult to evaluate. However, we know how much the Secretariat costs to operate. We also know how much the metadata Directory costs. Since our inception in excess of one million dollars has been devoted to personnel and activities. The in-kind support has been very significant.

We service a disparate user community. However, we have been less than successful in reaching out to the coastal community groups. To involve them practically is a very difficult task, and we are still struggling with that particular aspect. True "user friendliness" in relation to the information management technologies I have mentioned is absolutely essential.

Thank you very much.

FIGURE 1. ACZISC Communication Tools

Dean Meggison
educator, Gulf of Maine Marine Educator's Association (GOMMEA)

Good afternoon. I am wearing a couple of hats here today. I think I am the techie in the first batch of speakers because I built a website for the National Marine Educator's Association (NMEA), literally, from the ground up. I am also representing K-12 educators for the end user approach. It is an interesting mix of responsibilities, I think.

Primarily what I am going to be talking about are the trials and tribulations of a web presence creator. I am a full-time high school physics teacher, but one of my main loves has always been marine science and marine education. I have been a member of NMEA for quite some time. When they decided that they needed to build a web presence it fell to me as Chair of the Technology Committee. It was an interesting challenge to put together a group of people to see what we could do with no budget.

We were very lucky. We had three or four people who had some amount of experience either using the Web, noodling with the Web or at least knew what the Web was. Between the four of us, we came up with a reasonable plan to start the activities. Since I had a friendly neighborhood service provider practically right next door, I was able to impose upon them to let us use their facilities as a test bed. They set us up a virtual web presence with a mere five megabytes of space for a relatively nominal fee. You can build yourself a web presence with very little outlay, as long as you are willing to be fairly small and not do a lot of fancy graphics and Java work, like scrolling things coming by, leaping dolphins and everything else. We were able to do this for about two hundred and fifty dollars, including the production of reference materials.

Our website became www.marine-ed.org. It came into existence about two and a half years ago, and has been chugging along ever since. I am no longer the webmaster, but went back to visit my little fellow a while ago and noticed that it has come along rather nicely. It is kind of nice to watch your kids grow up on the Internet, as it were.

The National Marine Educator's Association website has been taken over by the Virginia Institute of Marine Sciences (VIMS). The website is part of a collaboration between VIMS, National Ocean Service and NMEA in a project called "The Bridge," which serves as an educator's contact to marine education data on the Internet. "The Bridge" now has a number of different access points, links and lesson plans dealing with all the different branches of marine science and marine education.

We tried very hard not to reinvent the wheel on this one. We made use of existing technology, and basically shared freely with everybody and anybody willing to listen, to get suggestions from or steal data, pictures, graphics and general HTML information. As the other speakers have mentioned, we have been asked to talk about obstacles, successes, time investment, money investment, and user groups as a common thread.

Getting past the nuts and bolts of putting together something that really works is not too hard. There is plenty of helpful data and information out there as well as "How To" manuals and

resources. It is kind of hard to cast a net in any direction without pulling up three or four high school seniors or early college people who have extensive experience working on websites and can tell you everything you need to know and then some about what to do. The resources are readily available. The problem is that most of these people, once they get the website up and running, want to go on and do another, or go do something else. The day to day maintenance or the week to week maintenance can become a major undertaking as can keeping the links and data current. The worst thing that can possibly happen is to have someone from the other side of the world drop in on your website and come back a week or two later and see exactly the same stuff. The business of keeping it current is one of the things that made me decide that perhaps being a full-time teacher was job enough, and that the website management should be moved onto other folks.

The other major obstacle we have found was getting found ourselves. It is really easy to go to a search engine like Yahoo or Lycos or whatever, and type in "marine education". You get approximately 2,000 responses to that query on "marine education," and at least 60 percent of those have to do with marine education at Fort Lejune, Guantanamo Bay, and other military responses to marine education. The other 30 percent are on education in general and a small number of your hits, usually way down on the list, have to do with oceans and fish and other critters. So getting found and making sure that your website stands out turned out to be one of the bigger nuts that they are still working on cracking.

As Michael Butler referenced just a minute ago, one of the nice successes that we have had is receiving the information that the Internet service gives us on who is dropping by. We do not get names necessarily, but we do get a lot of information such as when they came, what they were looking for based on how they moved around the site, and also, where they came from, both in terms of country and organization. We know whether they are coming in from a military standpoint, because they are probably looking for "marine education," and Guantanamo and ended up at our place, or they are coming from Europe or a different organization and just stopped by to take look. Based on that information and the number of repeats, you can get some tracking information about whether or not the website is actually doing the job it was intended to do.

My other big challenge, of course, was to keep it user-friendly from an end user point of view. I tried to make it so an elementary school teacher could come in and find some useful information about the National Marine Educator's Association, and then later with "The Bridge," could find some good, solid information. The user groups on our particular websites are primarily education-oriented folks, because we got the word out through the education networks that we are out there, and we are a good place to come and look for information. We also have quite a few people that are starting to find us, such as coastal zone managers, non-school educators, Aquarium folks, Girl Scout leaders, Boy Scout leaders and some of the national estuary folks. It is growing very nicely at this time.

That is a brief update on what NMEA has been doing. We are looking forward to being able to extend some of the aspects of "The Bridge" to our *Out of the Fog* creation, whatever that may be.

Bruce Tripp
vice-chair, Regional Association for Research on the Gulf of Maine (RARGOM)

When I started thinking about what I was going to say this afternoon in 10 minutes, I was thinking of a little presentation that paralleled Paul Boudreau's introduction about Council activities. I was thinking about the various scientific activities that have been going on in the Gulf of Maine now for several decades, certainly for the past decade. As I started doing that, I decided to try to do a broader brush presentation because I am afraid that we sometimes get lost in the details, without thinking about the bigger picture.

I thought about the bumper sticker philosopher who tells us that, "If You Think Education is Expensive, Try Ignorance." That is a truism; we can all accept that. But the cost of the education is ignored in that simple, glib truism. Information does cost, whether it is coming through the school system or wherever, and we are used to paying those costs as we search in the normal way for information.

For instance the library has costs. There are the municipal costs of the library, costs for the reference librarian who helps you wander through the stacks and stacks of hard copy, as well as the personal expense to go to the library. Those are easy. We accept those. We just incorporate them into our lives, because we are used to them.

Much of the information that is now available and increasingly becoming available, is available on the Internet. We just heard a webmaster talk about some of the trials and tribulations of getting things up onto the Net, and of other people looking through the Internet and wanting it to be more user-friendly. Those costs, such as the infrastructure costs for the Internet, the preparation costs to put the materials onto the Internet, and the maintenance costs to keep them there, are all new to us, and we need to develop a different way of thinking about these things as we try to make use of this magical system that we are in the midst of creating. The trouble is, I think, that we are in the midst of creating it and we do not quite see where we are headed with all of this. This is true generally for the Internet, and I think that it is true for the Gulf of Maine.

I would like to leave you with a couple of bottom lines. One of them is that there are real costs that need to be paid. We are going to have to pay them, and we are going to have to figure out the mechanisms for paying them; the personal, the institutional, the organizational mechanism to pay for those. We have that built into this conference. I do not think we are going to solve that today, but I think that addressing those real costs needs to be part of the discussion, if we are going to have a rational discussion about this.

A second bottom line that I would like to leave you with today, to start the next couple of days discussion, is that there is a data information system in the Gulf of Maine. It exists today. It is imperfect. It is incomplete. Depending on what you are looking for it may be a little bit clunky. It is always less than we want. We expect to point and click. We have already accepted the Web tools. We expect to be able to go and find exactly what we want, and as you can see that when you start searching, when Dean Meggison started searching, he winds up in Guantanamo instead of at a marine website.

There is a learning curve that we have not all completed yet. The data information system does exist and it is functional. It is perhaps functional first for the people who need it most. The scientists have been talking to each other for decades. They are trading information daily through whatever mechanisms they have created: telephone, mail, meetings, and sitting down and having discussions like this about a specific topic. There has also been a clunky connection between scientists and resources managers, policy makers, regulators and people in government who need technical information in order to make some sort of a decision. Those groups do not get along really well, but they have made attempts in the past, and I think that the infrastructure does exist.

In terms of the transfer of scientific and technical information, I think that we are probably fortunate in the Gulf of Maine region because there is and has been a critical mass of scientific activity going on in the Gulf of Maine region for decades. The physicists and the oceanographers have had their own meetings going back to 1970. There have been meetings around physical circulation and the physics of estuaries or the Gulf of Maine. Those discussions have been taking place for a long time, but they have been invisible outside of the specific audience that is interested in the science or trading of war stories about the science or the scientific results.

More recently there has been a series of scientific activities that has heated up the fountain of information that is now beginning to spew onto our own radar screens. The regional marine research program that was funded temporarily for a cycle of years is just now ending. The research results from those funded projects are now becoming visible. There is a large project on Georges Bank. We have a long-term history of fishery science on Georges Bank, but we tended to concentrate going back to the middle of the last century on the adult population. Now there is a large group of scientists looking at the planktonic stages of fish or a commercially valuable species on Georges Bank, and the physics that drives those life stages around that will help us to understand better whether or not we are going to have a good year or a bad year, regardless of whether or not we are catching all the species.

We cannot make management decisions until we have a more sophisticated understanding of how the natural system works. This is something we are working towards here in the Gulf of Maine. There is some reaching out to the management community with these activities. The people who have been ignored up until now are the broader public, the teachers, the citizen action groups and the K-12 educators. Those folks have not yet been incorporated into this data and information system that we are now creating.

My second bottom line is that we do have a system, imperfect, clunky and needing more resources, but it does exist and it can be broadened to include the wider groups that are especially represented here at this New England Aquarium meeting. My third bottom line focuses on the user groups, which I agree, are a hard nut to crack. I have a research analogy to share with you. Since we have expanded coastal waters to 200 nautical miles, a lot of research activity which at one time took place in international waters, is now taking place in national waters. That is a different paradigm for the research institution that wants to send a research vessel to those national waters.
The Woods Hole Oceanographic Institution (WHOI) has worked off of Venezuela. We have worked off of Chile. We worked off of Peru. Initially there is a communication in order to get

permission to work in those waters, and the nation state will say, "Well, we want to put somebody aboard. We want somebody there. We want to have all the data that you collect from that cruise." But every time that we have done that, the reaction has been fairly negative from the national, usually agency, people. Usually the agency wants us to interpret the collected data, not just tell them what has been collected. That is a very different agreement, one that WHOI and the national agency that was given the permission to enter those waters, had not ironed out.

The issue of user groups and the need to have information, not data, but audience-specific information is my third bottom line, because that directly relates back to cost. If you want data, NOAA, the National Marine Fisheries Service and a variety of research academic institutions have data. There are some websites at the various academic institutions that are now streaming live data online that you can pick up and look at if you want to, but it does not mean anything unless you have the story in which that data fits. That is a research translation effort.

My experience has been with the state and provincial agencies, now that I have become part of RARGOM. The folks in the agencies have specific needs: fisheries biology, contaminant mixing and dilution and transport. These are non-scientifically trained professionals who want the data that the scientifically trained professionals have, perhaps at their fingertips and are able to exchange. That can happen, even in a clunky way. It does happen. But if you are looking to satisfy the needs of a broader audience, teacher's needs are not the same as those of the fisheries biologist in the Massachusetts Division of Marine Fisheries. A teacher's lesson plan at the fifth grade level is not the same as a teacher's lesson plan at the eleventh grade level. A citizen action group that wants to prod the Division of Marine Fisheries into doing something or not doing something needs information in a different context and at a different level of detail than the fisheries biologist.

Each of these audience-specific products needs to be prepared. They need to be prepared by someone who has the skills and the credibility to do it. They will cost. They are not free. Every website that you look at including the National Marine Educator's Association's has been put up by the organization that wants to tell you about itself (i.e., "This is not a list of everything that we know in the world about our particular mandate; these are the things that we want to show to you." The broader community that we have brought here into this meeting is going to increase the complexity of the conversation that has been going on and is certainly going to increase the cost of the products that we are being asked to prepare. Those products should be prepared. We need to do it. We need to work together. The "people, people, people" figure was absolutely correct, but it is not free, and it is not easy.

I think that is where I will stop because I think we do have a good model, between the scientists and the managers. We have been working together in good faith, if not always smoothly. To open the doors for that conversation to include all of the other possible groups that want to come in and learn about natural resources and environmental processes in the Gulf of Maine is a big issue, and we are only going to start that in the next couple of days. Thank you.

Lissa Widoff
project officer, Collaboration of Community Foundations for the Gulf of Maine (CCF)

Good afternoon, and thanks for the invitation to speak with you, not so much about a data information management system, but perhaps an approach for having such systems be as useful as possible to community groups.

Let me just back up for a minute and explain that the Collaboration of the Community Foundations is a group of community foundations stretching from Cape Cod to the Bay of Fundy region. These are all charitable institutions that provide funding for non-profit organizations. They formed a partnership in order to better serve the non-profits in the region who are focusing particularly on Gulf of Maine-related issues or coastal issues in their own region. Community foundations are either regional or state-wide, and we have five partners.

One aspect of our work has been to really look at how to overcome barriers to communication among non-profit organizations working in the region. We are doing that in a couple of different ways. One is through funding small grant projects that groups can work on over a range of issues and the other is to provide technical assistance such as organization development assistance and so on, on issues that are really of common interest.

One of these is the communication issue. It is the need for people to know what is going on elsewhere in the region to really be able to do a better job. I am going to move right to my bottom line, which is that just because there is information on the Web, it really does not mean that you have accomplished anything.

Secondly, getting the hardware online and all of that is really the easy part. The challenge is to provide a service that is going to make people's jobs easier, add value to their projects and become integrated into their daily operations whether it is a non-profit or a researcher or a policy maker. In explaining what is partly our vision and partly a concept that we are currently developing, my key message is that, like most managed systems, they really should be designed from the bottom up with the people in mind.

Although I missed some of the earlier talks, I gather that I may echo some earlier comments. We have found that as funders, we can see much of what groups are facing in the way of challenges with technology and so on, but we do not necessarily have the means to solve all those problems. We find that entering into partnerships with other organizations that have the skills that we lack is certainly a reasonable way to go, and it might also be a path when thinking about these difficult nuts to crack. How do you develop content or materials that are going to be appropriate to a user group? Work with organizations that perhaps are better able to do that.

In our case, the CCF, the Conservation Law Foundation and the Gulf of Maine Aquarium have been talking particularly about how to improve Gulf of Maine-wide communications, exchange and action among community groups and non-profits working on Gulf of Maine issues. There are three parts of a strategy that we are developing to do this. It is not funded yet. It is not

implemented yet, but pieces of it have been put into play on other issues particularly around some environmental issues and perhaps on other issues as well.

One part is the content. The Conservation Law Foundation, through its Restore America's Estuaries Project, has been involved with a couple of other major environmental groups in the region to document and collect information about major estuaries in the Gulf of Maine. They are working from the point of view of citizen groups, looking at the community level action that is occurring and integrating it with whatever policy issues or scientific research is occurring. They are committed to put some of the content online. But they do not have the expertise or capacity to really work hand and hand with community groups to help them make the best use of that information.

In that case we are proposing a concept that has been tried on a couple of issues, namely a circuit rider, who is a staff person who goes onsite to work with non-profit groups and look at a range of things. One, of course, is how they are using technology. Is their information on the Web? Are they not on the Web because they have an early Pentium with only four megabytes of RAM and their computer keeps crashing, and they get frustrated and do not bother, but still minimally use email? By having somebody onsite, they can do a real assessment of how a particular group uses the technology that is out there and available, and identify the barriers to maximizing that use. Similarly, we are able to learn if they have a webpage that they managed to put up because somebody donated space, how they are able to keep it current and so on, and what some other opportunities are.

We are developing our NGO exchange by putting some content on the Web that relates to estuaries and watersheds, which is how most community groups think about marine ecosystems. They start where they are, and then the context broadens. At the same time you have to look at how we can really provide some onsite assistance to groups to lead them. Quite often we have found with community groups, or even you may have found this with your own kids, that as soon as the Internet is in front of them, they are all over the place. I think it helps to give some assistance and say, "Here are some places you can go; here are some things that are going to match with your objectives." You have to work with organizations to really build Internet use into their routines. Is it that there is only one computer, and it is in the Executive Director's office and nobody has access to it? An interest group may be online, but what are some of the barriers that are preventing people from making maximum use of the Internet?

The third part of it is the Community Foundations again doing what we do best, helping to provide some small grants on strategic activities. In terms of the concept that we have for putting content on estuaries on the Web, one aspect is geography. Where are the estuaries? Then people. Who is working in those estuaries, who are the researchers working there? What are the kinds of land trusts or water quality monitoring groups and so on, working in those different watersheds? The goal is to combine these aspects in a way that could be searchable; somebody working on a water quality monitoring project within a watershed can perhaps search and find these other groups. With hard copy compilations of groups, contacts are forever changing. The Internet provides a more immediate means for identifying players.

There is still the issue of maintenance, and that is where our third partner comes in, the Gulf of Maine Aquarium, which to date has really been a virtual aquarium. It currently does not have a site and has invested a great deal in developing educational materials, and has also looked very closely at how people use the Web, and how government agencies such as NOAA and so on struggle with translating this information for different user groups.

There would be a place, whether it is an individual homepage or a book in a sense, where community groups could plug into discussion lists. It would really be a reference point. Currently there is no single place where a non-profit group can go to find out who else is doing what, in the realm of non-profits in the Gulf of Maine. It is very scattered. I do not in any way propose, nor do we propose a centralized approach, because in fact the Web exists as a decentralized system, and people operate in a rather decentralized way when we really look at how work gets accomplished.

Our hope is really just to make it easier for groups to find each other. How able they are to find and use more technical, scientific, and research information is another question. Our orientation in this is to really help the non-profit community and the community groups to find each other, and perhaps find the technical resources that are relevant to what they are doing; and also to be able to enter into a dialogue with each other that can lead to a more profound collective action. Each of these groups are working in their own territory. But as I said, we really need to provide a service that is makes their jobs easier.

I would be happy to talk in more detail about the concept that we are developing. As I said, the partnership is a key part because none of us really have the ability to reach all parts, developing content, working with the non-profit groups and then also working on the technical side. The partnership is something that we hope to launch and are currently seeking funding for and are optimistic that we will be able to find. Thanks very much.

Question Session

MS. MOONEY-SEUS: Hopefully we just provided you with some food for thought. We heard from a diversity of speakers here, ranging from webmasters to individuals with specific systems in place who are ready to take the next step to carry them further and broaden their constituency or user groups. Our last speaker spoke a little bit about the efforts under way to help NGOs find other NGOs and share technical expertise.

I want to turn the floor over to all of you now. This would be a good opportunity to ask some of our speakers questions about their respective efforts.

I will throw one out first to Michael Butler. Michael, you talked about a monthly email update and you talked about an Atlantic Coastal Community update. I got the impression, and I am not sure if it was a correct impression, that your Coastal Community Update allows individuals to input information. Is that correct? If it is, how do you control the quality of what is inputted?

MR. BUTLER: I am glad you asked that question. We recently sent letters to some 200 communities in the Maritimes inviting them to submit brief outlines of their community project or projects. We offered to post them on our website, following necessary processing and quality control. The rationale is that in many cases, communities would benefit from knowing what their neighbours are doing. I think Lissa Widoff was alluding to that. The Community Update is just one step in the communication/information dissemination process.

The monthly email Update, in contrast to the Web-based Community Updates, consists of short anecdotal items, which we think will be of interest to our readership. Again, as I said in my presentation, we are very conscious of information overload, so we constantly seek feedback from our readership. To date we have had no requests to delete a name from the mailing list; we consider this to be a positive endorsement.

MS. MOONEY-SEUS: How many individuals or organizations do you have on your mailing list?

MS. LEBLANC: Currently, there are only about 200 individuals on the mailing list. But we encourage the individuals on our mailing list to send the information along to their mailing list. So eventually, a couple of hundred thousand people end up getting the update.

MS. MOONEY-SEUS: I am going to ask one more question of Lissa Widoff. Lissa, what stage are you at in terms of your process in identifying the different groups out there and in setting up your whole infrastructure?

MS. WIDOFF: Right now, Peter Shelley at the Conservation Law Foundation is hoping to finalize or at least have the content for an estuaries website and have it online in the next six months or so. We are currently fundraising for the circuit-rider and we hope to have someone within six months. The Community Foundations will soon be seeking proposals from

community groups that are working on community fisheries-related issues. It is likely that grantees will be the first groups to receive onsite assessments.

MR. LINCOLN: Dave Lincoln, Massachusetts Business Partnership. I have a question for Mike Butler. I would like to know about your search engine or your data inventory. Can you tell me a little bit about your strengths, and maybe some of the problems you have had?

MR. BUTLER: I am going to be clever and defer to our webmistress.

MS. LEBLANC: Currently we use a search engine with a database, and we determine a list of keywords or overall full text search. The main point is the geographic search capability which we would like to strengthen in the future. When someone is carrying on a search, a map of Canada will come up, there will be a window on the map, you will have a particular area of interest, and that window will come up. That is in the future. There are some capabilities along that line on the Web now, but they require powerful systems. I do not have a fancy system, and I can wait minutes for certain maps to come up. This is the sort of thing that we need to deal with in the future.

MR. BARKER: Seth Barker, Maine Department of Marine Resources. A question for Lissa Widoff. Looking ahead, it is one thing to do the estuaries; it is something else to have strategies in place and make recommendations. I run into the situation with folks trying to seek out information who say, "give me everything you have" or "I need maps." You have to sift through and find out the best way to provide it to them. Do you have some strategies or thoughts on the best way to deal with these types of requests?

MS. WIDOFF: I think part of it involves working with the groups to better understand their needs and for them to understand who to go to for what kinds of information. For example, they may want to find out who is doing similar work, or they may need more in-depth information about their own sites. In either case, they need to assess whether they have the capacity to handle that information. Our view is that by helping groups understand what is available to them, perhaps their request could be more focused and targeted. This will require handholding with a number of groups. In our project, if we work with twenty groups in a year, that will be a lot.

For our project, the focus will be on groups who are working in a coastal region and see their work in the context of the Gulf of Maine. They are working on issues that are common throughout the region. Our orientation will be on the interface between fisheries, water quality watershed and local management.

I often find that individual non-profit groups do not have a collective voice. They work on their own issues and need a particular kind of information. When several organizations call, you see the patterns of activity occurring, and then ask yourself how able we are to provide the kind of information they need.

I think there is a need to help groups become more strategic about their information requests. Training with the help of a technology circuit-rider can provide this kind of assistance and learn

not only what to ask for, but what will be useful to them. The ideal technology circuit-rider in this context will be someone who has that mix of skills. Someone who understands the work environment of small non-profit groups, and is comfortable with the technology. They do not have to be an expert, but they need to understand the kinds of information that community groups use. To put it in research terms, that is where we will be doing the field testing. It would be interesting to look at the ways that you are extracting information, and look at the data sets or information that are currently available and not being used. Perhaps then you could identify where the translation is most needed.

MR. WESTGATE: Michael Westgate, I am on the board of the Northwest Atlantic Marine Alliance, known as NAMA. I have heard very little reference to fisheries. I am curious if anybody has experience, success or failure, in trying to get the kind of information that is being talked about to the fishermen either on land or sea?

MR. BARKER: I cannot say successes or failures. The Maine Department of Marine Resources is looking at putting current information online so that there is one stop, one place to look.

MS. INCHES: I am Sue Inches with the Maine Department of Marine Resources, and my area of focus is the seafood industry. To answer the question that Michael asked, I am involved with a feasibility study to see what the users in the Maine seafood industry would like to have in the way of a website that will meet their needs. It will include such things as market, pricing and product information. There is also interactive dialogue and some selling of the databases of product possibilities. That is being done, at least in our department, but I do not know if there are other efforts.

MR. BUTLER: Certainly in Canada. There are one or two people sitting in this room who can expand on this topic. Two very interesting programs are ongoing within the Department of Fisheries and Oceans which rely primarily on Traditional Ecological Knowledge.

The verification of TEK information was a problem for many years but I think the process has been refined through two major resource mapping projects in Atlantic Canada: The Scotia Fundy Project which Denise McCullough can address and a project in the Gulf of St. Lawrence region. The mapped information has been returned to the communities which originally provided it; I think this is of fundamental importance if the cooperation of the coastal communities is to be retained. However, I have always criticized the fact that we have beautiful resource maps which are insufficiently used as decision-support tools. I do not think we have addressed that issue.

MS. MCCULLOUGH: As Michael Butler mentioned, we have been involved with the Scotia-Fundy project for the past six years. I am wearing a couple of hats here. There is our community and fishery groups and as well as the Department of Fisheries and Oceans program which we have been involved in for the past six years. We are very involved in providing information directly to the fisheries. This project was initiated by the community and fishery groups so it is not something that we are doing and giving back to them. They are the ones that initiated it, and we are working in partnership with them.

MR. HOPKINS: Will Hopkins from Eastport, Maine. I do not really have much to say, but I do have one question to ask. The DFO Communications Secretariat in Halifax seems to be a pretty good model of a situation where the DFO is generating a certain amount of information and making it available via fax and the Web to fishermen and fisheries groups. I do not know if there is anyone here who can describe the Communications Secretariat any better than I can? If there is anyone else here, I would certainly like to hear that.

I am glad that the discussions are turning to the bottoms-up perspective. The first part of our discussion today seemed to have been that we all have data and we all want to disseminate it in some manner. I am glad that you asked the question about the fishermen, because I think that if we are talking about a Gulf of Maine information exchange, I do not just see the exchange as being lateral or just from the top down. I do see the exchange as being from the top down and the bottom up. I am hoping that we can focus the next couple of days here to examine what we need to do to be able to work from the bottom up. I invite anyone here who has thoughts on that to share them.

MR. COLLINS: I am Norval Collins. I do not work for the DFO, but I have used the fax and the media service, and I would say that it is quite an amazing service. I really cannot say how well it works, but I do generally know how it works.

One of the principles is that they produce a defined list of topics that they send out to everyone on their list. If you want more information on a particular topic you can request it. As Mike Butler pointed out, it is very important not to overload the system. It is an extremely useful service from which to request information and to see how people feel about a give subject. I hope that helps a little bit.

MS. MANNINEN: My name is Christine Manninen. I am with the Great Lakes Information Network, known as GLIN. I have a question for Dean Meggison. As a teacher, I was wondering if you feel that the curriculum materials are out there online, and whether the problem is just linking to them and giving teachers and students better access in finding them, or do you think that there needs to be more development of the actual materials?

MR. MEGGISON: Well both actually. There is information out there, and it is beginning to become more and more prolific. Different groups are starting to put curriculum on the Internet. The problem is, number one, finding it easily. There does not seem to be any one simple spot where you can go and pull down specific curriculum material from all over. Although NMEA has a large site, and if you roam in there long enough, you will find things. NMEA with "The Bridge" is starting to do some things with marine education. The problem is in finding sources of this stuff and in the quality, because a lot of new materials there are considerably less than high quality. So in answer to your question, you need more and easier access and better quality stuff. There is some, but it is hard to find.

MS. MOONEY-SEUS: I have a question for Bruce Tripp. Bruce, when you are thinking about EDIMS and REDIMS and your current user groups being managers and scientists, have you begun strategizing about how to achieve your goal of broadening your reach to include NGOs,

educators and maybe fishermen? If so, have you thought about not only getting information to these groups, but following up on this concept of the bottoms-up approach, getting information back from them?

MR. TRIPP: No. There were two organizational activities; one was EDIMS, one was REDIMS. Wendell Brown helped to create EDIMS, which was an attempt to get the Council visible and make useful information available to a wider group of people. REDIMS was intended more for the science community's sharing of data to facilitate communication between the scientists so that people know what kinds of things are being measured and where and how often.

They are both online. They both have lots of stuff available. They are both working. In my personal opinion, they are both kind of clunky in that they do not look like what we all thought they might look like when we first created them. That is not a criticism. We have been through the experience of building these things, and we are wondering where to go from here. Is it just more of the same? Do we need more time, energy, money and people to build more like what we have; or should we be doing something that is slightly different, building on what I think is a solid base? I think the second. I think that there is a lot in EDIMS. But, if you wind up searching EDIMS, you may not find the level of detail that you want about a specific scientific issue. If you end up finding REDIMS, you almost always will not find the summary of how all of this applies.

So the discussion has been going on not just among the folks that have been doing the EDIMS, and the REDIMS, but also among RARGOM and the Council. The two committees from RARGOM and the Council have been thinking about how we can create a front-end that will help a user, help a fisherman, I do not care who, coming in from the outside to find their way through to the level of detail that they particularly care about.

That level of detail is not in there right now. That is the second issue. But finding this one-stop shopping on Gulf of Maine scientific and technical issues, and then finding what you want, does not currently exist. We have two separate products designed from different funding sources, and therefore different philosophies, that do not look alike. If you were totally outside the system, you would not necessarily recognize that they belong together, that they were cousins. I am just telling you how I view it. I think an additional effort needs to be made to make sure that the kinship is more clearly recognized coming in from the outside, as well as building up what is in there. Then the people who are using them now will benefit even more from using them in the future.

Making them widely accessible to a wide group of people, fishermen, school teachers, whoever, is another step and I think that needs to be addressed. That is a step that is going to take time and energy and resources, just as the initial EDIMS and REDIMS did.

MR. BUTLER: The Americans and the Canadians have freedom of information legislation. However, I think that one of the problems that we are trying to address, I believe unsuccessfully, is the business of actually exchanging information. In Canada, we have a cost recovery

requirement dictated by the federal government and Provincial governments. I am not sure whether you have similar problems in the United States. For example, some of you will remember ECNASAP, the East Coast of North America Strategic Assessment Project. This involved NOAA and numerous other agencies on both sides of the Canada-U.S. border. It was very interesting for us to note that we found it far easier to access U.S. information than from our own departments.

MS. MOONEY-SEUS: Does anybody from the U.S. want to tackle that one?

MR. SCHROEDER: My name is Paul Schroeder. I am a graduate student at the University of Maine. Part of what we do in our department is to focus on the legal and policy arena. Our department has sponsored several surveys on access policies including the cost recovery issue. So, I will just say that it is definitely a trend in the United States, and it is getting stronger. I think that the trend is more among municipal governments than it is necessarily at state levels or among research and data providers. I think that building an ethic of information and data sharing is part of the strategy that has to come out of this whole initiative being discussed here.

MS. MOONEY-SEUS: Well, I have one last question that I would like to throw out to most of our speakers. Lissa Widoff talked about technical training, and I was wondering, because I did not hear any of the other speakers discuss that, if it is a service you have thought about or something that you had undertaken in setting up your respective systems. Can anyone address that? Has anybody thought about that?

MS. LEBLANC: We recognize that sometimes communities do not have that very sort of basic use or basic knowledge of using the Internet, so we offer different workshops to teach the basics. We have recognized that as a service that should be offered.

MR. BUTLER: Perhaps the implication of what Claudette is saying is that communities are not always technologically sophisticated, but they are very willing to learn.

MS INCHES: I do not have anything conclusive, but a big part of the study that I am working on right now is telephone interviews with potential users to find out not only what their access issues are, but also what their attitudinal issues are. Is the Web something that they feel they are going to be using? What is the comfort level? Are there hardware and software issues?

So I guess I thought that Lissa Widoff made a really important point when she talked about where we are getting with the potential users and then working with them. From my point of view, it is also a marketing issue. Who are your customers? What are their needs? How can you design their site and your information to best meet their needs?

MR. MEGGISON: The assumption that if they pretty well knew how to do the basic navigation, and click on a link, and that sort of activity; I suspect that, for lack of a better word, handle or guiding to a particular site would depend on the way it was set up.

I was involved with another project using information exchange that was called Lab Net. One of the very first things that we did when we created Lab Net was somewhere between an email and web activity. It was hosted on AOL, and locked into an AOL structure. One of the very first things that we did whenever anybody joined up or expressed interest in joining up, was to direct them to a little downloadable file that basically dealt with how to get the most out of Lab Net. It included hints about how to pose questions, how to get involved with chat groups or discussion groups or interactive lab activities or something along those lines. I suspect that if we come up with them through a mechanism that is reasonably diverse, you might want to consider doing something like that. If you are fishermen, this is how you get the most out of this part of it, and so on.

MS. NYE: My name is Tara Nye. I am from the Waquoit Bay National Estuarine Reserve. I recently relocated from New Hampshire. While I was up there I taught an Introduction to Internet class. I found more often than not, and this was for a community, that people were not even familiar with how to use a mouse. So I think that it is necessary. There are definitely some people out there that know how to, but I think there are a lot of people in the community that really do not. They are so afraid to enter the classroom, because they do not even know how to double click on an icon or anything along those lines.

MS. REID: Ann Reid, from Great Bay in New Hampshire. As the coordinator of the volunteer monitoring group there, we have a grant from a coastal program which includes how to use the Internet and how to train our volunteers to be able to present the data that we collect during the sanitary shore surveys. We are in the process of learning how to do that and how to teach that. We have lots of data. We are learning how to input it. It is supposed to be going online on the Web through the CICEET at UNH, which is the Cooperative Institute for Coastal Estuary for Environment Technology.

We had a glitch. We gave all the data on this to the webmaster, who went to Massachusetts for the big bucks, so it is not online. Then they were not able to read the disk. We are at all different stages. Yes, we have volunteers that are very good at accessing information, and then the other volunteers that know how to do the maps, others that move away to Michigan on us. So that whole business of having a volunteer staff or having a university at hand, how do you access it all? How do you get it to work? How do you make it easy to find, and make it user-friendly?

MR. FAY: Brad Fay, Nova Scotia. I just wanted to mention that last year our Nova Scotia Coastal Zone initiated a traveling road show to go and talk with some communities about the need to accept this and what it was doing to them. I guess in summary, three of the points that were made were first, federal and provincial governments, get your facts in order; second, federal and provincial governments, get your facts in order amongst yourselves. The third and very important one was a need on behalf of the community for capacity building. They really want any assistance that can be provided to them in terms of assistance in accessing and writing proposals.

MR. BOUDREAU: I am questioning what the training leads into. We are all sitting here, and I am very pleased with the discussion because everybody is getting up and getting a little bit warm,

if not heated, about the topic of information exchange. But, I think we have not decided what we really want, in terms of training and in terms of the capacity of building needs. I mention this, because this is a magazine put out by Sympatico. It is one of the largest Canadian Internet service providers, and they are in the job of distributing information, and they still put out a monthly hard copy newsletter.

From my perception, the Gulf of Maine fishing industry exchanges information via the Gulf of Maine Times. I think that there is a lot of other information we could include in this publication. At some point in the next day or two, we have to get to some core. I think we all have our own view of what is most important, but I hope that we can all come upon some common vision. This is not a question that I am asking for comments in terms of what you think, rather I hope that this group of people could sit down and agree on one or two lines in a day or two about how we can better share data and information. To me, that would be a big step forward without getting into search engines, and webpages. Are there any comments from the rest of the people? Is it doable? Is it cheaper? Is it worth doing?

MR. DIERS: My name is Ted Diers, and I am from the New Hampshire Coastal Program. I wrote two, two-word phrases at the top of my paper as I was listening to the speakers today. One was appropriate technology, and the other was Ocums Razor. If we each keep both of those in mind as we go through the next couple of days, I think we can achieve what Paul Boudreau is suggesting.

Appropriate technology in some cases is paper. Appropriate technology in some cases is a fax. Appropriate sometimes is just talking to someone. PowerPoint presentations and all these kinds of things that are data intensive or data manipulating kinds of things, are appropriate to the situation that you are using them. This leads very clearly to the second of those two phrases, Ocums Razor, which essentially says that things should be no more complicated than they absolutely have to be. Why have two, when you only need one, is essentially the way it translates. So I think that if we keep both of those things in mind, it is possible to come up with a system that will meet a lot of different needs for a lot of different users.

MS. MOONEY-SEUS: What we are going to do next is to give you some preliminary findings from this survey that we keep eluding to. Patrice Farrey is going to do the initial presentation along with David Keeley. Just to give you a quick background, the survey was developed by a number of individuals, but fine-tuned by the Steering Committee of this workshop. The Aquarium added a couple of questions to help develop the Vision Statement.

SURVEY FINDINGS

Patrice Farrey
conservation associate, New England Aquarium

The *Gulf of Maine Survey of Electronic Environmental Data and Information Users* was created as a tool to broaden the input into discussions to expand the region's existing data and information system (Appendix 4). To date, there has been a lot of input from scientists and managers on the current EDIMS and REDIMS, so the survey targeted input from non-profit organizations and educators. The survey was prepared by the New England Aquarium Conservation Department, in collaboration with the Gulf of Maine Council on the Marine Environment (GOMC) and other organizations, with funding received from the Cabot Family Charitable Trust. The survey was distributed and compiled by the New England Aquarium Conservation Department.

More than 800 surveys were distributed over the course of four months, from September through December, 1998. The survey was distributed to many groups including the Gulf of Maine Council, Women's Fisheries Network, New England Fisheries Management Council, International Year of the Ocean conference participants, Marine Educator's conference participants, Environmental Writer's conference participants, U.S. estuary and sanctuary program staff and many others. The survey achieved a twenty five percent response rate, with 202 persons responding. Typically surveys of this type produce closer to a three to five percent response rate. The survey successfully targeted educators, which comprised 29% of the respondents and non-profits which comprised 19% of the respondents (Figure 2).

The survey focused on three areas: 1) identifying the issues of concern to people in the Gulf of Maine, 2) rating the effectiveness of the existing data and information exchange system, and 3) examining the inputs and features of a data and information exchange as we move forward.

In assessing the current level of use of the internet, email and data and information exchange, the survey indicated similar responses for overall respondents, educators and non-profits. Sending and receiving email was the most common form of information exchange, taking place at least once day (34% of educators), but more commonly all day (59% of all respondents, 68% of non-profits). Respondents indicated that they browse the internet only once each week (Figure 3).

Respondents were consistent in the types of data and information they most often use. All respondents as well as the educator and non-profit respondents indicated that the three most often used types of data were synthesized environmental and public health data, synthesized biological data and synthesized land use data. The demand for raw data was secondary to the need for synthesized data in all categories. However, some respondents indicated that they would like to see a combination of both (Figure 4).

The majority of respondent's organizations currently have websites (overall 67%, non-profits 59%, educators 42%, Figure 5). Both the educators and the overall respondents rated the data and information available on their website, navigability and organization of their website and

their organization's capacity to update the website as good. The non-profit respondents indicated that their organization's website was excellent in terms of navigation and organization, but only fair in terms of the availability of data and information and its capacity to update (Figure 6). All respondents (overall 42%, non-profits 35%, educators 54%) indicated that existing Internet search tools meet their current needs (Figure 7). However, time and lack of adequate computers and/or internet access were cited as the biggest obstacles to accessing and using data and information among the overall, educator and non-profit respondent groups. However, approximately 20% of respondents did not feel that they had enough Internet experience to respond to this question (Figure 8).

The survey assessed respondents opinions on design considerations for a Gulf of Maine environmental data and information system. The educators and overall respondents indicated environmental and public health data, biological and oceanographic data as the top three types of information the system should link to. Non-profit respondents agreed with the first two, but identified land use as the third most important type of information to link to (Figure 9). These correlate closely to the types of data and information these respondents currently used (Figure 4). Survey respondents (overall, educators and non-profits) identified that a Gulf of Maine information and data exchange system should have a spatial framework to aggregate and summarize information, and address database of Gulf of Maine contacts, and a Gulf of Maine search engine as key features (Figure 10).

The survey assessed respondents willingness to contribute financially for a Gulf of Maine data and information system. Overwhelmingly, they indicated that their organization would not be willing to contribute financially or that they could not answer the question on behalf of the organization (Figure 11).

Finally, the survey looked at why the Gulf of Maine was important to each respondent. Although this was an open ended question, approximately 30% of respondents (overall, non-profits, educators) indicated that it was important to them because they live here, and for its ecological value (Figure 12).

David Keeley
state planner, Maine State Planning Office

Patrice has offered a look at all of the results. The next step for us is to continue to gather information, but also to begin to look at the different categories in the survey.

We asked some questions about who the users were and the type of organization they worked with. We asked them questions about the kinds of data information that they were looking for and to give us a sense of the priorities that they placed on that type of information being available. We asked some questions about their capacity to access the Internet and use these electronic tools. We asked them questions about the structure of the system that might be useful. Then we just suggested asking some questions about money.

One of the values of the survey is to be able to do some cross tabs. I would assume, for example, that Lissa Widoff would be interested in the results pertaining to the non-profits. So we would be able to work with Lissa and others, to ask some really penetrating questions. We can use the survey results to determine how to meet the data and information of non-profits. Through a series of cross tests, we will use the survey to gain insight into they types of variations that exist in the Gulf of Maine region amongst user groups, and their ability to access information.

My last comment is about money. Knowing as Bruce Tripp and Paul Boudreau suggested, that we have been working for some time in putting together some sort of data information management system, an important question is, "What are people willing to pay?" It begins to drive the system. It drives the design of the system. We must be cautious with the survey results which seek to learn an organization's willingness to contribute financially. Often if you have something, and then ask someone what they are willing to pay for it, they will give you a much more honest answer about the value of that information. They may say, "This is important and I am prepared to contribute" versus "That sounds really great, and I cannot wait for you to give it to me." That is something that we need to come to grips with. As Bruce Tripp suggested, we are going to be working on this until the next ice sheets come through.

Question Session

MR. TRIPP: I think that an organization's willingness to contribute is the most important one (Figure 12). It looks like all of us all want one click, accurate detailed information, and we want it free. Perhaps the next step after this workshop should be to explain costs. I alluded to that earlier. We pay costs when we borrow a book from the library. The library has a book budget. The municipality has a line item in their annual budget for their librarian and their support staff, for oil, heat, electricity, and all those kinds of things that support the building or building a new building. We pay. We carve a piece out of our Saturday or our Wednesday evening to drive to the library at thirty cents a mile, if you are thinking about realistic cost. We spend time in the library searching on our own personal time, which also has value. We do not think of those as costs. If we had a questionnaire that said, "Would you pay for library services?," we might answer in very indeterminate terms, as I think we received on this questionnaire. It is as though this is a new activity.

Do you want to search the Web? Will you pay? Tell me today will you pay five hundred or one thousand dollars? It is almost an unanswerable question unless you rephrase it. Maybe it requires going to the various NGOs and working with them a little bit, perhaps using the circuit-rider approach, and asking them to think about what are they willing to pay realistically by stepping them through the thought process.

What are they now paying for information? Let us call NOAA about a coastal issue in Canada. How many times would you have to make a sequence of calls in order to find a person who can actually answer your question? How many people here have internet service at home? How many people have cable TV at home?

I suspect that most people would say that they do not have internet service at home, but that they do have cable TV. What does it cost to get onto the Web? It costs the hardware, the cost of a TV, if you will. That is what a computer will cost you. What does it cost to connect to the Web? About the same thing as your cable bill.

If you can put the cost into a context that we can all understand, then maybe you can ask what are you willing to pay. Am I willing to pay the cost of a TV and a cable link up to get the Web service at home? I can do that. A thousand bucks? TVs are cheaper than that, but a thousand bucks, plus twenty bucks a month. That is the real cost, and I can understand it in that context, even if I do not know how to use it. I think that working on the cost, if you get people to figure out what they are willing to pay in a more sophisticated way, could be one of the things that comes out of this.

MS. WIDOFF: I think the question is, what are you offering, and then people will figure out what they are willing to pay.

MR. TRIPP: I agree that this is basically a passive mass marketing kind of thing. This is data that already exists. It was produced, because producers felt that it was important to produce it, more than because the consumers indicated that this is specifically what was needed. I think that

we do need to take, as you said, a more sophisticated marketing approach. When I fill out my survey, I do not want to commit to paying five hundred dollars a year, but if I pay nineteen dollars and ninety-five cents per month for unlimited Internet access, I may be willing to sign on a monthly basis to a Gulf of Maine information exchange, and be billed monthly for it. There could be all the various levels of the charges associated with specificity of data.

I know that when it comes to NOAA, information is being gathered by my tax dollars. I do not want to pay for it. I have already paid for it. Obviously there is some room for discussion there. Lissa Widoff's comment reminds me of Jim Acheson from the University of Maine, who has made some presentations about fisheries management schemes in other parts of the world. In those places, such as Australia and Japan, fishing organizations are primarily responsible for managing the fisheries within their zone. They also establish the research priorities which the industry pays for, at least to some extent. I know that is a question far beyond the scope of these next two and a half days. But it is something perhaps that we might think about.

MS. MANNINEN: I am Christine Manninen from GLIN, the Great Lakes Information Network. Is the cost to the individual users or is it to an organization? I can say from experience, charging users right off the bat is not going to fly. We tried this and they would not pay for it. I agree with the comment that you have to show them what it is before you can charge anything for it.

We have just now received core funding to set up the network. We are just beginning to solicit for sustaining donors from those organizations involved with GLIN. It looks like it is going to be successful, but, they have been using the system for about four or five years, and they know that it is worth the money.

FIGURE 2. Survey Results: Primary User Category

Primary User Category:	#	%	**Other Respondents:*
Education	**59**	**29%**	other gov't
Non-Profit Organization	**37**	**19%**	media
State/Provincial Gov't	37	19%	academic
Other*	23	11%	private industry
Research	18	9%	personal interest
Federal Gov't	15	7%	
Marine/Commercial Trades	5	2%	
Total Respondents	**202**	**100%**	

FIGURE 3. Survey Results: Frequency of Use

How Often Do You:							
		Send or Receive Email		Browse the Internet		Exchange Info/Data	
Never	*Overall*	6	12%	13	6%	18	9%
	Non-profits	3	8%	2	5%	2	5%
	Educators	6	10%	5	8%	8	14%
Once/Week	*Overall*	6	13%	76	38%	52	26%
	Non-profits	1	3%	12	32%	16	43%
	Educators	9	15%	23	39%	14	24%
Once/Day	*Overall*	39	19%	62	31%	46	23%
	Non-profits	7	19%	14	30%	5	14%
	Educators	20	34%	21	36%	18	31%
All Day	*Overall*	117	59%	31	15%	58	29%
	Non-profits	25	68%	8	22%	12	32%
	Educators	17	29%	4	7%	9	15%
No Response	*Overall*	21	10%	20	10%	28	13%
	Non-profits	1	3%	1	3%	2	5%
	Educators	7	12%	6	10%	10	17%

FIGURE 4. Survey Results: Types of Data and Information Most Often Used

Please indicate the types of data and information you most often use:

		Raw Data		Synthesized Information		Raw & Synthesized		No Response	
Environmental/Public Health (i.e. water quality, pollution, waste materials, red tide)	*Overall*	32	16%	63	31%	33	16%	74	37%
	Non-profits	5	14%	16	43%	7	19%	9	24%
	Educators	12	20%	19	32%	5	8%	22	37%
Biological (i.e. fisheries, birds, mammals)	*Overall*	30	15%	55	27%	43	21%	74	37%
	Non-profits	5	14%	12	32%	10	27%	10	27%
	Educators	13	22%	20	34%	7	12%	19	32%
Oceanographic (i.e. currents, bathmetry, sea surface)	*Overall*	16	8%	21	10%	17	8%	148	74%
	Non-profits	3	8%	3	8%	3	8%	28	76%
	Educators	3	5%	6	10%	4	7%	46	78%
Meteorological (i.e. weather, temperature)	*Overall*	12	6%	26	13%	8	4%	156	77%
	Non-profits	0	0%	3	8%	1	3%	33	89%
	Educators	4	7%	9	15%	2	3%	44	75%
Physical (i.e. geology, soils, slope, wetlands)	*Overall*	11	5%	22	11%	12	6%	157	78%
	Non-profits	1	3%	3	8%	3	8%	30	81%
	Educators	2	3%	9	15%	2	3%	46	78%
Land Use (i.e. population, land cover, socio-economic)	*Overall*	16	8%	50	25%	23	11%	113	56%
	Non-profits	3	8%	12	32%	7	19%	15	41%
	Educators	2	3%	13	22%	4	7%	40	68%
Other:	*Overall*	2	<1%	2	<1%	1	<1%	178	88%
	Non-profits	0	0%	0	0%	1	3%	36	97%
	Educators	0	0%	1	2%	2	3%	55	93%

- coastal mapping/satellite data
- contact information/organizational profiles
- socio-economic data
- natural resource policy/regulations
- local level data/anecdotal information

FIGURE 5. Survey Results: Organizations with Webpages

Does your Organization have a webpage?

	Yes		No		No Response	
Overall	135	67%	22	11%	45	22%
Non-profits	22	59%	4	11%	11	30%
Educators	25	42%	11	17%	23	39%

FIGURE 6. Survey Results: Effectiveness of Website

Rate the overall effectiveness of your organization's website:							
		data/info available		navigation/organization		capacity to update	
Poor	*Overall*	14	10%	7	5%	15	11%
	Non-profits	0	0%	0	0%	2	5%
	Educators	2	8%	0	0%	1	4%
Fair	*Overall*	51	38%	37	27%	46	34%
	Non-profits	10	27%	5	14%	10	27%
	Educators	7	28%	7	28%	5	20%
Good	*Overall*	61	45%	76	57%	52	39%
	Non-profits	9	24%	7	19%	8	22%
	Educators	16	64%	13	52%	11	44%
Excellent	*Overall*	9	7%	15	11%	22	16%
	Non-profits	3	8%	10	27%	2	5%
	Educators	0	0%	5	20%	6	24%

FIGURE 7. Survey Results: How Existing Web Search Tools Meet Needs

Do existing web search tools/engines meet your needs?						
	Overall		*Non-profits*		*Educators*	
Yes	84	42%	13	35%	32	54%
No	67	33%	11	30%	14	24%
Other	14	7%	3	8%	4	7%
No Response	37	18%	10	27%	9	15%

FIGURE 8. Survey Results: Most Significant Obstacle

What is your most significant obstacle to accessing and using electronic information?						
	Overall		*Non-profits*		*Educators*	
Time	50	25%	14	38%	8	14%
Lack of Adequate Computers and/or Internet Access	49	24%	23	62%	11	19%
Skills navigating the Net	35	17%	3	8%	6	10%
Data accessibilty and volume	27	13%	7	19%	3	5%
Work priorities	11	5%	7	19%	4	7%
Software compatibility	7	3%	3	8%	2	3%
Software	7	3%	1	3%	1	2%
Money	5	2%	2	5%	2	3%
Credibility of Data	4	2%	2	5%	0	0%
No Response	35	17%	7	19%	13	22%

FIGURE 9. Survey Results: Information System Links

What sources of data and information should a searchable Gulf of Maine information system should link to?

	Overall Results		*Non-profits*		*Educators*	
Environmental/Public Health	133	66%	26	70%	42	71%
Biological	118	58%	31	84%	31	53%
Oceanographic	56	28%	9	24%	18	31%
Meteorological	19	9%	1	3%	7	12%
Physical	29	14%	1	3%	10	17%
Land Use	62	31%	12	32%	17	29%
No Response	15	7%	0	0%	4	7%
Other:	19	9%	4	11%	3	5%

- satellite data
- contact info/organizational profiles
- socio-economic data
- natural resource policy/regulations
- local level data/anecdotal information
- local calendar/how to get involved
- visual art

FIGURE 10. Survey Results: Features of System

What qualities or features should an environmental data and information management system have?

	Overall		*Non-profits*		*Educators*	
address database (Gulf of Maine contacts)	89	44%	18	47%	29	49%
Gulf of Maine search engine	90	45%	14	38%	22	37%
repositories which can be queried & transferred	65	32%	13	35%	12	20%
acronym dictionary	18	9%	4	11%	7	12%
index	41	20%	4	11%	13	22%
spatial framework to aggregate and summarize information at different scales	92	46%	21	57%	24	41%
No Response	22	11%	4	11%	8	14%
other:	7	7%	0	0%	3	5%

- someone to maintain and manage system
- maps, visuals, photos
- fun
- accurate
- searchable through NSDI/FGDC
- metadata standards
- link to environmental web ring

FIGURE 11. Survey Results: Willingness to Contribute

How much do you think your organization would contribute annually for a Gulf of Maine electronic environmental data and information system?						
	Overall		*Non-profits*		*Educators*	
Nothing	56	28%	15	41%	18	31%
< $500	33	16%	7	19%	8	14%
$500-$1000	9	4%	2	5%	1	2%
> $1000	10	5%	1	3%	2	2%
No Response	94	47%	12	32%	30	51%

FIGURE 12. Survey Results: Importance of Gulf of Maine Watershed

Why is the Gulf of Maine Watershed Important to you?						
	Overall		*Non-profits*		*Educators*	
Ecological Value	55	27%	11	30%	12	20%
Live here	48	24%	11	30%	16	27%
Work here	42	21%	6	16%	13	22%
Sustain coastal communities	28	14%	10	27%	10	17%
Fisheries	25	12%	5	14%	7	12%
Recreation	21	10%	3	8%	12	20%
Education	12	6%	1	3%	6	10%
Degradation	11	5%	1	3%	2	3%
No Response	49	24%	7	19%	22	37%

SUMMARY OF COMPUTER SESSION RESULTS

A hands-on computer session was held as part of the workshop to offer workshop participants an opportunity to explore the Internet and experience existing Internet tools. The session was designed to accommodate both beginning and advanced Internet users. The session began with an introduction to the Internet, an overview of existing search tools, and navigation tips. This was followed by an exercise using these tools to explore the issue of coastal development, which was identified as an issue of concern through the Gulf of Maine Survey of Electronic Environmental Data and Information Users.

Approximately 45 workshop participants met in the Dewey Library on the MIT campus, in Cambridge, Massachusetts, for a two hour session. Bruce Tripp of the Regional Association for Research on the Gulf of Maine (RARGOM) conducted the introductory portion of the session. He distributed a hand-out to all participants outlining some background information on the Internet and identifying several websites focused on Gulf of Maine issues (Appendix 5). Mr. Tripp provided a brief orientation to the World Wide Web, using Netscape. He explained the layout of the Netscape browser, the toolbars, and demonstrated how to conduct searches and the difference in results from the various search engines such as Excite, AltaVista and Yahoo.

John Evans of MIT continued the session. Under his guidance, workshop participants visited several sites identified by Dr. Evans (Appendix 6). These sites were chosen because they demonstrate the variety of data and information available on the World Wide Web.

Participants were asked to use the remaining 30 minutes to use the Internet to explore the issue of coastal development, as identified in the survey.

The group reconvened to discuss the computer session, specifically, the types of information they found, obstacles encountered, things they liked, success in exploring the issue of coastal development and other general comments.

Overall, the group found the experience to be more positive than negative. The information available on the Internet was more in depth than many expected. This was due, in part, to the fact that the computer facilities at MIT are more advanced than the equipment that most people have in their homes and offices. The group was struck by the number of "consolidator" sites like the Gulf of Mexico and GLIN sites, which seem to indicate success using a centralized approach to accessing information and data exchange systems.

The group also encountered many obstacles. There was consensus that the speed of the machinery did not make up for the number of "dead ends" on the Web. Several participants were not able to access all of the sites that they visited, despite the advanced equipment available at the MIT Lab. In particular, the group did not have success opening the StreamNet site or Microsoft's TerraServer.

The group found many websites to be poorly managed. Furthermore, participants questioned the quality of the data and information that they came across. In particular, the quality of geographic

data not tied to land-based attributes, such as roads or towns, was found to be poor. The group found the Internet to be weak in terms of its ability to help uninformed users locate specific information and assess its quality. Many were tempted to assume that they were looking at high-quality accurate data, because of the elaborate presentation of the material.

Others questioned what to do with the data and information they had found. If you were to share it with others, should you alter the data to send it or should you only send people the source? Several people were frustrated by the number of metadata sites, which present information but do not allow the user to download the information.

The group did come across several high-quality sites. Among these sites were the MIT project, which had excellent orthophotos and GIS capabilities; the USGS homepage; the Maine GIS page, which offered the user the ability to query data sets by town, quad and watershed; and the GLIN site. The group liked these because they had good design elements, were well organized, easy to navigate, and contained quality data and information. A few group members were impressed with the search engine "Dogpile," which searches a keyword in 12 different search engines.

The group was then asked to assess the Internet in terms of their assignment to investigate the issue of coastal development. In general, the group felt that it was difficult to investigate such a broad topic in a short amount of time. Simply entering "coastal development" into a search engine produced too many links.

Several people had success exploring the topic from more focused points of view. For instance, a few people visited the MIT site and viewed orthophotos of the Boston Harbor area. Others were able to locate information on population trends and land use trends affecting the coast.

OVERVIEW OF INTEGRATED INFORMATION SYSTEMS

Richard Signell
oceanographer, United States Geological Survey

I am going to tell you a little bit today about this information system that I have been participating in for several years. I understand some of you looked at during the computer session.

To give you some background, the work developing this site was funded by the Regional Marine Research Program (RMRP), which from 1993 to 1998 funded about seven million dollars worth of work in the Gulf of Maine. They tried to target priority research issues for the Gulf of Maine, to identify the scientific projects that would most effectively contribute to a better understanding of the ecosystem and environmental problems in the Gulf. They funded a wide range of programs from basic physical oceanography issues to atmospheric loading to geographic mapping of the coastal zone, a lot of different projects.

In 1995, they put out a request for proposals for an information management system to manage the RMRP data as well as to provide an overall information system for scientific investigators in the Gulf of Maine. So, the emphasis was primarily on an information system for scientists working in the Gulf. We submitted a proposal that got funded. It was Dan Lynch from Dartmouth University, Peter Smith from Bedford Institute of Oceanography in Nova Scotia, Wendall Brown from the University of New Hampshire, and myself from the USGS. Three physical oceanographers and a civil engineer, which may seem strange. It certainly affected the way we developed the system. We are coming at it from a physical oceanography viewpoint.

Now, I think the reason that physical oceanographers have an information system bent is because they deal with very large data sets, and multi-dimensional data sets, that do not fit into conventional databases or GIS very well. They naturally have a need to try to find a way to obtain better physical oceanographic information.

I want to walk you through this site to show you what we did. First of all, we picked a humble name here, Gulf of Maine Information System (Figure 13). We have the categories listed at the top. Somebody said they did not like to see a lot of text. Well, instead of having some really attractive icons here in the front, we just tried to put most of the main categories of things right on the front page so you can get an overview right away of what is there, instead of having just a pretty picture on the first page and then having to click onto some other page and so on and so forth.

We tried to put the direct links to what we thought were the important parts of the system right on the front page, in fact, on the first window that you see. Some people actually do not even browse down to the bottom of the page, so we tried to get everything to fit onto a screen the size of a notebook.

We decided to separate the information on this site into links to data, modeling, descriptions of the research projects, and a laundry list of all the other links that we know about (Figure 13). We actually concentrated on the data and on the regional research project descriptions. We split the data out by categories. Of course, they do not always divide cleanly into categories such as physical, geological, chemical, biological or geographic. We also put all the things that had near or real-time access together in a particular spot. I should mention that I actually do physical simulations, particularly, circulation modeling and interfacing with biological-physical models. So, I need to have real-time or near real-time information to drive these models. From a selfish point of view, this was very useful.

When I look at the hits on this site, a number of people are using it to get at other information that does not actually exist on this site. For instance, meteorology and wave data from the NOAA buoys, water levels from NOAA, river discharge from the USGS, sea surface temperature images and current sea surface observations. Some of these sites are relatively difficult to find. If you are looking for water level data, that site presents you with a national list of water level gauges which you have to work through. The same is true for some of these other sites.

What we tried to do initially was to customize the interface with the national sites to make it more useful for people who are just interested in the Gulf of Maine So, instead of being presented with a list of 3,000 stations, they might only get the 20 that were in the Gulf of Maine. Simple things like that are things that make it a lot easier for people trying to get data.

Again, this system is basically geared towards people trying to get data. There was some discussion earlier during the workshop, indicating that a lot of people do not want data; who are what they want is knowledge. They want to get the knowledge of the scientific community or from the general community. We had a hard enough time trying to figure out how to get the data together. I do not have a clue of how to go about trying to serve knowledge, although we talk about it a lot.

Figure 14 shows one example of the customization. If you click on river discharges, instead of going to the USGS water discharge page which is a wonderful site, it just comes up and it lists some of the main river discharges in the system: Penobscot, Kennebec, Androscoggin, Saco and Merrimack. You can click on these to find the real-time data. So, that was one effort to try to make this system more useful for users.

We realized that the data was, in many cases, most effectively served by a specific institution. The Bedford Institute has a very large database including hydrographic data of temperature and salinity that they serve very effectively from their site. So we did not want to bring that all here. But at the same time, we wanted to try to figure out some way of letting people find out about all of the information that was being served. So, we actually spent some time in the beginning to try to develop our own metadata system to allow people to come in and type in some key words and then be led to the site that could provide them with the data (Figure 15). But that turned out to be a fair amount of wasted effort. It was one of the lessons that we learned.

The metadata site has never really worked very well. There are national metadata places, like NASA's global change master directory, that have a tremendous amount of data and metadata that you can search, but to tell you the truth, I have never really found any useful scientific data by going through those things. The way I actually find data that is not on the system is through the standard text search tools that are already on the Web, as opposed to a lot of these ones that try to be fancy with latitude, longitude and specific metadata.

It was difficult to develop the metadata in a consistent way. Just to give you an example, we decided to contribute metadata from this project to the global change master directory. We thought it would be most effective if people searched on latitude and longitude so that they could come back with individual time series measurements that we had made in the Gulf. So, we sent each time series observation down as a separate metadata document, so that if somebody did a query they could see the number of documents, for example in a specific query, like Boston Harbor. They could come back with just the time series that was obtained in Boston Harbor as opposed to one response coming back saying all current metadata on the East Coast held by USGS.

Well, the result was that when you did a query of the global change master directory for the Gulf of Maine, you were flooded with USGS time series data throughout the Gulf. Somewhere buried in there might be NOAA's entire collection of time series data for the East Coast. It is a very tricky issue. At what point do you develop a metadata for a particular document? Is it one measurement in space and time? Is it a collection of measurements? Is it a one time series? Is it a collection of time series? It is a very tricky issue. I think that might be part of the reason why my experience with metadata has been somewhat less than satisfactory.

Another approach that we thought was clever, and it may be useful to this audience, is using existing web engines by putting metatags into your web documents. The idea is that you could do something like the AltaVista search. You can put "metatags" in your documents that do not appear to the person browsing. The metatags are searched by the Web engines. So, in this case, if you put something in your document that is fairly unique, like "Go Maine" or "Go Maine 23" or something like that, then you type that in on one of these search engines, it will find only those documents that have that metatag in this site.

For example, "Go Maine" plus "circulation model" would find all the documents that had "Go Maine" in them plus "circulation model." That means if you want your page to be searched by this Gulf of Maine system, all you have to do is put "Go Maine" into your HTML code, and then that would be automatically searched for by the engine.

It is pretty neat because it does not involve you having to go harass somebody to try to get them to contribute something. If somebody is out there and they say, "Hey, that is a system that I would like to be associated with," they can just put a tag into their document and have their page searched.

We got three hundred thousand dollars to do this. It was split between four institutions over a period of three years, so each had about twenty five thousand dollars a year. That was enough to

get a person to half time on this at four different institutions. I think if we were going to do it again, I would have taken that money and put it into a couple of people working at one place, so that person who is being paid full-time on this project was coming in every morning and thinking, "what can I do to improve this Gulf of Maine information system today?" As it was, it was fractionated out among four institutions, part-time people, and there was a tendency to be waiting for the other person to do something. It was not clear who was going to be the lead on various components of these things, so I think that was a bit of a struggle.

Another mistake was that initially we wanted to build a map-based interface. At the time, we had a lot of data sets in Arc. There were no tools out there to effectively browse through ArcInfo, so we started building our own with pearl strips and stuff. We actually spent a long time developing this system. Then ESRI announced map server products which basically blow all our efforts out of the water. That was an important lesson for us to learn. We are such a small community that we should not be building the software.

We learned that we should be working on our data sets to make them compatible with systems that may be coming along. Actually, we spent the majority of our effort in this project working on large data sets that we had in-house that we felt could be put into such a system when it arrived we put them in order so that it would be available. The main showcases of this system are a large time-series database, including the Bedford hydrographic database and this bathymetry database that we put together for the Gulf, realizing that there was no high-quality digital imagery for the region available at the time (Figure 16).

I find myself using the system. Just yesterday, in fact, I was looking at a paper on red tide in the Gulf of Maine. It was written back in 1988. They were talking about a particular event where the toxicity level went from zero to eight thousand at Pemaquoid Point in Maine. Eighty is the closure level. I was very interested in how that might have happened. I actually went into the system. I went to the time series browser, did a time search and found a wind record from August 1980, plotted out those few days before that event, and found that there was a big event, which was blowing on shore just before that time (Figure 17).

So, I learned something. There are two different ideas about how these red tides hit the coast. One is that they come from lower layers and are upwelled. On an upwelled coast there is another hypothesis that they come from offshore and are, therefore, brought to the coast by downwelling events. This was clearly a big downwelling event. I cannot imagine how I would have found that information before. I am sure it would have taken me several weeks instead of a minute to come to that answer. It was definitely an event being brought in from offshore.

Question Session

MR. BARKER: Evidently, for your project the user base was defined. But how did you further identify what the needs were, because it still is a pretty diverse community that you are dealing with? Did you go through a process of really looking at different institutions and what would serve you best, or did you pretty much use what you felt was common wisdom in coming up with that?

MR. SIGNELL: I guess we would have to say there were several meetings where people got together and talked about various data sources that might be available. To be honest, we went with data sources that we knew about that needed to be fixed up and put together. We have also relied somewhat on people telling us that we needed to add certain information to their site. We did not go out and do a market survey to find out what people thought of this particular site. Hopefully we will get some of that feedback today.

MR. TRIPP: But you were not asked to do that. Your community was the Regional Marine Research Program (RMRP).

MR. SIGNELL: Right. You know, I did forget to say one thing that I wanted to say, which was, on these RMRP research projects, if you go to the "RMRP Research Project" link, you will find a one-line description of each of these projects, and from there, you can link to the data (Figure 18). When you click on one of these links, it tells you a couple of paragraphs about the project, and then if you want to go look at what the data is, you can go get it.

Now, every one of these should have been filled in for data, because our primary mission was to get the data for the Regional Marine Research Project, but they are not. They are not because it is incredibly hard to get data from scientists, even as a fellow scientist. I did learn some things. I mean, initially we thought, "We will just send out an email to everybody and they will give us the data." So, we sent out an email list. Nobody responded to that. If I personally sent an individual email to each person, then I got some more responses, because they figured, "Okay, well, he is not just dumping this out on a list; he is taking the time to write me personally." That got a few responses. I had the guy working for me, who was getting paid by this project, call them up. Nobody would talk to him. If I called them up, they were a little bit more likely to talk to me. If I spent more time on the phone with them, they were more likely to give me data. Then I said, "Can I visit you and spend a day with you and help you get your data together?" That was the only thing that actually really worked. Unfortunately, I could not really do that with everybody.

Scientists are willing to cooperate, but they are tremendously busy. I think the psychology was that if they see that I am busy but I am willing to spend a day of my time to go get their data, then it must be really important at least to me so they will spend a day of their time to try to get me the data.

MR. KEELEY: It seems to me there is a much easier solution. On the very first grant, say six hundred thousand dollars over 36 months, you can withhold the last ten percent until the data has been provided.

MR. SIGNELL: That sounds right. You can say, "Okay, no money if you do not hand over the data." But, on our project, they were all mandated to hand over the data. Bruce, would you like to comment on this?

MR. TRIPP: They did hand over the data. They were mandated to hand over the data electronically. You can get a floppy disk with some data on it, but it has got to be readable. It has got to be in a form that other people can use.

MR. SIGNELL: You cannot get that data on a floppy.

MR. TRIPP: Well, in some format. But there are data that are accumulated when you are doing the science that are very specific. Scientists may be using software programs to accumulate and store data that are not widely used. Just getting that data electronically will not be useful to everybody. There is another step needed in there.

MR. KEELEY: It seems to me that if that is the case, we need to do a better job when we are awarding grants. We must articulate exactly what are the final products. It is quite common when you are asking someone to prepare a report to specify that you require 12 copies camera ready, or whatever are the requirements. So, maybe what you are saying is that we need to be more clear in describing the end products of research projects.

MR. SIGNELL: I think that is fair. Some of the problems we had in this project had to do with the physical oceanographic data, because there was no format, really, that we could tell them to hand it over in. We could not say use Excel or Access or something like that.

MR. HOPKINS: I wonder if this is not an issue relating to what scientists expect to have to do with their data and whether or not we can coerce them to hand it over by withholding the last ten percent. I wonder if this does not illustrate a much larger issue having to do with the nature of exchange, the nature of relationships between humans and between organizations, whether this is an important enough event that people should invest in it and whether you have demonstrated that it is important to you. All those kinds of levels are really the human factor. How much can we trust this organization? Where I come from, in eastern Maine, a lot of folks have great distrust about how much they are going to reveal to any scientist or agency person or anyone else, and that is part of the nature of the difficulty of working at the local level. I wonder, as we go through this over the next day or two, if we should try to address this issue. I think that it has something to do with the nature of the way humans interact, more than just the way scientists do not want to let go of their findings.

MS. MOONEY-SEUS: Could you explain more about the metadata, not only what it is and how you use it, but also why you had trouble with it and why you did not find it effective?

MR. SIGNELL: Well, I think it is a great concept. When you first hear about it you think, "Wow, this is perfect." It is almost like an index card for data sets. There is certain information about that data set that you can put down on an index card. You can include the minimum latitude of your range or extent of your data, latitude/longitude range, time range, a few key words, who the investigator was who holds the data, a few things like that. For every project, you could put a little bit of information about that data.

The data itself could then be put into a database, and you could search on that metadata. It would return you to the actual data or the actual site. There are very large systems set up to do that. I do not know if you looked at any last night, but it would be a good thing to examine. I am not saying you cannot find useful data on a metadata system. There is a tremendous amount of data that is there. It is just that I have usually found it more effective to locate data through the Web. I do not know if others have different experiences, but I can usually locate stuff more effectively using pluses and minuses with AltaVista to find what I want as opposed to these metadata engines. Part of the reason, I think, is because, if you were NASA, you could put in one metadata document and you could say, "Goes from the south pole to the north pole, all the way around the world, all the data we have ever collected." But that is not very useful.

If you go to the other extreme of collecting a grab sample with a certain characteristic, and the metadata is written about that -- that is totally at the opposite end of the spectrum. Part of the problem of doing a metadata search is you might get 5,000 grab samples of something which you do not care anything about. You know, page after page of hits, and then buried in there is something like a global data set. Maybe that is good. Maybe you did not know about all that was out there. That has been my personal experience.

MS. MOONEY-SEUS: Are you basically saying that the information that is put into metadata is arbitrary and that is why it is not effective?

MR. SIGNELL: I think there are others in the room who have very different view points on this, and it would be useful to hear from them.

DR. EVANS: My comment about metadata is probably that the whole philosophy of searching, based on detailed metadata, requires the metadata be very detailed and very highly structured. It takes a lot of work to prepare this very complicated card catalogue, if you will. There are only a few people in this world who actually enjoy doing that work. They are called librarians. Most of us just cannot stand doing that work, so metadata tends to get done sloppily or not at all. So, searching on that metadata that was not really put together with any great loving care tends to be unsuccessful a lot of the time.

The reason the search engines are so successful is that most of them have very good ways of dealing with highly unstructured webpages and extracting and indexing their "content" as represented by the actual text in the pages. If there were search engines that could go into relatively unstructured geographic data or other kinds of data and extract the meaning of what is in there, then we could probably have just as successful a search experience on these geographic data resources without someone having to go in and compile a whole onset of structured metadata.

MR. BARKER: We could probably talk all day about metadata. At least, some people could, but we do not need to. There is another reason for metadata, particularly for managers or people who are familiar with data sets -- just to have an idea of what it is they are looking at. That is very important, very basic and does not have to be that complicated. It certainly does not get at search engines and really using the data to a full extent. But unless there is some of that

information, we are going to be continuing to deal with the limitations of the Web. There is a lot of information out there, but what is it that we are looking at? And, that is where metadata really comes in handy.

MR SCHROEDER: I would like to add one more perspective. I heard an interesting presentation about a month ago, very parallel to this discussion. It was a person who works for NOAA. I believe he is in Colorado. He said, "In research, the fundamental metadata object is the published article of the research report." He had also a spectrum from data elements through general theory and where you land on that spectrum when you are looking for something.

I thought that his suggestion of the research report as being the fundamental document was very helpful, because that can also lead into what John Evans was talking about, the free text searching. If we had more access to publishers results, we might have a better success when we do our full text searching. The person who made the presentation also said, "Well, this could tell us where we should be archiving, because data are changing all the time and it is really the researchers responsibility to archive data." If there could be some archiving standards when research results are published, then you could have that more easily.

So, I think that we are trying to move toward a set of standards that people are going to maintain within this community. The whole publication world also is responsible, because a lot of these research results go places that are not accessible to anyone, and they are held in copyright in very small circulation journals and so forth. I think that there is a convergence here of a number of trends.

MR. KEELEY: Rich, I am curious. Looking forward here, we are going to place a lot of stock or value in individual webpages. That seems to be the medium that we are going to use to link all of these efforts. As you worked with your colleagues in the scientific community, could you characterize for us the quality of individual principal investigators' (PI's) webpages, where they got their support, whether it was provided by the institution, whether the PI needed to learn how to create his or her own webpage, and how frequently they are updating their webpage?

MR. SIGNELL: It is a wide spectrum. Scientists who have a technological bent will do their own webpages. I do my own webpages. I do not know any institution that actually gives people money to make webpages. So, it is almost all after hours or whatever. So, the quality varies widely. Obviously, if you go to a particular institution and just look around, there is a tremendous variety of personal webpages. I think that may change. Maybe people will start giving money to develop webpages at the individual investigator level, but I do not think that happens now.

MR. TRIPP: There are two issues of quality. I am not sure which one David Keeley was referring to. There is content, and Rich Signell has been working with a really small universe, and the quality of the content is probably unparalleled. There is no question about that. The aesthetic quality may vary dramatically. I used the Rinehart Coastal Research Center website last night, but there was no aesthetic quality there. It is a list of bullets. There is nothing fancy or wizbang about that. So, there are definitely two qualities.

As you get beyond Rich Signell's USGS site and you start looking for information elsewhere on the Web, you certainly need to think about the issue of quality because anybody could put up a website. It takes nothing at all to learn how to write some HTM and to make your own website. So, the issue of content quality is one that we are going to have to deal with, and we do deal with it in the hard copy world. We just have to learn the tricks to deal with it in the virtual world.

FIGURE 13. Gulf of Maine Information System Homepage

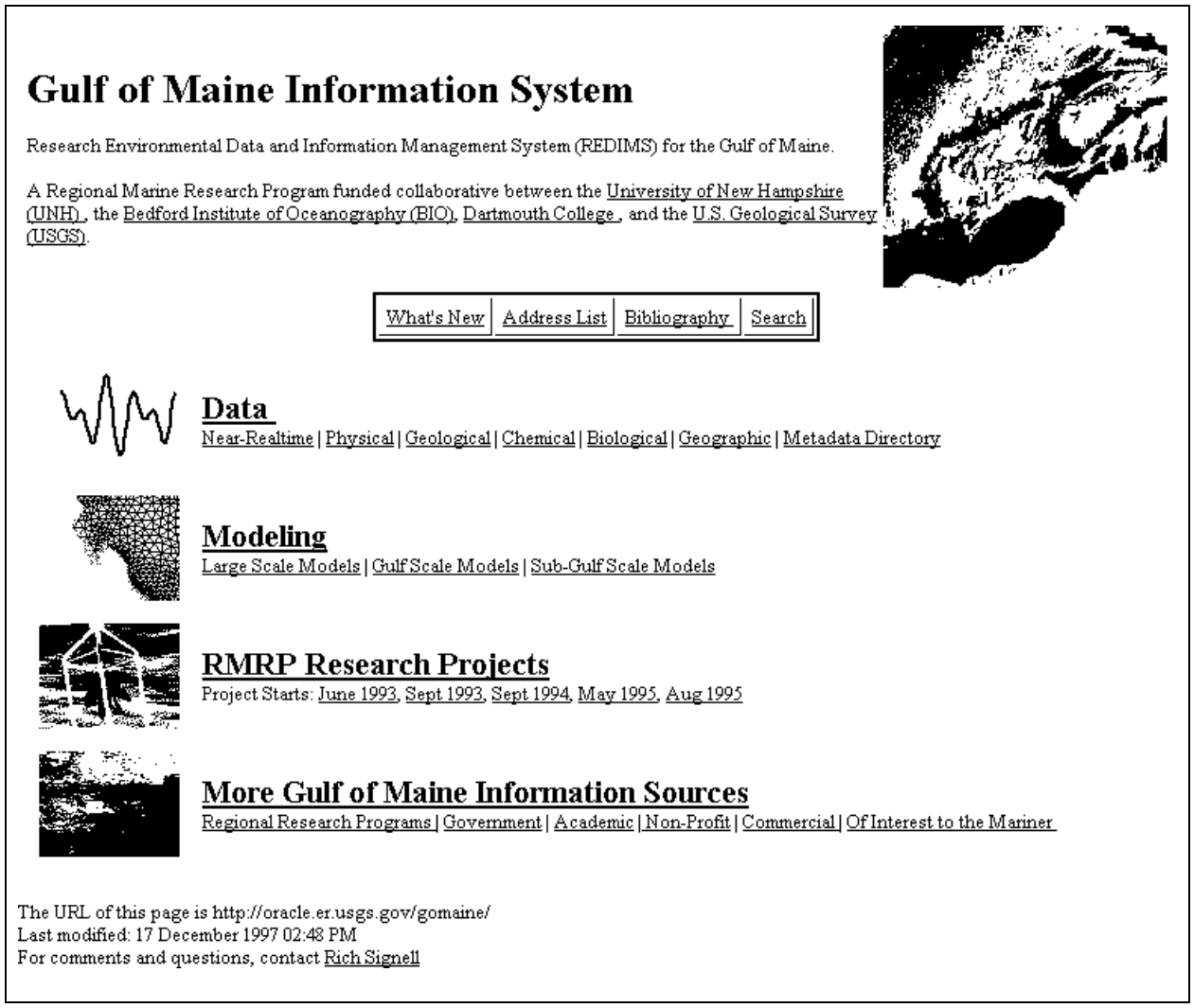
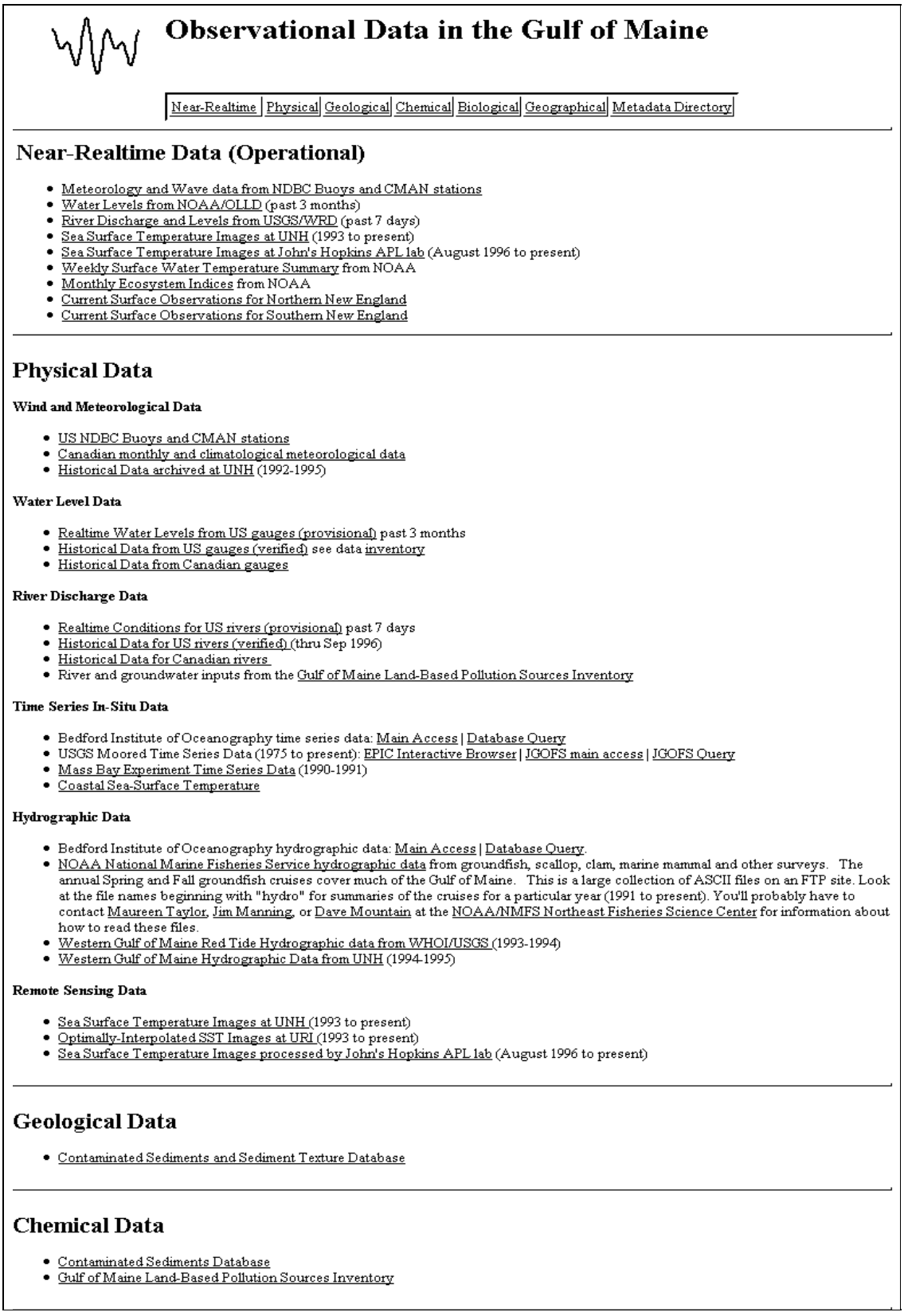


FIGURE 14. Observational Data in the Gulf of Maine Link



Observational Data in the Gulf of Maine

Near-Realtime | Physical | Geological | Chemical | Biological | Geographical | Metadata Directory

Near-Realtime Data (Operational)

- Meteorology and Wave data from NDBC Buoys and CMAN stations
- Water Levels from NOAA/OLLD (past 3 months)
- River Discharge and Levels from USGS/WRD (past 7 days)
- Sea Surface Temperature Images at UNH (1993 to present)
- Sea Surface Temperature Images at John's Hopkins APL lab (August 1996 to present)
- Weekly Surface Water Temperature Summary from NOAA
- Monthly Ecosystem Indices from NOAA
- Current Surface Observations for Northern New England
- Current Surface Observations for Southern New England

Physical Data

Wind and Meteorological Data

- US NDBC Buoys and CMAN stations
- Canadian monthly and climatological meteorological data
- Historical Data archived at UNH (1992-1995)

Water Level Data

- Realtime Water Levels from US gauges (provisional) past 3 months
- Historical Data from US gauges (verified) see data inventory
- Historical Data from Canadian gauges

River Discharge Data

- Realtime Conditions for US rivers (provisional) past 7 days
- Historical Data for US rivers (verified) (thru Sep 1996)
- Historical Data for Canadian rivers
- River and groundwater inputs from the Gulf of Maine Land-Based Pollution Sources Inventory

Time Series In-Situ Data

- Bedford Institute of Oceanography time series data: Main Access | Database Query
- USGS Moored Time Series Data (1975 to present): EPIC Interactive Browser | JGOFS main access | JGOFS Query
- Mass Bay Experiment Time Series Data (1990-1991)
- Coastal Sea-Surface Temperature

Hydrographic Data

- Bedford Institute of Oceanography hydrographic data: Main Access | Database Query.
- NOAA National Marine Fisheries Service hydrographic data from groundfish, scallop, clam, marine mammal and other surveys. The annual Spring and Fall groundfish cruises cover much of the Gulf of Maine. This is a large collection of ASCII files on an FTP site. Look at the file names beginning with "hydro" for summaries of the cruises for a particular year (1991 to present). You'll probably have to contact Maureen Taylor, Jim Manning, or Dave Mountain at the NOAA/NMFS Northeast Fisheries Science Center for information about how to read these files.
- Western Gulf of Maine Red Tide Hydrographic data from WHOI/USGS (1993-1994)
- Western Gulf of Maine Hydrographic Data from UNH (1994-1995)

Remote Sensing Data

- Sea Surface Temperature Images at UNH (1993 to present)
- Optimally-Interpolated SST Images at URI (1993 to present)
- Sea Surface Temperature Images processed by John's Hopkins APL lab (August 1996 to present)

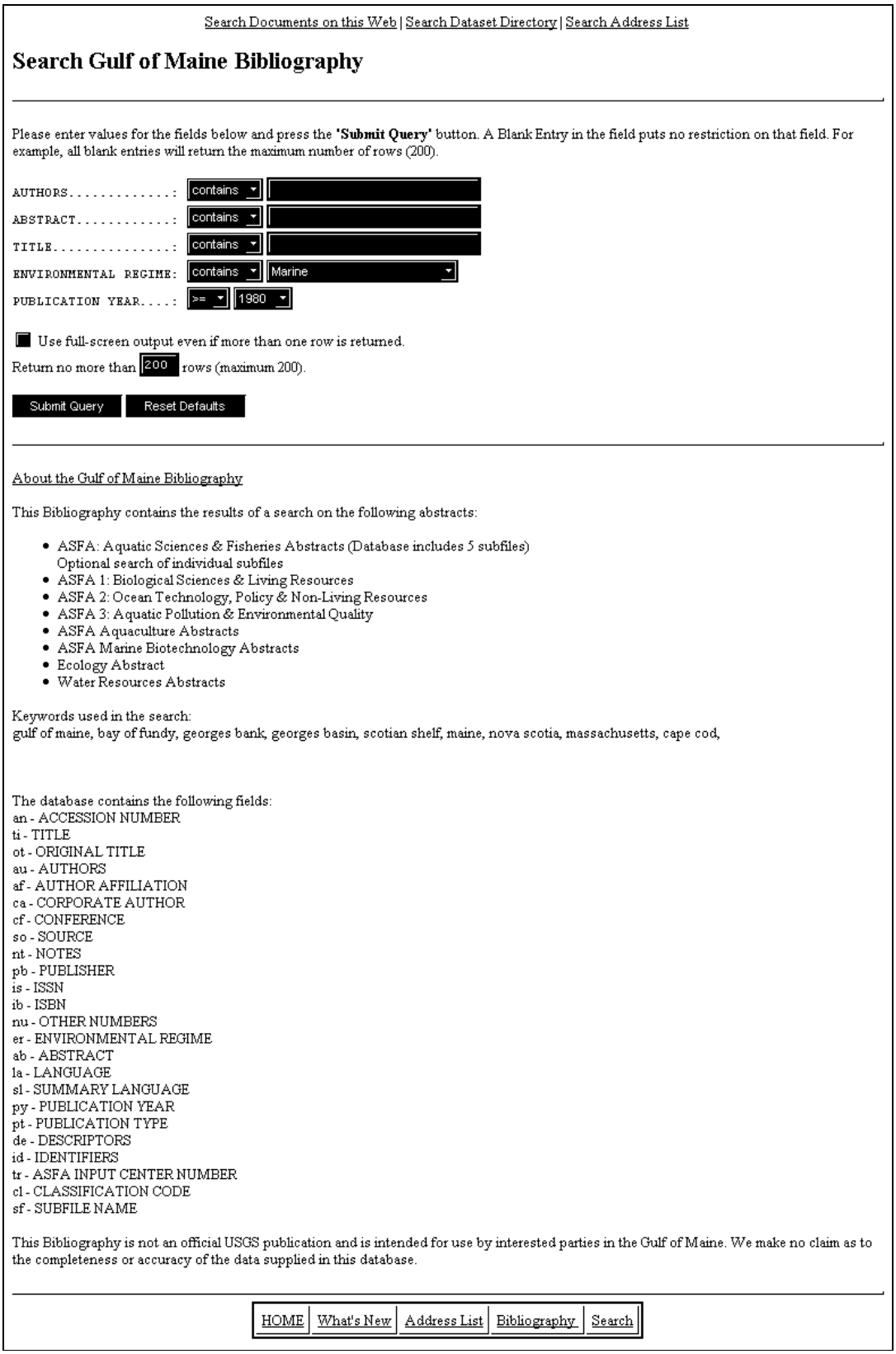
Geological Data

- Contaminated Sediments and Sediment Texture Database

Chemical Data

- Contaminated Sediments Database
- Gulf of Maine Land-Based Pollution Sources Inventory

FIGURE 15. Gulf of Maine Search Link



Search Documents on this Web | Search Dataset Directory | Search Address List

Search Gulf of Maine Bibliography

Please enter values for the fields below and press the **'Submit Query'** button. A Blank Entry in the field puts no restriction on that field. For example, all blank entries will return the maximum number of rows (200).

AUTHORS.....: contains
ABSTRACT.....: contains
TITLE.....: contains
ENVIRONMENTAL REGIME: contains Marine
PUBLICATION YEAR....: >= 1980

Use full-screen output even if more than one row is returned.

Return no more than 200 rows (maximum 200).

Submit Query | Reset Defaults

About the Gulf of Maine Bibliography

This Bibliography contains the results of a search on the following abstracts:

- ASFA: Aquatic Sciences & Fisheries Abstracts (Database includes 5 subfiles)
  Optional search of individual subfiles
- ASFA 1: Biological Sciences & Living Resources
- ASFA 2: Ocean Technology, Policy & Non-Living Resources
- ASFA 3: Aquatic Pollution & Environmental Quality
- ASFA Aquaculture Abstracts
- ASFA Marine Biotechnology Abstracts
- Ecology Abstract
- Water Resources Abstracts

Keywords used in the search:
gulf of maine, bay of fundy, georges bank, georges basin, scotian shelf, maine, nova scotia, massachusetts, cape cod,

The database contains the following fields:
an - ACCESSION NUMBER
ti - TITLE
ot - ORIGINAL TITLE
au - AUTHORS
af - AUTHOR AFFILIATION
ca - CORPORATE AUTHOR
cf - CONFERENCE
so - SOURCE
nt - NOTES
pb - PUBLISHER
is - ISSN
ib - ISBN
nu - OTHER NUMBERS
er - ENVIRONMENTAL REGIME
ab - ABSTRACT
la - LANGUAGE
sl - SUMMARY LANGUAGE
py - PUBLICATION YEAR
pt - PUBLICATION TYPE
de - DESCRIPTORS
id - IDENTIFIERS
tr - ASFA INPUT CENTER NUMBER
cl - CLASSIFICATION CODE
sf - SUBFILE NAME

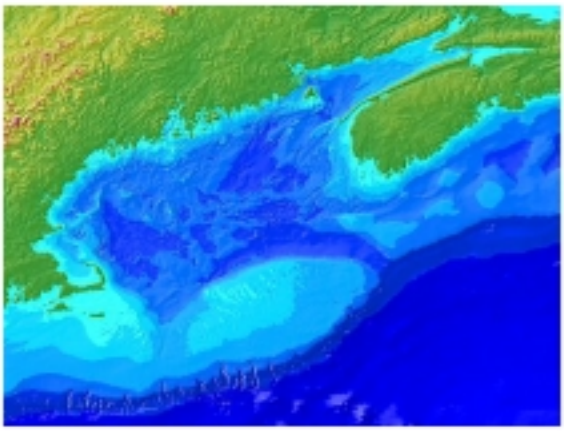
This Bibliography is not an official USGS publication and is intended for use by interested parties in the Gulf of Maine. We make no claim as to the completeness or accuracy of the data supplied in this database.

HOME | What's New | Address List | Bibliography | Search

FIGURE 16. Construction of Digital Bathymetry for the Gulf of Maine Link

USGS Geologic Division Coastal and Marine Geology Program GOMAINE

Construction of Digital Bathymetry for the Gulf of Maine



Authors: Ed Haworth & Rich Signell

On these pages we document the procedures we used to construct 15 arc second (~1/2 km grid cell size) and 30 arc second (~1 km grid cell size) resolution bathymetric grids for the Gulf of Maine (Longitude = 71.5 - 63 W, Latitude = 39.5 - 46 N). The goal was to construct the best gridded products possible using available digital bathymetry datasets. In addition to the grids themselves, valuable ancillary products such as corrected sounding data, digital bathymetric contour lines and shaded-relief maps were generated and are available in a variety of formats, including Arc, Matlab, GMT and ASCII.

Introduction to Gulf of Maine Bathymetry

Assembling the Input Data

1. NOAA Hydrographic Survey Data and NGDC Marine Trackline Geophysics Data
2. Naval Oceanographic Office DBDB-V gridded bathymetry
3. Datasets from Bedford Institute of Oceanography and Brookhaven National Laboratory
4. NOAA Medium Resolution Digital Shoreline and DMA World Vector Shoreline
5. Defense Mapping Agency ETOPO5 Digital Relief of the Surface of the Earth
6. GEBCO General Bathymetric Chart of the Oceans
7. USGS North American 30 Arc-Second DEM

Generating the Bathymetric Grids

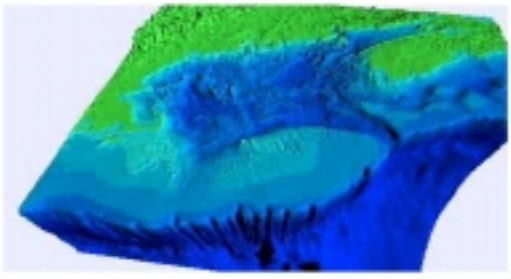
Data Products

1. Images: for graphics packages and map overlays.
2. Grids: The 15 and 30 second grids in Arc, GMT, Matlab and ASCII formats.
3. Contours: ArcInfo and Matlab (a simple ASCII format)
4. The processed sounding files in ASCII format: 3 column flat files containing longitude, latitude and elevation.

Appendix

Metadata
References

Fly-By Movie of the Gulf of Maine (1.7 Mb MPEG)



The URL of this page is http://oracle.er.usgs.gov/gomaine/
Last modified: 02/18/99
For comments and questions, contact Rich Signell

FIGURE 17. Modeling in the Gulf of Maine Link

Modeling in the Gulf Of Maine

Large Scale Models

- East Coast Forecast System: NOAA/Princeton operational nowcast model for the East Coast. 3D Blumberg/Mellor type circulation model forced by Eta atmospheric model.
- Atlantic Shelf Circulation Modeling: Bedford Institute of Oceanography model results of the seasonal circulation on the Scotian Shelf, GeorgesBank, Gulf of Maine, Newfoundland Shelf and Laurentian Channel .

Gulf-of-Maine Scale Models

- Dartmouth Circulation Models for the Gulf of Maine and Georges Bank: Data, software, model results, publications from 3D finite element diagnostic and prognostic circulation models of the Gulf of Maine. Also an interactive drifter simulation!
- Ecosystem Modeling : Circulation and seven component ecosystem modeling of the Gulf of Maine at the University of Maine.
- A model study of buoyancy-driven circulation in the Gulf of Maine. Journal of Physical Oceanography. 24 (11), 2387-2412. For more information contact Dave Brooks

Sub-Gulf-of-Maine Scale Regional Models

- Cobscook Bay Modeling (TAMU)
- Maine Coastal Current Modeling (Dartmouth)
- Western Gulf of Maine Red Tide Modeling (USGS)
- Massachusetts Bay Modeling (USGS)

Related Modeling Information

- Coastal Ocean Modeling at Dalhousie (Mostly Scotian Shelf)
- Coastal Hydrodynamics Modelling (Canadian Fisheries and Oceans)

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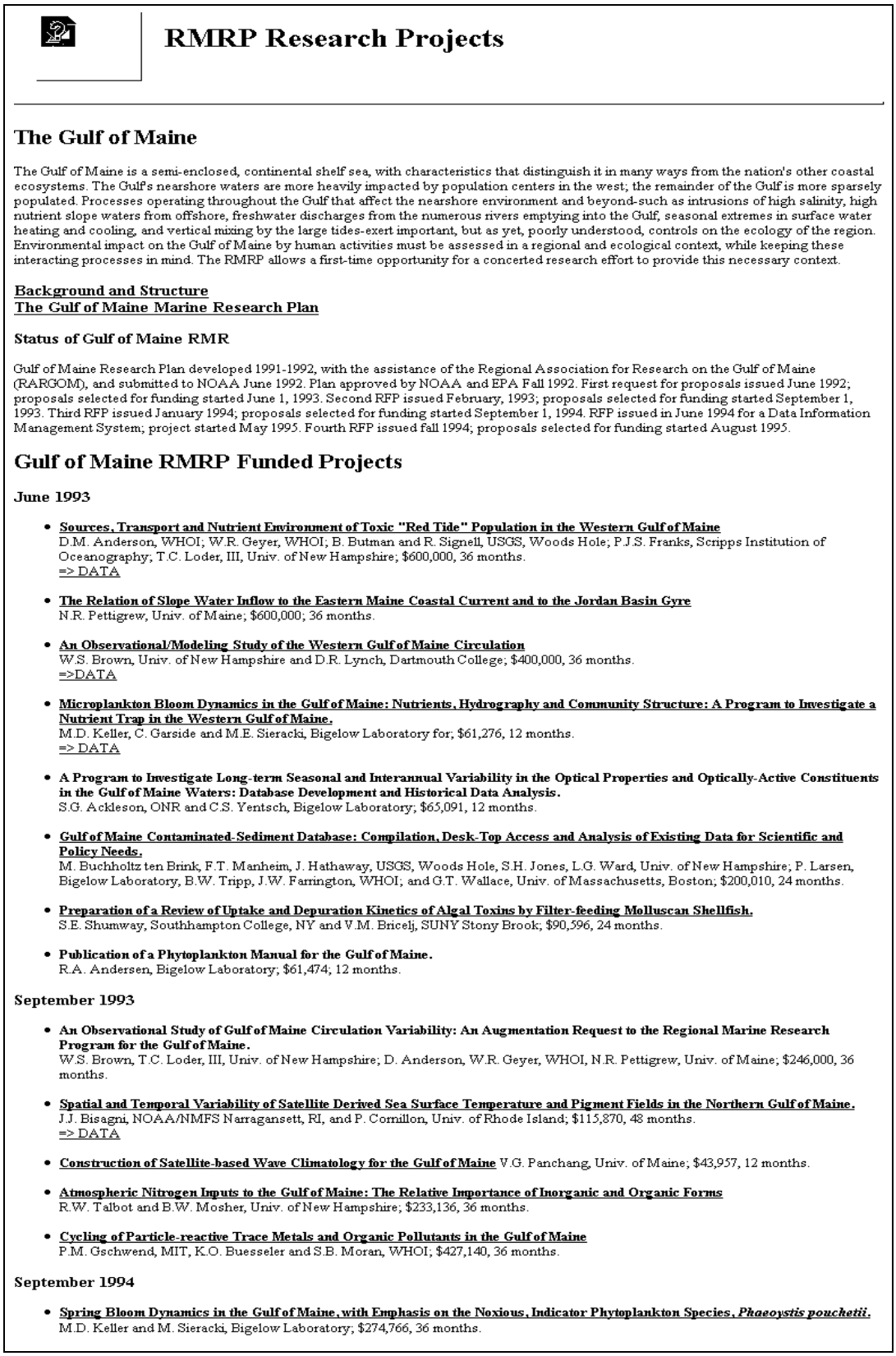
The URL of this page is http://oracle.er.usgs.gov/GoMaine/models.html
Last modified: 05 April 1998 11:55 AM
For questions or comments, contact: Rich Signell

FIGURE 18. RMRP Research Projects Link



RMRP Research Projects

The Gulf of Maine

The Gulf of Maine is a semi-enclosed, continental shelf sea, with characteristics that distinguish it in many ways from the nation's other coastal ecosystems. The Gulf's nearshore waters are more heavily impacted by population centers in the west; the remainder of the Gulf is more sparsely populated. Processes operating throughout the Gulf that affect the nearshore environment and beyond-such as intrusions of high salinity, high nutrient slope waters from offshore, freshwater discharges from the numerous rivers emptying into the Gulf, seasonal extremes in surface water heating and cooling, and vertical mixing by the large tides-exert important, but as yet, poorly understood, controls on the ecology of the region. Environmental impact on the Gulf of Maine by human activities must be assessed in a regional and ecological context, while keeping these interacting processes in mind. The RMRP allows a first-time opportunity for a concerted research effort to provide this necessary context.

Background and Structure
The Gulf of Maine Marine Research Plan

Status of Gulf of Maine RMR

Gulf of Maine Research Plan developed 1991-1992, with the assistance of the Regional Association for Research on the Gulf of Maine (RARGOM), and submitted to NOAA June 1992. Plan approved by NOAA and EPA Fall 1992. First request for proposals issued June 1992; proposals selected for funding started June 1, 1993. Second RFP issued February, 1993; proposals selected for funding started September 1, 1993. Third RFP issued January 1994; proposals selected for funding started September 1, 1994. RFP issued in June 1994 for a Data Information Management System; project started May 1995. Fourth RFP issued fall 1994; proposals selected for funding started August 1995.

Gulf of Maine RMRP Funded Projects

June 1993

- **Sources, Transport and Nutrient Environment of Toxic "Red Tide" Population in the Western Gulf of Maine**
  D.M. Anderson, WHOI; W.R. Geyer, WHOI; B. Butman and R. Signell, USGS, Woods Hole; P.J.S. Franks, Scripps Institution of Oceanography; T.C. Loder, III, Univ. of New Hampshire; $600,000, 36 months.
  => DATA
- **The Relation of Slope Water Inflow to the Eastern Maine Coastal Current and to the Jordan Basin Gyre**
  N.R. Pettigrew, Univ. of Maine; $600,000; 36 months.
- **An Observational/Modeling Study of the Western Gulf of Maine Circulation**
  W.S. Brown, Univ. of New Hampshire and D.R. Lynch, Dartmouth College; $400,000, 36 months.
  =>DATA
- **Microplankton Bloom Dynamics in the Gulf of Maine: Nutrients, Hydrography and Community Structure: A Program to Investigate a Nutrient Trap in the Western Gulf of Maine.**
  M.D. Keller, C. Garside and M.E. Sieracki, Bigelow Laboratory for; $61,276, 12 months.
  => DATA
- **A Program to Investigate Long-term Seasonal and Interannual Variability in the Optical Properties and Optically-Active Constituents in the Gulf of Maine Waters: Database Development and Historical Data Analysis.**
  S.G. Ackleson, ONR and C.S. Yentsch, Bigelow Laboratory; $65,091, 12 months.
- **Gulf of Maine Contaminated-Sediment Database: Compilation, Desk-Top Access and Analysis of Existing Data for Scientific and Policy Needs.**
  M. Buchholtz ten Brink, F.T. Manheim, J. Hathaway, USGS, Woods Hole, S.H. Jones, L.G. Ward, Univ. of New Hampshire; P. Larsen, Bigelow Laboratory, B.W. Tripp, J.W. Farrington, WHOI; and G.T. Wallace, Univ. of Massachusetts, Boston; $200,010, 24 months.
- **Preparation of a Review of Uptake and Depuration Kinetics of Algal Toxins by Filter-feeding Molluscan Shellfish.**
  S.E. Shumway, Southhampton College, NY and V.M. Bricelj, SUNY Stony Brook; $90,596, 24 months.
- **Publication of a Phytoplankton Manual for the Gulf of Maine.**
  R.A. Andersen, Bigelow Laboratory; $61,474; 12 months.

September 1993

- **An Observational Study of Gulf of Maine Circulation Variability: An Augmentation Request to the Regional Marine Research Program for the Gulf of Maine.**
  W.S. Brown, T.C. Loder, III, Univ. of New Hampshire; D. Anderson, W.R. Geyer, WHOI, N.R. Pettigrew, Univ. of Maine; $246,000, 36 months.
- **Spatial and Temporal Variability of Satellite Derived Sea Surface Temperature and Pigment Fields in the Northern Gulf of Maine.**
  J.J. Bisagni, NOAA/NMFS Narragansett, RI, and P. Cornillon, Univ. of Rhode Island; $115,870, 48 months.
  => DATA
- **Construction of Satellite-based Wave Climatology for the Gulf of Maine** V.G. Panchang, Univ. of Maine; $43,957, 12 months.
- **Atmospheric Nitrogen Inputs to the Gulf of Maine: The Relative Importance of Inorganic and Organic Forms**
  R.W. Talbot and B.W. Mosher, Univ. of New Hampshire; $233,136, 36 months.
- **Cycling of Particle-reactive Trace Metals and Organic Pollutants in the Gulf of Maine**
  P.M. Gschwend, MIT, K.O. Buesseler and S.B. Moran, WHOI; $427,140, 36 months.

September 1994

- **Spring Bloom Dynamics in the Gulf of Maine, with Emphasis on the Noxious, Indicator Phytoplankton Species, *Phaeocystis pouchetii*.**
  M.D. Keller and M. Sieracki, Bigelow Laboratory; $274,766, 36 months.

Elaine Brown
program development coordinator, Institute of Water Research, Michigan State University

I am very happy to be here today. I am going to talk about two projects that we did in the Midwest. In this Midwest effort we have focused on a particular resource issue, area and target audience, using a more "bottoms-up" approach. I will present the background of the projects, our goals, challenges, successes, and lessons learned. If we have time, I will go into the future direction.

I work at the Michigan State University in a building that is across the hall from the Natural Resources Conservation Service (NRCS), which is part of the USDA. They specialize in programs that get conservation on the land, by working with farmers on non-point sources of pollution. They have a lot of wonderful data and information that people cannot readily access at this point, so we started thinking about how to use the information technology to get information to the field staff and landowners. How could we use what we have learned to get materials and information into the hands of NRCS field staff and conservation planners to make their jobs easier and get more conservation on the land?

We wanted to focus not only on a particular field with a particular farmer, but also to integrate that information into watershed management. We wanted to integrate into state planning or the national perspective to allow information to flow back and forth.

The concept was to implement an integrated natural resources integrated information system. The goal was to get more conservation on the land by designing a user-friendly system that meets the local resource needs. I have worked in policy for a long time, and I know that unless we get the landowners to make changes, we are not improving the environment. It was based on partnering, to allow the NRCS to work with other agencies. We worked in particular with the NRCS science centers and their information technology programs to create user-friendly interfaces for national models. Because local end users are absolutely critical, we also worked with farm organizations and commodity groups.

Land conservation requires making science-based decisions on a watershed basis. Michigan State is a land grant university, which means we have research, education and extension functions. Our project brings the science from the crop and soil scientists to local landowners to help people make better decisions.

We set out several objectives for this project. First, we set out to create and test a natural resources communications network that is appropriate for today but looks to the future. It must be open-ended enough to deal with changes and to enhance communication through tools such as the Web. I recently read an article that stated it took about thirty years for 50 million people to have radios. It took thirteen years 50 million people to have television, and it took only four years for 50 million people to get on the Internet. We need to look at the Web as a tool or a piece of equipment that you use to conduct business, not what drives the business. Second, we set out to develop and facilitate interaction and the ability to use software technologies across the eight state Midwest region or a region of planners within a particular state. Third, we wanted to create

a prototype sharing of mapping images and data sets over the Internet, and last, we wanted to provide training, because we recognize that there are people that are afraid to touch a computer.

This system was designed to meet the needs of field staff and landowners and to be useful and transferable to other states. The tools must complement ongoing NRCS efforts, so that they would be complementary with national projects and national standards. The system has to be user-friendly and accessible to partners.

We have a map server that allows the user to take data layers and create a view. It uses digital orthoquad photography and soils data. The user selects which layers he/she wants to examine. Selecting the soils layer brings data and information about soils to your fingertips.

When we started this program, I drove to a small community in northern Michigan and met with about 15 people serving on the NRCS Technology Transfer Team. We sat in a room and brainstormed about using the new equipment, we asked "What is it that you need to do a better job and to make your job easier?" They came up with 43 items. We asked, "What tools or analysis devices do you need?" The Team named 10 different items, and that was a basis for creating the Website for Michigan NRCS. Then we assumed, and we surveyed the other Midwest states also, that what worked for one NRCS state agency, will work in others.

We continued to work with a team of end users and partners, such as soil conservation districts and the Michigan Department of Agriculture, to evaluate how to organize this information in an easy to use manner. Based on that, we created the Website. We created new tools, and we are still developing new tools and ways to use the Internet.

Working within that framework, we created tools like personnel directories, schedulers, and a calendar on the Internet to post activities of interest to other partners. One of the things that we have learned over the last three years is that it takes time for people to feel comfortable and adopt the system.

Based on our NRCS sponsored effort, we initiated another partnership for regional cooperation. The purpose of this "Partnership for Regional Cooperation" (PARECO) project was to expand collaboration efforts.

One of the tools that we used for PARECO was a project webpage. We established a listserv that project participants from all eight states could use to post conference call meeting summaries, subcommittee member information, progress reports, etc. This particular project was very small. We had seventy thousand dollars to work with and eight states with which to work. We did not have an opportunity to meet face to face. I had an opportunity to visit with only two or three of those folks, yet the cooperation has been phenomenal.

We collaborated using information technology tools such as the Web and listserv. There was a monthly conference call, and at the end we were able to meet with these folks. We learned some things that we could share, and we leveraged what were already good programming activities.

The lesson from PARECO is that you can do some good things with a small amount of money, but you cannot create a whole new program. Again, the goal was to get more conservation and natural resources management on the land. For example, we were able to make integrated pest management resources available on the Web. With regard to the issue of metadata, people searched for websites, evaluated the quality of the website, and wrote an annotated description of each website, in this case for integrated pest management.

We wanted this effort to be very participatory, so we did not go to each agent and say, "This is what we want you to do." Rather, we asked, "What can you do to contribute information to the region? Can we work together and form committees with representatives from the different states?" It is a different approach and we would like to continue the effort. We are developing a prototype site to expand our regional cooperation. We had a split within our team with regard to targeting the website audience. The scientists wanted to talk to and provide information to peers, while others wanted to help the community and focus information resources toward local decision makers. The compromise was to design the site for the two different viewpoints. You may link to the information, and if it were from a community point of view, it would be presented a little differently than it would from a scientist's point of view.

The biggest challenges to a regional cooperative effort are building cooperation and gaining management support. We worked with and worked through the Directors of Extension to get their support from the beginning. But the level of cooperation really depended on who was appointed as a representative for the project. It is important to work through that process. One should expect different levels of cooperation within each state.

Based on our first project, the Net 21 effort, it takes a while for people to get comfortable with data and information systems. We have been creating and managing a website for Michigan NRCS, but we do not hold the NRCS data and information. While the website has been online for two years now, NRCS staff has been getting excited about putting their information on the Web for only the last six months. Resource and conservation development groups are finally sending new data to update the website.

I recently received an email message from a woman saying, "I would like to update my program page; can I send the changes to you?" This person is paying attention to a new front door and using the Internet system. That is a sign of success. People are volunteering to add the data, and making end users jobs easier because the information will be at their fingertips.

It took us about six months to work through quality issues with the soil scientists. They now bring us new images and text. They understand that this tool is to their advantage. It is a different front door. On average ninety people a day are visiting the Michigan NRCS site.

Field personnel know that they will never have all the resources and people they need to do their job. So, if they can have tools that help them get more conservation on the ground, then that is what they want. The website is a tool that may help landowners learn about the programs that are of interest to them. They can take this information to the conservation field staff and ask

program specific questions. This saves the landowner and the conservation planner time. So, it is a different way of looking at an information technology tool.

The training aspect has been difficult. We cannot do as much hands-on training as we would like. We offer several hands-on introductory workshops annually for the Internet and new information tools. Seeing people learn to do something new is a nice experience. We had people bringing up soil data with an interactive server, 25 people at a time, and it worked; it was wonderful.

Funding is a constraint. We have had NRCS grants, Michigan State University has provided support, and we are looking to the other partners for support also. There will never be all the money that you want to do things. Funding support is important to the success of the project, but I believe it is collaboration that makes a successful program.

The key lesson learned is that it is important to work with partners and capitalize on each partner's skills and strengths. NRCS has a wealth of data and technical expertise, but they did not have the expertise to put that information online in a way that was useful to field staff or their clients. The University has bright, young computer science students that want to make a contribution. They can bring cutting edge information technology as user-friendly tools. The Extension Service has a wealth of outreach and training activities. We all benefit from each other's strengths. The program capitalizes on the strengths of the partners.

The program has to have a target audience. Our regional project is good for conservation planning. It would not be the place to go for all regional information. You have to keep the interface and information technology tools simple. We did end user surveys. We identified the data and information that people wanted. We created something, and sent it out to end users for testing and refinement.

I had one person call me with feedback about the soil maps. He said, "Elaine, I waited six minutes for this to come up on my machine. I could not get the function buttons to work right." For him, this cutting-edge program was not a useful tool. So we looked at how we could improve the programming to make it work faster. We modified the program so that it brings up the soils more effectively. It is very, very important to get end user feedback. It may look simple to you when you have been looking at it for six months, but that does not mean it looks simple to the person you really want to use the tool.

Another critical element for a successful program is agency leadership support. Commitment and support are important when it comes to adoption and training. Again, the example I use is NRCS. They do a lot of training. But unless the subject is important to them, they do not require people to get training. So you have to look at how to fit into their training system. It is important for field people to know where these new tools are located and know that it is available to them. It is also important that staff people know that it is okay for them to use that tool. There has to be support for using the Internet as a tool, not a source of entertainment.

Capitalize on the energy and the ideas of the early adopters. That first team of 15 people are the ones that are willing to go out on the edge and say, "Oh, it would be so useful to do this with an

Internet tool." There are people on this committee who do not have Internet access but they understand the importance of being ready for the future. Others will go home and use it on their home computer, because it is not readily available in their office. They are excited. They tell you what the user needs to make their job easier. If you capitalize on those ideas, then the system is designed in a way that is useful to all end users.

It is critical to seek the strength of partners. Adoption of new ways of doing business takes time. The Internet is a new tool. If you think about how fax machines changed how you do things, you realize that it takes time to get used to doing things in a new way. It is important to think about this as a technology, as a tool or a resource. It does not drive how you do it, rather people can use it to do business more effectively.

You have to identify your target audience. It takes leadership and money. You need to work at two levels. You need to get the support of top management to obtain access to the end user of the tool, and you need to listen to the people that really need to use the tool and take their message back up to the top management. You facilitate getting things to happen.

In the three years that I have worked on these two projects, we have probably gotten about two hundred and twenty five thousand dollars. This is not a lot of money. More importantly, we have received a lot of in-kind services.

In terms of the future, we struggle with the same sorts of things that you do. Is there a place that we can go to do something? In terms of conservation planning, is there a place where people can go to learn about conservation and natural resources planning that meets the needs of NRCS, the Department of Agriculture, environmental protection groups, and end users? Can we create one resource that people can go to that does not necessarily have everything, but does provide links to the tools that they need? We want to continue to share the tools and the lessons learned. I know we are making progress when someone in another state calls to ask for a tool for his or her state. You know then that it is real, but it takes a while. I think I will just end there and open the floor for questions.

Question Session

MS. INCHES: I do not know if you have this. It would be helpful to know how those costs break down.

MS. BROWN: Of that money, there were two grants. Sixty thousand dollars of that was from the Vice Provost for Computing and Technology at Michigan State. They provided a Sparc computer and fund a staff person to create these tools. The remaining grants were used to hire graduate students, facilitate meetings, purchase materials, and pay for travel and training. Beyond that, I cannot give you a breakdown.

MS. MOONEY-SEUS: How did you come up with this as your initial directive? Did you set up the committee first, or did you come up with an issue and then try to set up a committee and go from there?

MS. BROWN: MSU used to be Michigan Agricultural College, and we are in the College of Agriculture and Natural Resources. Focusing on conservation and natural resources planning is part of our mission.

The fortuitous thing is that we are across the hall from the Natural Resources Conservation Service. The director at that time was a very forward-looking person. NRCS had just come out with a national report entitled "Data Rich, Information Poor", which criticized their efforts at disseminating these data. So, we capitalized on that idea. Conservation is broader than just agricultural practices. The natural habitat, environment, and water quality are all essential elements.

Also, agriculture is a major industry in Michigan. There is a network of interest in agriculture. A key focus of the Institute is agricultural non-point sources of pollution. How do you manage that? How do you make changes on the ground and improve water quality? Michigan is in the middle of the Great Lakes, so we are pretty sensitive to water quality. So, that was how this effort initially evolved.

MS. INCHES: Did you find that there was reluctance at first? You said that the soil engineers were contributing their information, but did they have to do very much manipulation of that, so that you could distribute it?

MS. BROWN: The NRCS has been doing soil surveys for more than 100 years. The soil on the ground probably has not changed, but the quality of where they draw the lines and where they put the boxes and how they give attributes has changed. Nationally, NRCS is in the process of doing what is called SSURGO certified soils. When you put one county map next to another county map, the lines match. That did not happen before. The accuracy and the precision of their work are very important, and they want to provide the best available data.

There are other soils data that exist, and some states have chosen to use it in the uncertified form. The mistake that we made was to use an uncertified product from a field office. The first county soil that we put online was not certified. We probably offended them and did not realize what we had done. After awhile, they voiced their concerns and we put a disclaimer on that data. They were satisfied that we had listened to them.

We now use an ESRI map server to serve the certified county soils data with basic land-based map features. This enables users to locate themselves with field boundaries or ditches. They can zero in and use that map server for their land. Because of the standardization of the SSURGO certified soils, they are all done the same way and all the soil attributes are all done the same way. It took us three weeks to figure out how to put the first county online. We can now do it in half a day, because the database is the same and the format is consistent across the country.

We know that we have 14 SSURGO certified counties out of 83 in Michigan. But Missouri has most of their counties SSURGO certified. So, as a partner in this effort, we have contacted the soil survey folks and the water quality person down there. We have a template that we can share with them, if they want to be able to serve soils data this way.

MR. MEGGISON: Could you speak a little bit about the training that you did? Is this training of people that were outreach folks, or is this training of end users? And was it the ubiquitous "read me" type of file that really should be called, "ignore this file completely?"

MS. BROWN: We have done less training than I would like to do. In Michigan, there is a very strong partnership arrangement between the Department of Agriculture, the NRCS and what are called Soil Conservation Districts. Each summer they have a joint conference at a college with a computer lab. So, what we actually do is bring end users into the computer lab, have them go to the Internet and use what is there. We have created a tutorial that you can do on the Internet and learn about the basics of the Internet and the soils map. But we actually show them the functions that are online and demonstrate how to access and use them. It really is just an introduction. There is an hour and a half session, geared at the end user. So, these 50 people are learning about those tools. They understand and can show the people back in their own offices.

One of the things that I am very pleased about is that one of the assistant state conservationists presented this calendar to the other partners and showed them how it worked. He distributed the "how-to" tutorial to them. They were very excited about being able to use it, but they did not necessarily know how to use it. So, a four-page, step-by-step, "How you use this calendar" tutorial shows them the screen captures that were going to appear as they use this tool. It can be something as simple as a piece of paper, but hands-on is much more powerful if you have got the time and resources to do it. That is what we have done. It is not enough, but that is how we have done training to date.

Paul Orlando
project manager, Coastal Assessment and Data Synthesis Framework,
National Oceanographic and Atmospheric Administration

I want to thank the Steering Committee and Council for inviting us here. I think in the last day and a half it is really been an awakening for us to see where you all are in the process, the types of data systems that are out there and available to you, things you have already built, and the diversity of end users that you are trying to reach. I think a lot of the challenges and the struggles that you all face are really being able to breach where you are now with what, ultimately, end product users want.

Something else that has come to my mind, as I have been listening to you all. It seems to me that a lot of what I have been hearing the last day and a half really has to do with web-based technologies that offer an awful lot of data access capabilities. Really, I think there is a lot that you all have already done that have moved you a long way along that road. I think what else is being said, and it keeps getting repeated over and over again, is that having data is one thing. However, being able to use the data for all the different functions that you all intend to use it for is a completely different issue and something I think that you are not quite as far along with. We have data and we have taken steps over the last decade or so to try to synthesize that data, and provide the data in a way that is user-friendly.

Now, the project I am going to talk about is our National Coastal Assessment and Data Synthesis Framework. This is something we call CA&DS for short. This is our new analytical capability for the nation's estuary and coastal resources, environmental quality and watershed activities. Figure 19 is a clip from the homepage for this particular system. It is something that is not available right now in this final form. But it is something that over the next couple of weeks will be available. It will be available to the Gulf of Maine community and provided through the Internet.

This is something that we got into about 15 years ago, in the early 1980s. We actually had the staff resources to do what Rich said that he could not do and Elaine said she could not do, and that is go around to different places. We invested a lot of money and in-house capabilities to have staff go around and work with states, local communities, NGOs, and the like, and actually synthesize all the data that I will be talking to you about right now. This is our system, and I think there are some ideas that, at least for our user community, work for us and may be transferable to some of the directions that I think the Gulf of Maine Council wants to go (Figure 20).

To set the context for where I am going to go in this talk, clearly, I think the two principal data sets that I have learned about are REDIMS and EDIMS, and I understand that they have two completely different functions. One is scientifically-based and has a lot of data and information. This one tends to be more for a management type context and really offers a lot of hyperlinks, context, contact information, and project level information. Those two data sets are very good, and they are probably serving exactly the functions they are supposed to be.

In addition, through the Gulf of Maine Council and through RARGOM, there are other information systems that are available. Again, you have a whole series of users out here, at this end, that are asking to do a multitude of things to allow them to be able to use the data, to be able to synthesize the data in a way that makes the most sense for them. So, these are the things that you all are struggling with. Again, there are certain things that the CA&DS system has worked through for our applications that might be useful to that end. It hits you with the take home messages right up front.

The CA&DS system is our new analytical tool (Figure 21). It is for national and regional assessments. That is important because we have, up front, defined a particular user group. Again, it is something you all are working through and you are trying to satisfy many more people at this stage than we are through our system. It is for environmental assessments. The key point and the underlying point is, hopefully, in the next couple of weeks our system will be available to the Gulf of Maine community as something that we are offering, a product that you all can take advantage of, if it meets your particular needs.

What were the lessons learned and the operating principles for our success? I think over our 15 years, and really this is a statement that has been echoed by many people here the last couple of days, the challenge is not necessarily in the Gulf of Maine data access, but it is really how to better enable the user to integrate, analyze and develop products from multiple data systems. I think that is really the type of service that we see ourselves offering through the CA&DS system.

I would like to offer a few ideas from our own experiences that might be relevant to the Gulf of Maine situation. Let me talk a little bit about the CA&DS. I have a handout that is a four page public relations piece on the Coastal Assessment and Data Synthesis Framework and the types of data sets, special geographies, and intended uses of this particular system (Appendix 7).

There are three basic components to CA&DS (Figure 22). The first of which is data, and we have a lot of it. Like I said, over the last 15 years we spent a lot of time dealing with all of you and people just like you all around the country. We looked at the nation as a whole. This is a national database. We looked at 140 estuaries around the U.S. and the Great Lakes system.

We have been collecting tons of data over time related to three general areas: pressures, state, and response, which comprise a subset of the information available in CA&DS. There is a lot of data contained within each of these three areas.

The section on Pressures contains data on pollution sources, population and land uses. Data on pollution sources includes non-point urban, upstream and atmospheric sources. We have compiled historical population data, divided by spatial units, that allows us to make certain types of assessments about coastal areas. We have compiled land use data starting from the original USGS information. We have made improvements to the information, and worked through some new thematic map imagery to update land use information.

The section on State contains information on estuarine resources, eutrophication, shellfish harvest, sediments, contamination, tissue bioaccumulation, freshwater inflow, and salinity. We

have just finished up the state assessments. Maybe some of you participated in a national assessment of estuarine eutrophication, where we looked at 16 different eutrophication variables, on temporal and spatial scales, and the impacts associated with those problems. This type of information is available for each of the 140 estuaries, which includes those in the Gulf of Maine.

We were one of the lead groups participating in the 1995 National Shellfish Register. All of that information is contained in there. We have included bottom sediment contaminant information from our national status and transmonitoring program, sediment contamination and bioaccumulation data over the last 15 years for all estuaries, in addition to the type of stuff that you already have through the USGS work.

We have synthesized fresh water inflow data from the USGS site so that you can look at the aggregate of multiple streams in a particular watershed. So, if I want to know about all the freshwater inflow coming into Penobscot Bay, I could find it in the CA&DS. We have synthesized that and we have put it together in certain spatial and temporal scales, that may make sense for some of your work.

There is a lot of salinity information available through REDIMS, for example, that will give you water level information, and CTD information such as conductivity, temperature and the like. This information is very useful. It has certain scientific and research applications. We have synthesized that data to know something more about it in terms of seasonal salinity distributions, annual salinity distributions and long-term salinity trends. These types of data are in CA&DS.

The section on Response includes information on federal monitoring and management. Where are the federal agencies monitoring? We have done a lot of work with USGS recently. There is a four-page document on some of the work we have done with USGS related to developing a nationwide monitoring program for estuaries and watersheds. So, what are they monitoring? What are the EPA, NEP programs doing? This information is in CA&DS.

The second component of the CA&DS system relates to spatial geographies (Figure 23). I was amused in some ways, maybe bothered in other ways, by the survey results that showed only six percent of respondents decided that a spatial framework was important for the Gulf of Maine needs. This probably was the key element in helping us to move forward and put us where we are now. This is what allows us to take disparate data sources and make sense of them. We have focused on estuaries and watersheds, and we have developed several spatial units that allow us to aggregate all this disparate data, be it real time data, be it incrementally monitored data, or whatever it happens to be, and organize it in a way that we can say was measured anywhere at all within the watershed.

The system provides a way of obtaining, synthesizing and accessing all of the information about all 140 estuaries, along the three coastlines and the Great Lakes Region. We organized a lot of the information with USGS cataloging units, which are now readily accepted and available at state, local and federal levels.

NOAA has adapted this framework so that we can aggregate data and information, such as 40 or so cataloging units and call it Penobscot Bay. These cataloging units would represent the land area that drains to Penobscot Bay. The other thing we have done is adapted the cataloguing units along the coastline. In the Gulf of Maine, for instance, there is one eight-digit cataloging unit that covers the first four or five estuaries along the Maine coastline. These are four or five estuaries that NOAA would like to have information on, so we have been able to subdivide those cataloguing units as appropriate.

We also have organizing units for offshore areas. There might be ways to aggregate some of the information you have on Georges Bank if you have an appropriate spatial framework. We use ten-minute grid cells as one of our methods. You can take any piece of data and assign it to a ten-minute grid cell.

Somebody asked the broad question earlier, "What can you tell me about the Bay of Fundy?" If the data that has been put into the system has been clipped and georeferenced to certain grid cells which I have assigned to be called the Bay of Fundy, then I have a way of accessing and synthesizing and actually developing products for the Bay of Fundy data. We use spatial frameworks within estuaries. For instances, we use salinity zones, because certain fish species, and certain types of SAVs, and the like, are salinity sensitive. There are different ways of mapping and georeferencing some organisms by salinity zones.

There is a lot of work ongoing in the Gulf of Maine with rivers, or the quality of riverbeds. We have adopted, adapted and improved the EPA Reach File 1 and have clipped that into our framework. We have a shoreline, congressional districts, counties, and a number of federal programs. Every single data set that we put into our system from is georeferenced using ArcInfo to all these different units. If I, as a representative of a federal agency, want to know something nationally, I have a spatial unit that does that for me. Maybe a different user wants to know about a particular estuary, or a cluster of estuaries within a region. There is now a way of accessing that type of information. Every single data set can be cut in multiple ways depending on the uses. That begins to work toward some of your initial concerns of being able to reach different user communities.

Dan Farrow, a colleague that I am with here today, and another colleague, Katie Ries, have been working on finalizing the pollutant sources data for the entire Gulf of Maine region organized by certain cataloguing units and estuarine watershed-type units (Figure 24). It allows you to go in and pull up all of the point source facilities, non-point facilities, urban sources, any one of the estuaries, or the collection of estuaries in the Gulf of Maine region.

It is available now to use and download the data. It offers different scales of information. You can aggregate it to these watersheds, or you can take it at the end of the pipe level. You can go to a particular facility and to a particular pipe in the facility and get that type of information at different scales consistently applied and well documented. It is available in different units for different users. It is your data. It came from the state agencies, and we have documented it as such.

The disadvantage of this is that it is a single theme of information -- pollutant source data. I do not want to belittle it, because a lot of work went into it, but it is single theme data. There is not a way to overlay it with other data, yet. I think this pollutant source data is very comparable to REDIMS and EDIMS at this point in time. There is no interactive capability. There is no mapping product that you can do online. Somebody said yesterday that you often get requests for maps of specific study areas. There are things that we are doing now in CA&DS that allow people to do that online and then save, download, and overlay that product with other map products. But currently there is no interactive capability to conduct any type of analysis to actually integrate pollutant source data with eutrophication data or anything of the like. But again, it is a very good site and something that is available, and I encourage you to take a look at it.

Figure 25 shows the third component, which is the interactive website, which we are promising to deliver later on this calendar year. Again, the homepage (Figure 19) highlights a couple of examples. Multiple users, want to do different things. But the major data request we get is, "Give me the data; just give me the data." I heard someone from the audience say, "I hate to read text." Notice in Figure 19 that our homepage has only about two sentences of text. The homepage provides all kinds of capabilities to get access via spatial frameworks or units. You have access to all that data that is there. You can download that data. You can play different types of analytical games with that data. If you think that there is a particular theme area, and you do not want to go through and organize all that data yourself, CA&DS is providing a map gallery. We are taking some of those data sets and actually making national or regional maps for you. Those things are going to be posted on the Web, and you will be able to download them.

There is a great example with the Gulf of Maine watershed information that is available. The ability to make a map is really the advantage that we see right now. Say you want to see data by watershed, river, offshore zone, or whatever thematic layer it happens to be, such as all the point sources of pollution in the Gulf of Maine region on a map. You can then overlay that with a major rivers file. You can overlay that with the estuaries that have a eutrophication problem of chlorophyll of an exceedent concentration. You can begin to build your own data layers and do your own analysis right online. You can use it, you can look at it, you can download it, or you can change your analysis. It is all a matter of how far you want to go with it. That is the capability.

In an estuary profile, some people want to see everything available for, say, the Bay of Fundy or Penobscot Bay. We are developing estuary profiles which integrate a lot of these data sets for you, because we figure a lot of people want these things. We will tell you about the pollution sources, the physical, hydrologic, estuarine eutrophication, and the sediment contaminant conditions. This is the estuary profile for each and every one of the estuaries.

In terms of assessment aids, you all have parts of this in EDIMS and REDIMS right now. Who are the contacts? Where do you go? What types of tools go into this? How good are the data? These are types of things that fall under assessment aids.

We have been working extensively on "hot topics" over the last couple of years. We see this section evolving so that the webpage is always fresh and new. This section has all kinds of information on estuarine eutrophication, the essential fish habitat program that I think a lot of you are aware of, and impacts of coastal population. I wish I had highlighted this on a slide, given what I have heard the last day and a half. For those of you who are not familiar with our State of the Coast Project, please visit the website, which has been available for about two years. It synthesizes information down to a level where the layperson can understand what is going on.

There are a multitude of thematic issues related to pressures, the state management or scientific response to these pressures. Unfortunately, I do not have the URL for this with me. We are now looking to branch out and reach across different scales of user groups. Our primary focus, because of the NOAA and National Ocean Service (NOS) mission is predominantly geared toward national and regional assessments. We are aware of the different user groups out there, and this is one of our ways of allowing people to synthesize and interpret data. I think it addresses a lot of those issues that you have struggled with.

How do we use CA&DS (Figure 26)? I will use estuarine eutrophication as an example because of the national study that we did. One of the things you can do through CA&DS, and how we effectively use this in regional workshops, is to bring together the information on all the estuarine eutrophication parameters. You can use the information to explain the estuarine eutrophication conditions seen in a particular region, such as the Gulf of Maine. Is it something that is naturally occurring in the system? Is it something that is driven by specific physical and hydrologic characteristics? Is it caused by land-based sources of pollution? These are all things that people want to know at a multitude of scales to help analyze a eutrophication condition.

Through CA&DS, you can cut through those types of data layers for any estuary or any number of estuarine watersheds in order to help make some of those cause and effect types of relationships. We also are able to cut through these different types of data layers to support a coastal monitoring framework that is being worked on by USGS, NOAA, and EPA.

Figure 27 shows the CA&DS operating principles. We learned these a long time ago, and I think this is what you are running into right now. No single information system will satisfy all needs. Given the NOAA mission, we decided to focus on national and regional assessments. Our analytical scales are estuaries and watersheds, but we offer a number of data synthesis units. The smaller scales allow us to aggregate data and talk about the estuary of the watershed as a whole. They include things like the cataloguing unit counties, river regions, congressional districts, and the like.

We focused on longer temporal scales, seasonal and annual scales, for example, we have real-time water temperature or salinity data available. It is great for certain research and scientific communities, which is one small piece of the user group. We have found that a lot of people want to know something about the long-term average seasonal temperature and annual temperature, because it makes a difference for certain types of resources. They also want to know something about trends. A lot of the information we collect is a time series, 1970 to

present, for instance, so you can say something about the trend in salinity, fresh water inflow, or eutrophication in systems.

This is the key to the common analytical framework. Being able to take every piece of data that we have received over the last 15 years, and tag it to a salinity zone, a cataloguing unit, congressional district, whatever it happens to be, has been the key to allowing us to do all the types of analysis and provide that service to other people so that they can synthesize the data for their needs.

We have chosen to own the system in-house. This is the big difference compared to where you are here in the Gulf of Maine. You still are looking to branch out and reach and use the available resources on a catch as catch can basis. We made a decision a long time ago that we were going to have a dedicated staff for the system. At that point in time, there were probably about 25 people that went out and were part of this effort to meet with individual offices and collect the data to build the special geographies. We now have a dedicated team that continues to update and use this information to explore issues with national and regional types of partners. This is one of our strengths.

We also developed a simple criteria for adding and serving new data geographies and images. Is it something we need to support the NOS mission and is it readily available? Is it something we can get from people with good metadata documentation?

What did it take to build CA&DS? That is a two-part question. We started this in 1983, which is shown in the "that was then" column of Figure 28. There are certain things we are doing now to put CA&DS out on the street that are a very different resource commitment. Back in 1983 there were no national data sets for estuaries and watersheds. There was no mandate to protect and serve and all those other good things. They did not know where the estuaries were. There were no lists. There were not any thematic data sets that showed forested estuaries versus agricultural estuaries versus ones with a lot of fish.

We have spent a lot of time, years, and effort building those data sets that are now available through REDIMS, and EDIMS. You have a lot of the pieces that we had to go through and build at enormous cost. It took us about a decade and a 20 person multi-disciplinary staff. We needed geographers, biologists, physical oceanographers and the like to do this. A lot of our resources went toward travel money for the site visits or to actually divvy out contracts to collect data that did not exist before.

Back in the early 1980s, the challenges were data availability and formats from hardware and software. This was back when the Internet did not really exist and computers were not what they are today. Nobody really had data sets that were easy to access and transfer over to us. But now, things are a little bit different. Now what we are trying to integrate all of our products in GIS and database management systems as opposed to atlas products that we had before.

An interactive website represents technology, the future and what everybody wants to do. It has taken us about a year or so to get CA&DS to the point where we can deliver all the stuff we have

been building. Hopefully by the first of the year, this system will be up and running. Approximately five full time staff are still dedicated to this. That is a far cry from 20, but these are all information technology specialists now. These are our Oracle, ArcView, ArcInfo, and web specialists. These are the people who update and refine data as CA&DS staff.

Our resources are now going toward hardware and software upgrades and to integrating all the other information systems that are out there, because our challenge, like yours, is evolving to support other user needs. National and regional assessments serve us well, but we think there are different communities to reach out to, and we want to know how best to do that. We will continue to be a supplier of data, but we need to know which products will allow us to continue to meet the needs of the users.

Figure 29 shows five areas to consider, tying it all back together now for the Gulf of Maine. First, you must clearly define your users and objectives. This is something that we had because of NOAA's mandate, so, your job is much more immense than ours. Secondly, we have chosen a spatial framework for estuaries, watersheds and offshore areas. You must consider which type of an approach will work best for all of the data sets that are already available for the Gulf of Maine. That may somehow make life a little bit easier in terms of providing synthesized products and reaching out to some of those other users.

My third point is data topics and completeness. Through all of our experience around the nation, the Gulf of Maine has much less data than most of the other regions around the country. You are still struggling to develop some of the basic data sets that are taken for granted in places like the mid-Atlantic or the Gulf of Mexico region. I know that you have to continue to reach out and get a lot of that information.

Fourth, we integrated our information at a single site. This may be a good idea; maybe it is not. There are probably more reasons for not doing this. Once you finally nail down who your user groups are, there might be pieces of information out of REDIMS and out of EDIMS and things that you might learn from GLIN and the Michigan State experience. You may integrate pieces of all of those into a site that could then be supported by a dedicated staff whose job it is to find those users, to find their products and continue to support and upgrade that subset of that site. With that, I will stop here.

Question Session

MS. MOONEY-SEUS: Paul, did you collect the majority of the data from state organizations, NGOs or interest groups?

MR. ORLANDO: We got information wherever it was available. The states were the initial contacts. Sometimes it was counties and sometimes places like The Nature Conservancy. We secured data from a number of sources.

MS. MOONEY-SEUS: How did you develop criteria to assess the quality of data?

MR. ORLANDO: We usually entered into cooperative agreements with the local groups so that they could determine which data was worthwhile and which historically had problems. The level of precision on the data allowed us to do national and regional assessments, not real research types of questions that required six decimal places of precision.

MR. SIGNELL: I cannot wait for that to become available. I was wondering if you work with the Coastal Services Center, and do you see them providing a complementary suite of services at a different time scale? How do you see a relationship between what you do and what they do?

MR. ORLANDO: For those of you who do not know, I am part of NOAA and part of NOS. NOS has recently undergone a horrific reorganization that they are still struggling through. The Coastal Services Center is one component of NOS, located in Charleston, South Carolina. That particular group operates on a little different time/space scale than we do. They are into remote sensing and thematic mapping and being able to provide 30 meter resolution land use information. Their focus is really toward the local user and, as such, they continue to evolve their products so that thirty meter resolution on thematic map and land use is not sufficient; they want one meter resolution. So, that group is really working on different time space scales.

They do complement the work that we do and they allow us, through this new process, not only to do our national and regional assessments, but then to couple with them, and more effectively reach the local community.

MR. FARROW: My name is Dan Farrow. I also work with NOAA and NOS. I do not want to get into the programmatic minutia of NOS, but in this reorganization one of the things that has been identified is the need for a more integrated way to provide information, particularly geographically-referenced information. This initiative now is being called the Marine GIS, and I think that is going to involve the work that we do. This CA&DS system may be the forerunner of what will eventually be a more integrated way of providing NOS information.

The Coastal Services Center is a big player in that, as are a lot of the other programs in NOS. I do not think you are going to see that in the next year or maybe two years. I think you will see our system help either define what is good or give people a site to react to and say, "This is not what we want at all; we want something else." So, that is in the hopper over the next two or three years.

MS. SNOW-COTTER: With this site being in development for about 15 years now, I am curious to know, when and why the decision was made to wait until the site was pretty well developed before making it available. I guess I am assuming that such a decision was made. I am also wondering how much the whole site plan has changed from day one. How well did you stay on track?

MR. ORLANDO: I would like to believe that we have stayed on track pretty well, because we have had somebody with this particular vision for quite a while who hired the staff, maintained that staff support with very little turnover, and has continued to provide all the support that we have ever needed financially. The reason we are waiting to unveil it the way we are, I think, has

a lot to do with where we see it being able to provide this service on this continuum of user friendliness.

You can get to a lot of these data right now through different NOAA sites, but it is still incumbent upon you, like the REDIMS and EDIMS type of problem, to fit and match and analyze these data. What we are offering, if people are willing to wait, is for some of the work to be done for you. It is a lot more accessible to you that way.

MS. MEGGISON: My name is Jeannie Meggison. What is the annual operating budget for this project? Is that going to change when it goes on the Internet? How many people are involved? Is it paid for by core NOAA funding?

MR. FARROW: It is core funding. It is our base funding, and it is just something that we see as our mission. It really builds on the work of the last 15 years, but right now it consists of a team of five to six full-time people with Paul Orlando as the lead.

We have had lots of fits and starts. We used to call this our corporate database, and were just trying to get this internally. We had five different programs within our division. We tried many times over a ten-year period to make all the different data sets available just internally, and we had a hard time doing it.

The key, as Paul has emphasized, was finally deciding to get everybody to put their data into this spatial framework. This is really the first time, and it has taken us about a year to pull it all together using an Oracle database, to serve this internally, not only to our office but other offices in NOS. We have made the decision to make this available to the outside world as well. There has been a lot of consistency in vision, but actually making it happen is difficult. We are fortunate that we all are in the same office and are able to lean on people to get what we need.

FIGURE 19. CA&DS Homepage

FIGURE 20. CA&DS: Understanding Gulf of Maine Needs

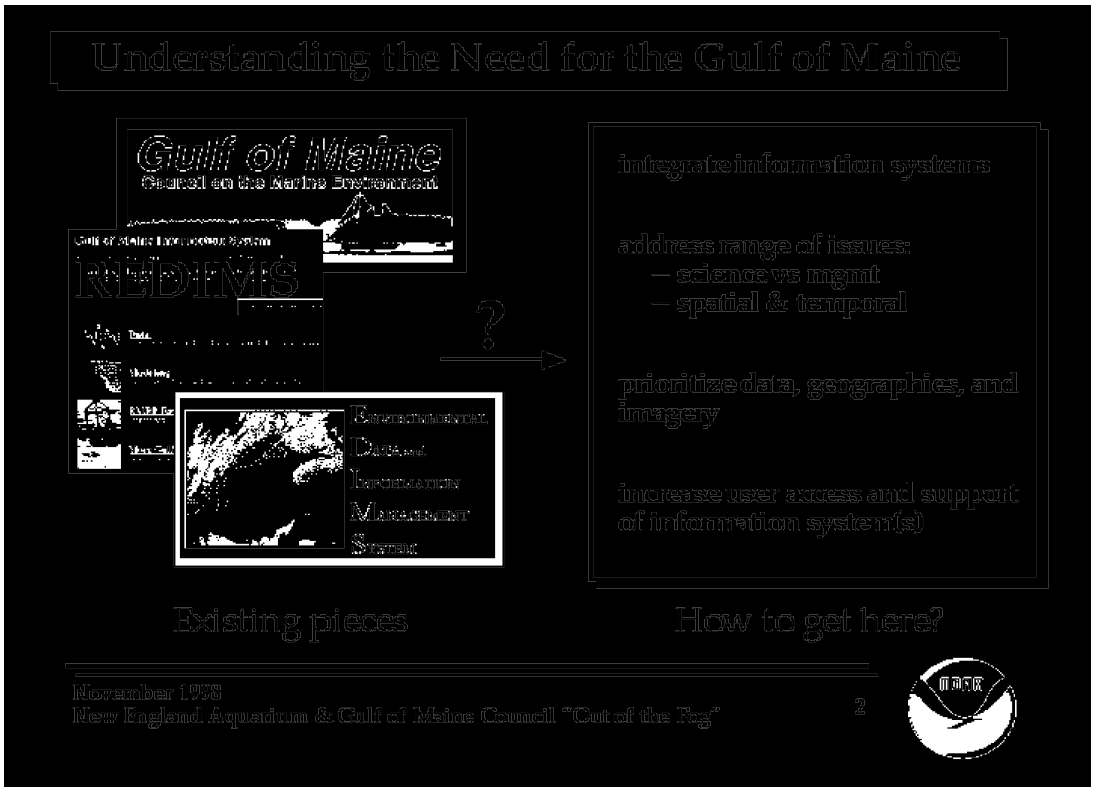


FIGURE 21. CA&DS: Take Home Messages

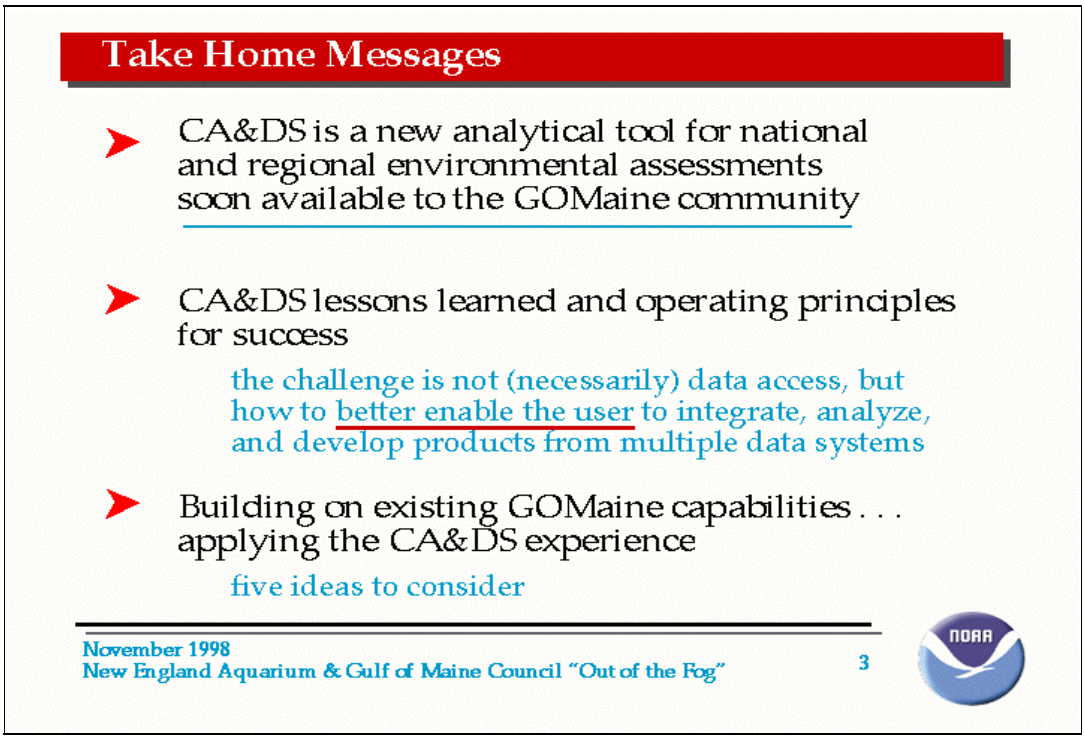


FIGURE 22. CA&DS: Components

FIGURE 23. CA&DS: Spatial Geographies

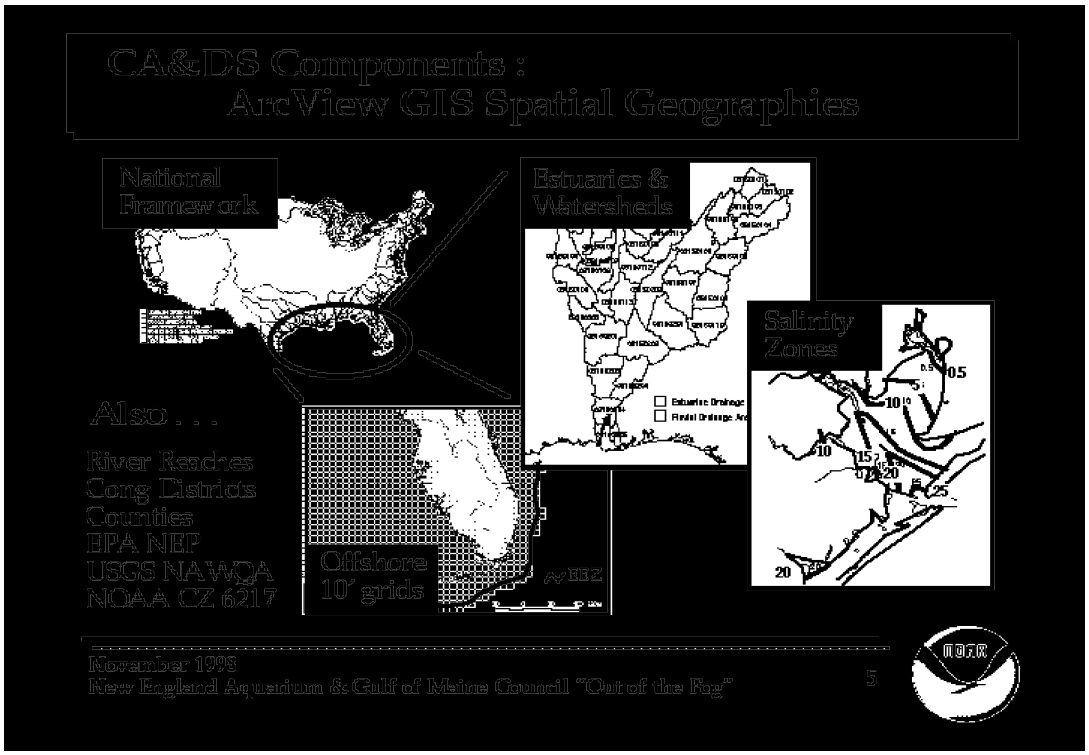


FIGURE 24. CA&DS: Gulf of Maine Land Based Pollution Sources

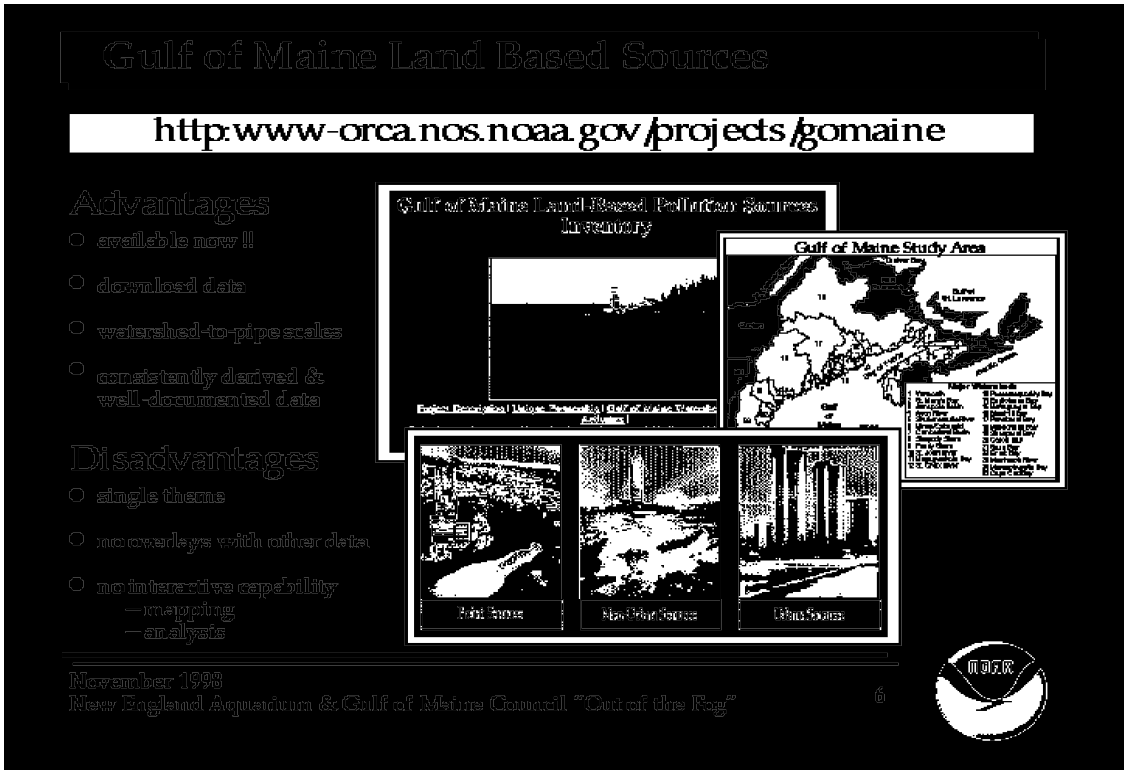


FIGURE 25. CA&DS: Interactive Capabilities

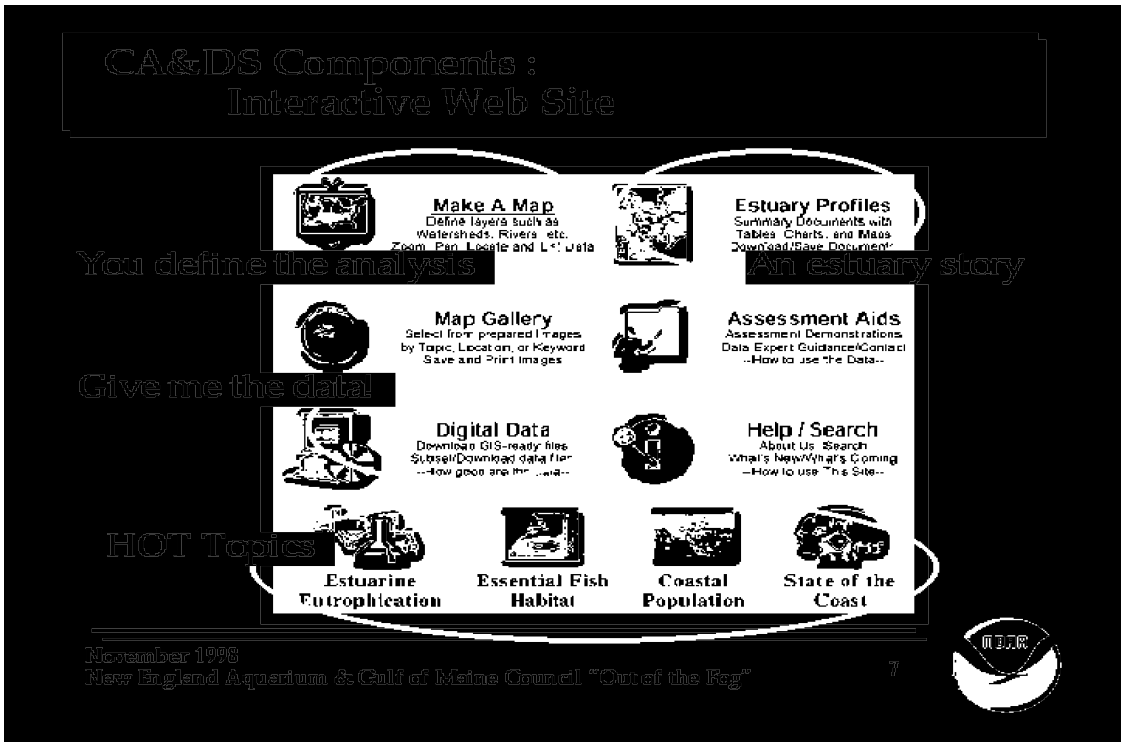


FIGURE 26. CA&DS: How is it Being Used?

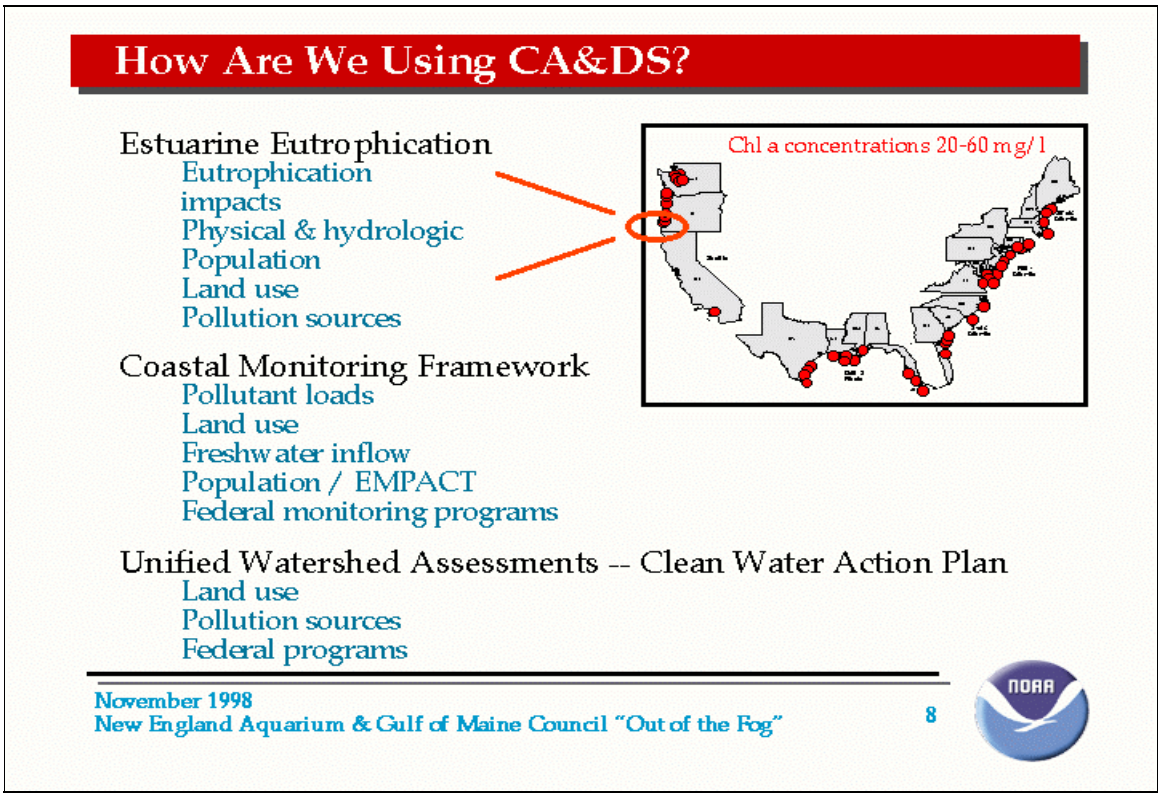


FIGURE 27. CA&DS: Operating Principles

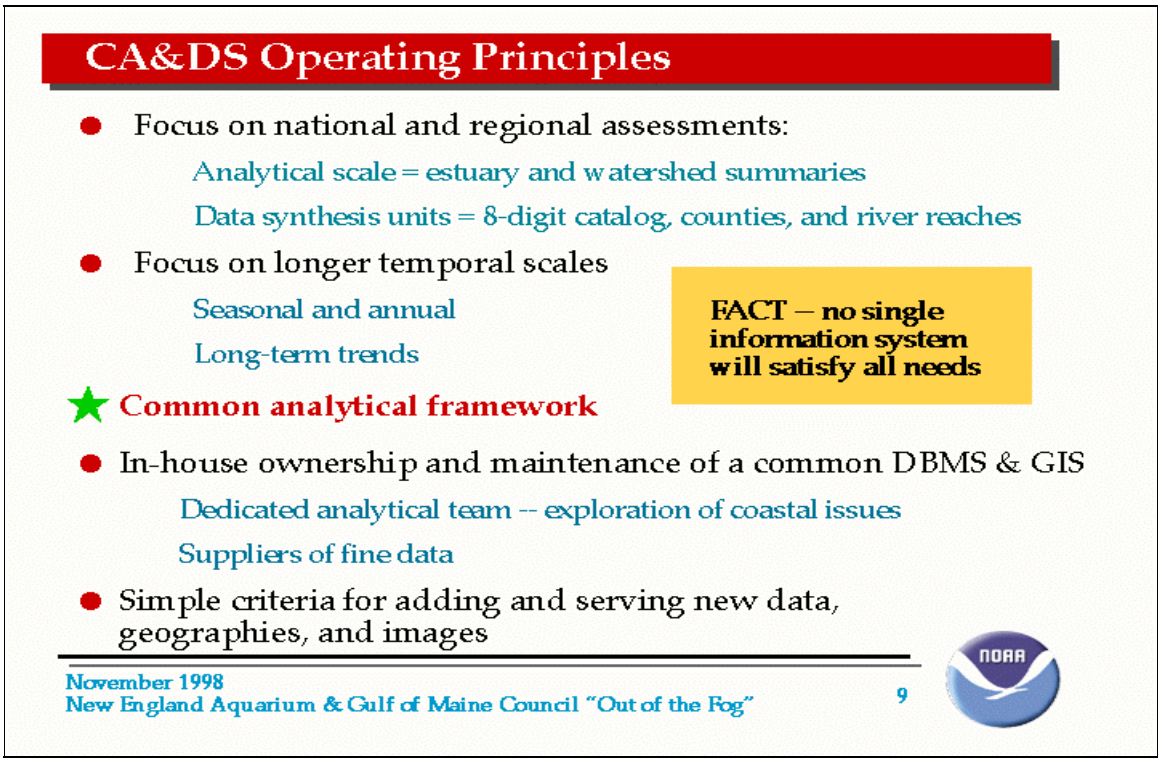


FIGURE 28. CA&DS: Building the System

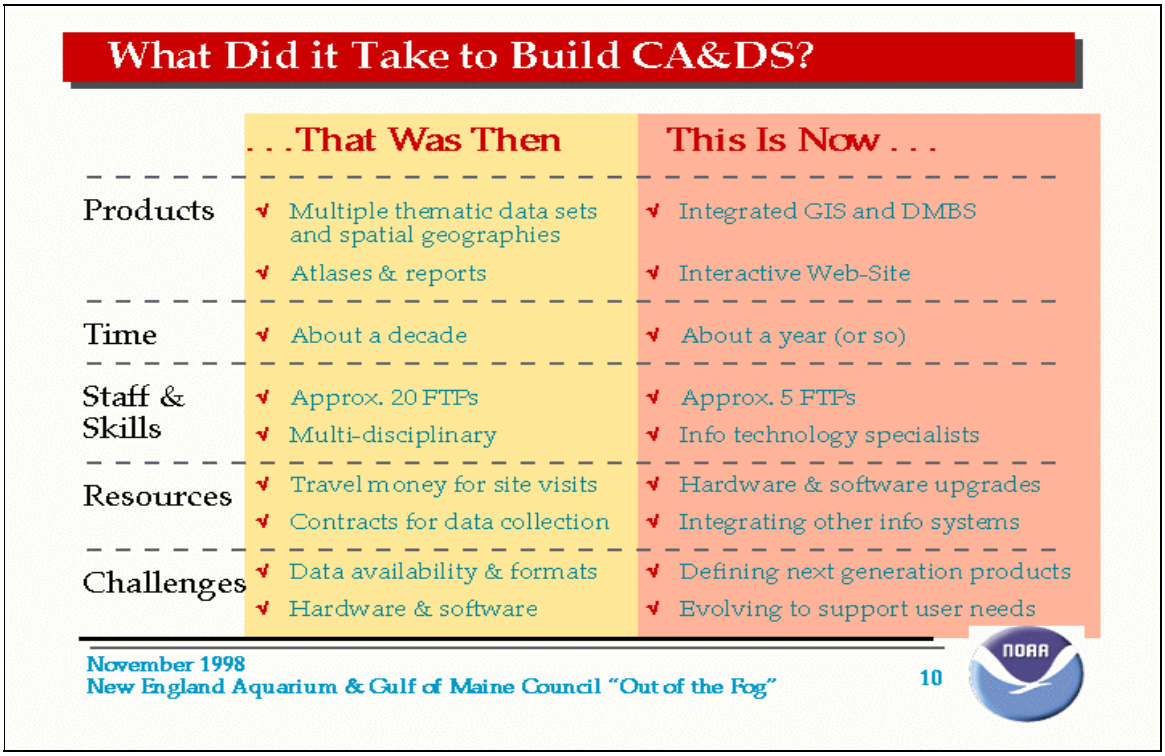
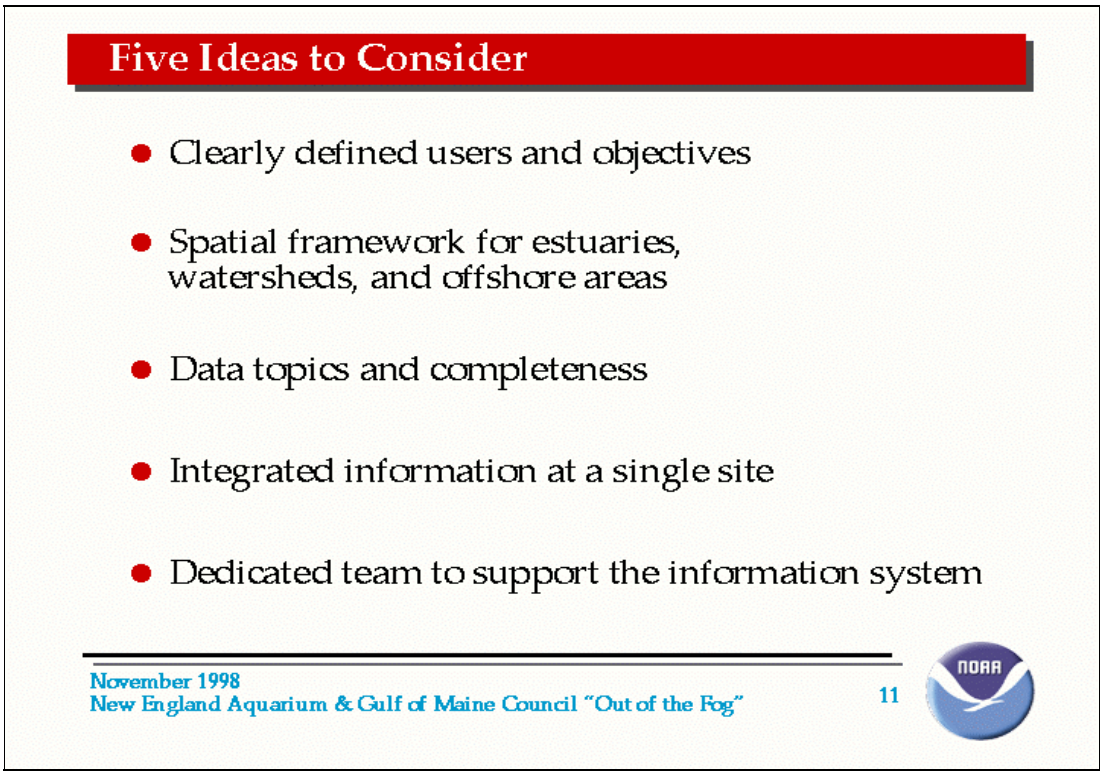


FIGURE 29. CA&DS: Five Ideas to Consider



Christine Manninen
project manager, Communications and Information Management,
Great Lakes Commission, Great Lakes Information Network

Good morning, I am Christine Manninen. I am webmaster for the Great Lakes Information Network, known as GLIN. Before I start, I would like to thank you for inviting me here. I think we have a lot that we can learn from one another.

GLIN has been and running for five years. It is an evolving system experiencing new things, new challenges, and new people, so I think working together to develop these systems is very valuable. For those of you not familiar with the Great Lakes Information Network, we have been online since 1993 (Figure 30). GLIN was the brain child of the Great Lakes Commission, who is my employer.

The Great Lakes Commission was established by federal legislation in 1955. It is an interstate compact agency, and works with the eight Great Lakes states in the United States. We work with Ontario and Quebec to a lesser extent. They are not full voting members in the Commission. The Great Lakes Commission was in a very good position to establish a network like GLIN because it is non-partisan.

GLIN is a clearinghouse for Great Lakes information. We do not maintain a lot of data sets on our server, rather, GLIN has been organized to make it easy for people to find information. We have worked with the partner agencies in the Great Lakes region, whether it be the USEPA, the Army Corps of Engineers, or others, to link to their data and to organize the data in a way that people can find it easily on GLIN. We are the only entity that I am aware of in the Great Lakes region that does this.

There is an entity in Canada called GLIMMER, the Great Lakes Information Management Resource, which is GLIN's counterpart on the Canadian side. However, Environment Canada is still a key GLIN partner. GLIMMER and GLIN were developed side by side. They came on the scene at the same time, so we learned a lot from one another.

The Great Lakes Commission wrote a series of grant proposals to establish GLIN. The Commission conducted a feasibility study in the early 1990s of the needs of regional agencies and the public. The Great Lakes Commission maintains a diverse mailing list, so many people were involved in the study. Overwhelming, the consensus was that establishing an information network would be a good idea. This was before the Internet was big or common in people's homes. We received an initial grant of eight hundred and seventy five thousand dollars from the Ameritech Foundation, based in the United States. That was followed up three years later with another three hundred and fifty thousand dollar grant. We also received generous grants from the Department of Commerce, the National Telecommunications Infrastructure Administration (NTIA) and USEPA. Agencies in the region gave us in-kind support and funding. To date, about a million and a half dollars have gone into this network.

As webmaster for GLIN, I have a staff of two full-time people and two to three part-time people who help maintain the network, fix links, and that kind of stuff. GLIN is not owned by the Great Lakes Commission. It is owned by the partners, which has been key in its development. This makes GLIN only as good as they want to make it. We manage it, but that is where it stops. The Great Lakes Commission is a partner just like the Army Corps of Engineers is partner.

The Great Lakes region of North America includes the states of Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York, along with the Province of Ontario and to a lesser extent, the Province of Quebec on the St. Lawrence seaway. The lakes are immense. They hold about one fifth of the world's fresh surface water supply. So this system had a lot of potential, and there was a great need for it to improve information exchange in this region (Figure 31).

There are a lot of diverse players maintaining the Great Lakes databases so there is a great need for GLIN. Figure 32 shows a snapshot of the GLIN homepage as it exists today. We are overdue for a change of graphics up front. That will probably change in the next six months or so. This is the first screen people see, so we tried to get as many links right up front, and avoid a lot of text so that people can dive right into the system network.

The sister site option, located on the bottom of Figure 32 is a concept we are currently developing. We have several specific project sites. ROBIN, the one listed here, deals with brownfields, redevelopment, and land use issues in Great Lakes region. It is a sister site in the respect that it feeds directly into the information on GLIN. It is not just an agency site; it is more of a mini-GLIN. You can find multiple links to information about land use by visiting ROBIN.

The ease of navigation on GLIN has been a key to its strength. GLIN offers multiple pathways to information geographically, by topic area, agency, or administrative unit. For instance, if someone wants to find information about water levels on Lake Superior, they could enter GLIN through our Great Lakes page, and find the information that way. They could enter GLIN via the hydrology section and find the information that way. Or, if they knew which agency collected the data, they could go through that agency and find the data that way. That has been a real strength in people coming back because they can find what they need.

Figure 33 lists the GLIN user community. These are not necessarily listed in order of use. When GLIN was established, we focused largely on the agency personnel and policy makers to exchange data. That has changed quite a bit since the early days. As more and more people access the Internet from home, we are developing a large community of citizen users. GLIN was developed using an ecosystem approach and includes more than just environmental data. GLIN also has a large economic component.

Travel and tourism are significant industries in the Great Lakes region. The maritime industry, including shipping, brings millions of dollars into the region every year. We recognize that these topics are connected to each other and to the environment. Take the example of an exotic species, the zebra mussel, which invaded the Great Lakes quite prevalently. It affects everybody from the research community to the resort owner on Lake Huron. It is important to use an

ecosystem approach, because all these different entities are connected and the exchange of information should also be connected.

Figure 34 lists the strengths of GLIN. As I mentioned earlier, the GLIN partners maintain the data. GLIN has done several issue specific projects. We did a large hydrology project on lake levels, where we brought all the different players who dealt with the data in the Great Lakes to the table and offered to catalog the data and make it available on GLIN. It was a huge success. We were funded through a fifty thousand dollar grant from the Army Corps of Engineers. That is the only type of data that GLIN really maintains.

We often catalog data to make the data more accessible to the user. The multiple pathways to the information are very important and, GLIN has been successful in linking to widely divergent points of view. As a non-partisan organization, the Great Lakes Commission links to environmental advocacy groups as well as federal and state offices. We try to be smart. We do not link to personal homepages. There are some checks and balances in the system.

There has been a lot of talk about the centralized versus decentralized approach. GLIN has centralized access to all of the resources through the Internet, but the actual development and maintenance of the data sets stays with the partner agencies. In that respect, GLIN is both centralized and decentralized (Figure 35).

There is no cost to being a GLIN partner, although they benefit greatly from being involved. They must work with us to get their online documents and data sets integrated into GLIN. There is not any specific time or protocol involved, per se, because we are not taking their data. They continue to maintain it on their own servers.

GLIN gets a half a million hits a month. The core partner agency sites, for example, the Great Lakes Commission website, gets fifty to sixty thousand hits a month, which is just a fraction of what GLIN is getting. They benefit a lot by integrating their information into GLIN.

Figure 36 shows a snapshot of the hydrology page which I mentioned earlier. This is what a typical inner page of GLIN looks like. This is not a frame; it is on one page. Because the site is integrated, no matter what page you are on, it is easy to get back and navigate around. This has been very crucial to GLIN's continued development.

If you go in one page into the hydrology section, you see a gauging station map of all the water levels (Figure 37). These are the lake gauges that we developed in cooperation with Environment Canada. We also worked heavily on this project with the Bi-national Coordinating Committee on Lake Levels, the organization which actually controls the flows of the lakes through the different dams and control structures. They wrote the synopsis for these pages, which has proved very useful because this is a huge issue in the Great Lakes. A lot of people do not understand how lake levels are regulated. Having the lake levels experts write the text has reaped a lot of rewards, because people recognize the quality of the information.

From here, you find an interactive map (Figure 38). If you want to know data on Lake Erie, you can get a blow up of Lake Erie. From here, you can get the real-time data. This section of GLIN has gotten a tremendous number of hits. The number increases greatly depending on the weather conditions or general changes in the level of the lakes.

GLIN offers a variety of services to its partners. One of the most important services that GLIN offers are the multiple pathways. GLIN has instituted a site of the month feature, which highlights the offerings of a different partner each month. Training services have also been a huge part of developing that partnership, because GLIN was online before a lot of these agency sites. For instance, the International Joint Commission and the Great Lakes Fishery Commission were not online when GLIN started.

We visited many of these agencies to analyze their capabilities and assess what they wanted to put on the Web. We gave them email accounts up front to get them rolling. We hosted a lot of their sites on our server for the first three or four years, until they could build up the capacity to do it on their own. This has been a huge building component to get the partners involved, and allow them to see what GLIN can do for them and to give them time to build faith in GLIN and GLIN's staff.

Over the next year we are going to start a donor corner on GLIN. The partners want to support it because they have seen what it can do. Many of them are so pleased with the information that we have helped them put online, and they have seen their hits go up. I think that has been important. We have built the system, allowed people see what it is, and how it can benefit them before asking for any monetary support.

Another important factor has been the GLIN Advisory Board. It was established right from the beginning and includes members from all the partner agencies. They run GLIN. They meet at least twice a year. They advise us on what they want to see on the network, its strengths and weaknesses, things they have noticed and where they want to see GLIN go. They are its owners, and we let them see that. We do not hide ourselves away and avoid interacting with them. We let them be involved.

GLIN has been used as an international model in several areas. BALLERINA, in the Baltic countries, is an initiative that has been online for the last two years. It is modeled heavily after GLIN. The Gulf of Mexico Information Network and the Border Information and Solutions Network are also modeled after GLIN. We also have several initiatives underway in South America. They are using the GLIN model to develop information systems for their own watersheds, many of which are shared by more than one country. The Upper Paraguay, for instance, is shared by Paraguay, Bolivia and Brazil. They have run into a lot of the same problems with shared data sets where one country does not want to share its data with the others, so we have been able to offer some guidance.

I would like to close by citing some of the challenges that we are up against right now. Sustainability is a big issue. It is difficult to get funding. A lot of people do not think about the long term. It takes a lot of time and staff to maintain the pages. We have gone through the

partner agencies in the region and said, "Do you use GLIN? Do you want it to go away? We need support."

So far they have been very forthcoming. They are going to carve out part of their general operating funds to keep us alive, because they recognize the necessity of the network. Keeping pace with technology is another big issue. GLIN has always been ahead of the times in the Great Lakes region. Many times we have brought the technology to the agencies. That has been another nice shared component of the Great Lakes Commission. We develop the technology and then share it with our member states. This has been very successful.

Then there is the issue of the bells and whistles versus general usability which we are running into a lot on GLIN. We have kept the graphics very limited on our network, so that people accessing from modems at home can use the information. We do not want it to be exclusive to the people in a university setting, for instance. We are starting to implement some of the real stream video audio clips, but we are being very selective. You want to use the technology but you want to use it wisely.

Building and nurturing the partnerships also is very important. We started GLIN with the idea of it being a very shared network, and it has continued to be that way. Having the Great Lakes Commission lead the management of it has been very smart and controlled. I think that will really be necessary as you develop a network for the Gulf of Maine. It is important to have one entity to guide development, whether it be a steering committee or an advisory board. They should be actual users. You have to get that user input. As many people have mentioned, you have to decide who you are targeting and where you want it to go.

I would like to leave you with a quote that hangs on my bulletin board at work, "The most absurd and reckless aspirations have sometimes led to extraordinary success." I will tell you when GLIN first started, there were a lot of doubters. A lot of people said, "What is this Internet? It is never going to work. It is a lot of money we are dishing out here for this system." But lo and behold, it has grown unbelievably. Nobody can fathom how fast it has grown and how it continues to grow.

I commend you for what you are trying to do. I want to say that this process of bringing people together and ironing out the basic structure and framework of the system, before you start developing it, is so important. So, any questions?

Question Session

MR. KEELEY: Could you talk a little bit about GLIN and what the next 10 years hold for two systems in the Great Lakes region.

MS. MANNINEN: Well, they are very different systems. GLIMMER has a very Canadian orientation and does not deal with any of the Great Lakes states. It is exclusive to Canada. On the other hand, we represent the Great Lakes states, but we also have that Canadian presence; so, we are quite different in that respect. GLIMMER and GLIN developed in different ways.

GLIMMER has taken more a of metadata approach than we have, so they are integrating more of the resources within Environment Canada and the other Canadian federal agencies. We take a much broader approach, so I anticipate both systems existing for a long time. It is not a competitive relationship.

MR. MEGGISON: I have a question about how you search for information within GLIN. I saw a search button there. If you do not do metadata with your partners, how does the search work?

MS. MANNINEN: Currently it is a keyword search on GLIN, but that will change soon. We are developing a new search function, using new software which will give us the capability of searching more than one partner server. So, for instance, if somebody went into GLIN to search on exotic species, such as zebra mussels, they could search all of GLIN, as well as the International Joint Commission and Environment Canada server. We will be able to search whichever partners want to be involved. This search capability is really going to add to GLIN. We have never done the metadata approach.

FIGURE 30. What is GLIN?

FIGURE 31. Why is GLIN Needed?

FIGURE 32. GLIN Homepage

www.great-lakes.net

FIGURE 33. GLIN User Community

GLIN user community

- State/provincial, federal and local government personnel
- Students and educators
- Academic researchers
- Members of citizen groups and associations
- Business and industry representatives
- Internet service providers/designers
- Citizens from around the world

FIGURE 34. Strengths of GLIN

Strengths of GLIN

- GLIN partners maintain their own files independently, but link to each other and to the main GLIN index

- GLIN provides multiple pathways to data and information: geographic, subject area and administrative

- GLIN impartially links widely divergent sources and points of view

FIGURE 35. GLIN Access Model

Centralized access + decentralized development and maintenance

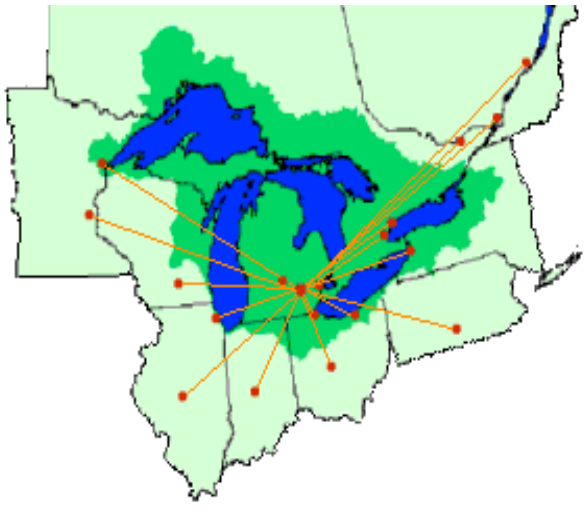
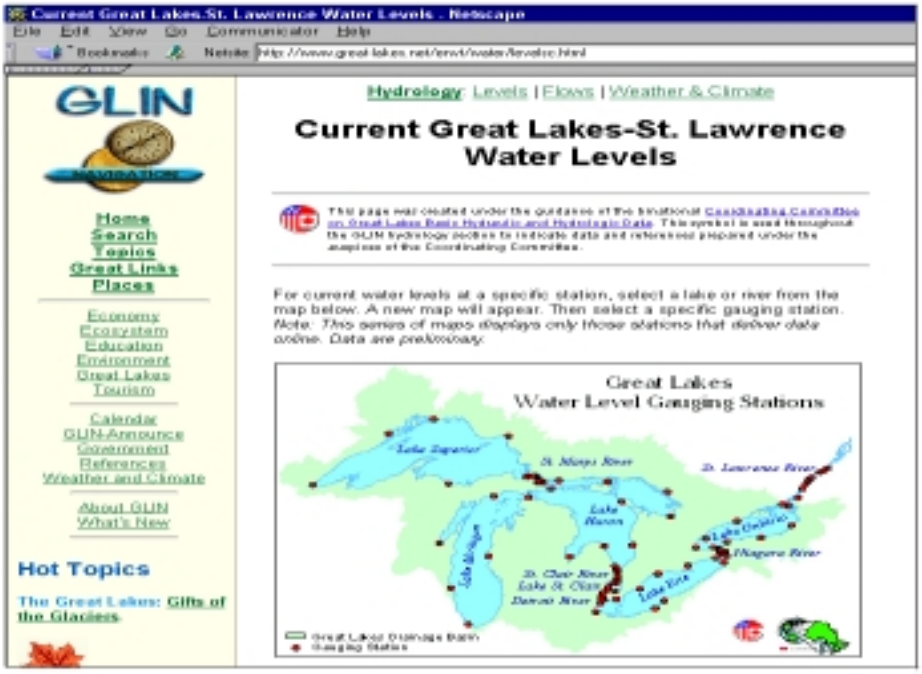


FIGURE 36. GLIN Hydrology Page

FIGURE 37. GLIN Lake Levels



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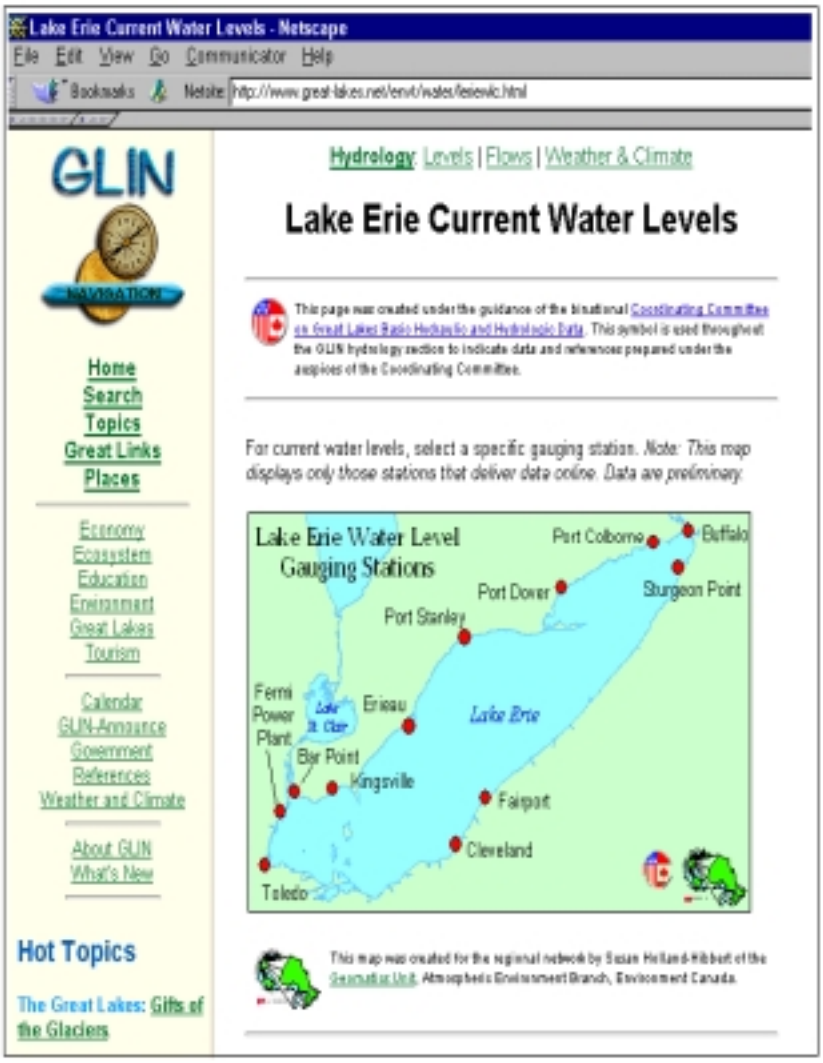
Lake Erie Current Water Levels - Netscape
File Edit View Go Communicator Help
Bookmarks Netsite: http://www.great-lakes.net/envt/water/leiservlc.html
GLIN
NAVIGATION
Home
Search
Topics
Great Links
Places
Economy
Ecosystem
Education
Environment
Great Lakes
Tourism
Calendar
GLIN-Announce
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What's New
Hot Topics
The Great Lakes: Gifts of the Glaciers
Hydrology: Levels | Flows | Weather & Climate
Lake Erie Current Water Levels
This page was created under the guidance of the binational Coordinating Committee on Great Lakes Basic Hydraulic and Hydrologic Data. This symbol is used throughout the GLIN hydrology section to indicate data and references prepared under the auspices of the Coordinating Committee.
For current water levels, select a specific gauging station. Note: This map displays only those stations that deliver data online. Data are preliminary.
Lake Erie Water Level Gauging Stations
Port Colborne
Buffalo
Port Dover
Sturgeon Point
Port Stanley
Fermi Power Plant
Lake St. Clair
Erieau
Lake Erie
Bar Point
Kingsville
Fairport
Cleveland
Toledo
This map was created for the regional network by Susan Holland-Hibbert of the Observation Unit, Atmospheric Environment Branch, Environment Canada.

Drew Parkin
consultant, Pacific Northwest StreamNet

Good morning. Given that time is short and John has a presentation due, I am going to dispense with demonstrations and just talk with you for a few minutes.

My project is a little different. All of our projects are different. I listened to your presentations yesterday so I could get a handle on the needs of this group. I found that you have a lot of diverse needs, and I had a difficult time sorting this out. I will just talk about my project and let you pull out the relevant pieces. Then I will offer a couple of recommendations.

First off, though this is a Pacific Northwest project, I live in Cambridge, Massachusetts; so, I have some relationship to what is going on here. I actually started my career in the State of Maine working on rivers and lakes, where I learned the importance of information in driving decision processes. I am interested in public policy and conservation, which is where I come from. There are probably penguins over at the aquarium that know as much about data management as I do. But I know the importance of it, and I have seen the power of it over the years. I think it is getting more and more important.

I want to crystallize a couple of ideas with which I am sure you are already familiar. Over the last twenty years, when I started using information to drive policy, a lot of things happened. One is that our understanding of ecological processes have changed dramatically. The concepts of conservation biology and landscape ecology are new, and they drive policy in different ways than we would have thought of twenty years ago.

The role of science in the decision process has changed for the better, fortunately. Judges in court cases are using science as the basis for decisions. In the Northwest, we pull together panels of expert scientists when we have decisions to make, so science is really starting to take hold. Another change is the idea of interjurisdictional decision making. This is really something. We cannot operate in our own little worlds anymore, we have to work interjurisdictionally.

The fourth thing is that technology has changed with GIS, the Internet and all of these types of things. If you pull these four ideas together, I think you will see that there is something really powerful in decision making that we should be exploiting. Certainly, that is why I wake up ever morning.

I am going to talk to you about the StreamNet project. StreamNet is a fisheries and aquatic ecology information system for the Pacific Northwest. Our original geographic area was the Columbia Basin because of an act of Congress in the early 1980s that established a four state compact to work on Columbia Basin issues. Collectively, we have since expanded beyond the Columbia Basin to encompass the whole four state area of the Northwest: Idaho, Montana, Washington and Oregon. We have information on all four of those states for each entire state, not just the part within the Columbia Basin.

Within the last year things have gotten interesting because of all the endangered species activities with the salmon. Some of you may be aware of what is going on in the West Coast. We have five species of salmon and virtually all of them are in trouble. California has been taking a much greater role, so we are now incorporating information on California. It looks like British Columbia and Alaska are going to start working together, too. I think we are talking about the whole anadromous fish zone for the Pacific Northwest here in a year or so.

Our original mandate is to provide information for the restoration of steelhead and resident salmonic populations in the Pacific Northwest. The region spends four hundred and thirty five million dollars annually to restore aquatic resources in the Pacific Northwest and we are not doing anything to evaluate whether we are being effective or not. StreamNet's charge is to identify time series data to compare the activities that people are doing to the biological responses. One of the things that we have taken on is monitoring and evaluation of restoration projects. However, there are a lot of spin-offs. Anytime you have good information, or if you have bad information for that matter, you are going to use it for a lot of different purposes. The region's endangered species management activity has been reliant upon us. We have a very strong partnership with them in evaluating their listing and their recovery plans.

Then there are state government spin-offs. There are lots and lots of examples where state laws were established in the Northwest based on our information. For example, recreational gold dredging in Montana is prohibited on certain streams based on our information. The State of Oregon establishes certain acquisition proposals based on our data. The Forest Services and the Bureau of Land Management use our information in their forest planning. I can go on and on.

We got started in a real entrepreneurial way. There were a number of compartmentalized projects compiling data for the Pacific Northwest. None of them did it in a consistent way, and a lot of them were failing. We took a business approach where we said, "Let us find a failing industry, and let us try to restore it to health." We did that. We found three different data compilation organizations. You can read John Evans' Ph.D. dissertation, to learn more about this.

We identified three different organizations, which had secure funding sources. We combined them together, invented the name StreamNet as something that everybody could relate to, and their funding sources. That is how we got started. We have a multi-jurisdictional Steering Committee that acts as the driving force for this operation. It is like a Board of Directors. I am the Chief Executive Officer (CEO). They can fire me if they want to, and I wish they would sometimes. But they make the decisions, which is important because it puts the onus on them.

The Steering Committee includes four state fish and game agencies, the US Fish and Wildlife Service, five major Indian tribes in the Northwest, and a regional authority. We meet quarterly, for serious three-day meetings where we talk about data standards and data exchange. The central core teams, for those of you who are thinking about how you do this, consist of myself who manages the project, a GIS specialist, a web specialist, and a data manager/programmer. The four of us comprise the team that works on this full time. I also have a librarian. Beyond that team, we have about a hundred people who are affiliated with our team in some way. They

all work for other people, but are committed to compiling data in a certain way and getting that data into our regional system. Our system could be characterized as a centralized distributive system. I think a theme that we are hearing today is a combination of centralized and distributed system.

I want to caution you to think about this long and hard and make a decision about where you are going. The general idea is to go through a distributive system. It is the Yankee way. I have lived here a long time and I know how New England works. It is the way to go. It sounds good. You cannot go with a completely distributive system. There has to be some centralizing themes. The question is how much they are centralized.

We operate on a strategic data plan, much like a corporate strategic plan. We have a five-year plan where we have identified with our information needs. I habitually go through every document that comes out in the Northwest on this topic and identify what they are talking about as far as data needs and try to see how it fits into our system. Things are always evolving. The whole idea of population dynamics, for example, is really hitting us hard lately, because we are starting to realize that if we are going to save species, we have to look at the population dynamics, not just the species or the individual. We do not have information on this, so it has really been on my mind lately.

You can see it on our strategic plan on our website. I put it out there so people can get at it, critique it and help us evolve. It has been a really nice thing, because we have been able to develop a workplan every year on which it is based. It is like we peel off another year of the strategic plan.

Basically, we compile information on five or six different elements. All of this information is compiled in a regionally consistent fashion. The same type of data comes out of Idaho, Washington and California. First, we compile information on anadromous fisheries. We include the biology of anadromous fisheries, adult escapement, natural production, artificial production, hatchery releases, distribution, life stages, habitat needs and those types of things. We do the same thing for resident fish. The information base for resident fish is much less mature and much more difficult to access. Resident fish are inland or stream fish. I know in Maine they call them inland fish. We use resident fish.

The third piece that we compile information on is aquatic habitat. We look at the different factors that make up the aquatic habitat such as sedimentation, temperature, bank cover, and those sorts of things. We also compile information on facilities such as dams, hatcheries, diversions and culverts. It is mostly information on where these things are located and who is managing them.

We also track information on enhancement projects. We track all of the information on what is being spent in the Pacific Northwest to restore habitat, as well as who is doing what, where, why and how.

We are experimenting with some non-standardized data, which is difficult to compile. I have talked to you about our regionally consistent data sets, but we are experimenting with non-regionally consistent data. This is similar to a lot of the things you have been talking about. For example, the Agma Indian Tribe has years and years of really good spreadsheets, but they do not know what to do with them.

So, we took all of their spreadsheets and cataloged them much like you would in a library. We just answered who, what, why, when and where, in a computer sense. When you do that with a data set, then you can create a database and query for it. We are finding it to be a really interesting idea. Rather than trying to standardize people's information -- and some of this information goes way back -- we will just have them document it or annotate and catalog it based on who, what, why, where and when.

Another issue is genetics information. Geneticists just do not want to give you their information for a number of different reasons. They all use different standards. They are all trying to publish or perish. They have all got graduate students working with them.

Rather than try to get that information, we decided to identify who is doing what and where. We go through a process where we catalog all that. For example, the University of Idaho is looking at genetics data on these species, on these streams, and this is the method they are using. That is all we do. Then you can query for that. If you want specific information, you go to those folks.

I believe it is important to have a common analytical framework. We use three things as a basis for our common analytical framework or the way that people can share information, particularly over the Internet. The three things we use are, first, data exchange formats or standards. Let us say there are ten agencies compiling the same type of information. We look for the common themes. We look at all of the data sets and look for some type of an overlap that we can pull out. Is there a common regional set that we can use? If there is, great. If there is not, we try to see if they will go back and adapt their data sets to meet some regional scheme.

If you visit our website, you will see that we do have an extensive data exchange format for virtually any of these topics. We have established agreements will all of the different organizations in the Northwest, and any new information they compile meets the standards developed by the Steering Committee. Data exchange formats and standards are very important. I cannot emphasize it enough.

There is a group working on the present Northwest Forest Plan involving the old growth and spotted owl issue. There is a lot of energy in the Forest Service to try to develop data systems. They developed the Interagency Resource Information Coordinating Council or IRICC. IRICC was trying to compile data systems. We saw this as an opportunity, and offered the IRICC, consisting of eleven different federal agencies, to help them develop standards for aquatic habitat. Because of this work, there is now a set of ten to fifteen, depending how you look at it, variables that everybody uses when collecting data. Anyone conducting field work always collects these twelve variables in a certain way. It is a tremendous thing. Again, data exchange formats are important.

Another important aspect is a spatial referencing system. This is something to really think about. In a truly distributed system you are not going to have a spatial referencing system. In a truly centralized system you can. I am trying to find a way to get people to see the value of the spatial referencing system and to tag that information into their data collection, so it is useful.

It would take a whole day to explain the way we have done it in the Northwest. In a nutshell, we use the USGS hydrologic referencing system. We have established certain cataloging units as core pieces for information collection. Within that we have adapted a one to one hundred thousand hydrology system using the River Reach System. It is now going national. There is a national hydrologic data set group, and I recommend highly that you check into the process.

There will be a national standard of one to one hundred thousand hydrography. We are attaching all of our information to this hydrography. We use dynamic segmentation and a lot of other things. It is a wonderful thing, because people see an off-the-shelf product that they can come pick up and use to compile their information. Then we have access to their information.

The third thing we use for our common analytical framework is to document the information. We did not just want to slap information out to people without them knowing its source. Part of our exchange standards and our basic protocol is that any information that goes into our system has to be referenced to its source document. Every piece of information in our StreamNet site has a document name, reference and an annotated bibliography.

We went beyond that and established a library. The StreamNet library is located in Portland, Oregon. We have a librarian and an assistant librarian. Every piece of information that is in our system is in our library. We keep either the original document, but will accept a copy if that is all that is available. There is a lot of gray literature out there. We are now the fisheries gray literature library for the Pacific Northwest. Referencing is really important. It has been interesting to enforce this standard because it has cut out a lot of nonsense, because people have to show us the information.

We have historic data in the Northwest going back to the 1890s for hatcheries. We have other information dating back to the 1910s and 1920s. We decided we wanted all of that information in our system, so we used our data exchange formats. We got money to go out and compile old sources and roll all that information into our new data standards. Now we have information using consistent formats, say, for hatcheries in Oregon. Our harvest would be a better example. For harvest, for Oregon, we can show you trends back from the 1890s, if there are data available.

Most of our time is spent on data development and synthesis, not on web development. I think on my project I probably spend five or seven percent of my time and energy on distribution through the Web, for my webmaster and those types of things. I spend about one hundred thousand dollars a year on the actual web access piece. We have developed a query system to provide access to the information. This is a real scary thing, but it is important.

We have a very sophisticated query system. We try to be at the leading edge, but sometimes you slide out onto the "bleeding edge." To have a truly interactive query system, you have to use some sophisticated technology. We are always grappling with this.

How sophisticated should you be? How much should we be doing on our own development? It is a tough issue, but we have a query system where you can come into the system from many different angles. If you are interested in something specific, you can come in that way, for instance year versus species versus geographic location, etc.

However you want to enter, our query system lets you come from one of four systems, and you can spin into the information and pull out the piece you want based on your need. It is really sophisticated. Do not ask me how we do it, because my programmer is not here, and I do not want to embarrass myself. Also, all of our information is downloadable from our site, which is another protocol we set. Everything had to be useable directly off the site. If you are sophisticated enough to use it, you can get in and take it off.

We also create CD ROM versions that access database versions of all of our information, so people can use it that way. We are experimenting with the idea of cloning the front end from our website onto a CD with the data, so people that do not have Internet access can just put a CD in a machine. We also archive every version of our information, both on the machine and CD ROM for legal purposes. If somebody referencing us goes to court, we want to be able to reference back to the specific date that they got their information, so, every time we change our information in a major way, which is about every quarter, we archive.

A couple of quick recommendations. One, do not try to be all things to all people. You really have to know your users. I did a formal survey, where we went out to all the fisheries biologists in the Northwest and asked them what type of information they wanted. Pick an area. Focus on your people. This also will help with your technical standards. It is difficult to serve your technical applications on the Web to virtually anybody who might want to use it, particularly when you are using sophisticated query systems.

The school systems may not be able to get at it, which you have to think about. I learned last night, that when some of you could not get into my system, you went right to a thing called Fish Facts in our site, which is a bunch of drawings by kids. I put that in there for that reason, so if anybody came in and wanted to know something about fish in the Northwest, there would to be something there for them that would be at their level of sophistication. I think it is important to have a site that allows people to come in wherever they want, but I do not think it is necessary to let everybody get to everything in the site in an equal way.

My last piece of advice is not to wait for guidance from on high, just start doing it. That is the only way to get things going. Success breeds success. I have more money coming. People ask me to do more things on our site than I could ever possibly do. I am being very honest with you there. It just sort of happens. Thank you.

Question Session

MR. WRIGHT: Could you give us some more examples of how this information is being used at a local level? For regional assessments it makes sense, but what kind of people visit the system for local information?

MR. PARKIN: Great question. I look at this as a pyramid with the regional application and policy up at the top and the local applications at the bottom. You can flip it around if you want, depending on your orientation. I think the critical thing is to identify what questions have to be asked at each one of those different levels. A policy question is where you have roll-up information, and you are asking certain questions. Down at that very local level, you are talking about specific information and data sets. That would be my first response to what you do. We saw the utility of this roll-up type of information at a local level, so we have allowed users to query at the county level, for example. It is a real simple thing to do. It took us about a day and a half to do, and has resulted in a geometric rise in the level of use, because people saw it at the local level. We continue to be more focused on that level.

One thing that has happened in the Northwest, and I think this is a truism everywhere, is watershed planning. We are trying to grapple with that right now, and we do not really want to have that be consistent for our system. We do not want to enforce all of our data standards for a watershed group, because you will lose a certain amount of creativity at that level. We grappled with that and decided to think of the types of information people need at the watershed level to make decisions. What are some basic pieces, for example, some GIS layers? We are providing those for people so they can pull them in for their own uses. We do not enforce how they use them, but they can access the information.

We also have identified what we call a set of core data, consisting of biological attributes that we hope people at the watershed level are trying to compile. Things like fish distribution, life history and population data are critical. We are basically trying to guide people and give them whatever type of support possible. But I do not think that enforcing standards at that level is right. We have offered people the use of our website. For example, I spin off about twelve different websites that we serve through our site that people do not even know are in our site. They are for local groups. We try to help facilitate their finding the websites and information.

MS. INCHES: You named the functions of the four different people on your staff. I wanted you to repeat that again. Also, I would like to hear more about your librarian.

MR. PARKIN: I work at a place called the Pacific States Marine Fisheries Commission located in Portland, Oregon. There is also a Gulf Fisheries Commission and an Atlantic one. The reason I work there is because they had the institutional funding mechanism to house me. There is no reason I am there other than they agreed to let me have an office. It is important to be affiliated with some type of an organization, but not somebody who has a vested interest.

We are clearly a group that does not have a vested interest. I only have four people that work in my group. I spend almost all of my time on the policy end talking to people and trying to sort

things out. I do virtually nothing technical, but I am the bottom line for testing our system. If I can get it to work, anybody can get it to work.

I have a full-time GIS specialist. That person works on the hydrologic referencing system that I talked about. He spends probably 80 percent of his time doing that and twenty percent of his time compiling geographic data sets to give to watershed groups. I have a database manager/programmer. I pull in a contract programmer every once in a while, but I have one person that does most of this. We have a dedicated SQL distribution system, which he manages. He is the one who manages our data exchange formats and brings the information into our system.

Then, I have a web development person who is a young professional who is self-taught and was a secretary in the organization. She probably spends about twenty percent of her time on the site that I have been talking about and the other eighty percent of her time on all of these little sites that I service for other people.

If you take all of those people and add a salary to it, the figure falls somewhere between one hundred thousand and one hundred and forty thousand dollars, because I use them on other things. This is about a two million dollar project all together. Our librarian is the person that services the reference library I mentioned earlier. She has a professional master's degree in library science. She has an assistant. They adhere to all the library standards, and our query engines adhere to all the library software. Thank you.

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I want to explore a few challenging, perhaps even provocative questions with you today. My basic question is: are we ready, today, for a Gulf of Maine regional information system (or a "Digital Gulf of Maine," to borrow a phrase from Al Gore)? What lessons can we draw from the related experiences in this region and elsewhere? Are conditions today any more conducive than they were five years ago to a lasting success?

I will try to sketch a brief history of the Gulf of Maine Council's experience in attempting to share information across the region, and some lessons I learned from studying this and similar efforts around the US and Canada since 1994. (Further details on this study may be found online at http://mit.edu/jdevans/thesis). I will then describe the constantly changing context of environmental information sharing systems, and suggest some keys to success as I see them today.

Environmental data sharing within the Gulf of Maine Council began in 1990-1991, with the Council's first ten-year Action Plan. This plan called for "methods to ensure that Gulf environmental databases are compatible" and for "the development of a common regional protocol to allow for the transfer and periodic updating of data information." Those were ambitious words for 1990! The Council's Data and Information Management Committee (DIMC) was formed in response to that call, and saw some early milestones under the charismatic leadership of Joe Pelczarski. In 1992, it established a prototype environmental data and information management system, or "EDIMS," on an Oracle database server at the University of New Hampshire, with Internet access through simple Telnet and file transfer (FTP) protocols. At the time, the Internet was not at all widespread (this was long before the World Wide Web became a household word), and not everyone on the Data and Information Management Committee saw the Internet as the way to go for exchanging information over wires. The Committee's reluctance to put "all its eggs in the Internet basket," and the lack of Internet connectivity among Council members (two very intertwined conditions), kept them from further exploring the Internet's potential for information interchange at that time.

In late 1993, the Committee's initial surge of funding dried up, and the project went dormant for about two years -- just as the World Wide Web burst onto the scene and made the Internet the obvious choice for digital communications in industry, government, and everywhere else. When funding returned to the Data and Information Management Committee in 1996 to continue work on EDIMS, the world had changed quite a bit. Just about everyone in government agencies around the region now had some Internet access and some experience with the Web: the DIMC were no longer the only Internet game in town, and to this day they have struggled to redefine their role within a radically changed context.

The Gulf of Maine experience was certainly not an isolated one. The World Wide Web caught others by surprise as well -- for instance, the Great Lakes Information Network (GLIN), which you heard about from Christine Manninen earlier this morning, started out in late 1993,

distributing all its information via the Internet's Gopher protocol. As the Web gained prominence in 1994-95, GLIN had to backpedal and start putting everything on the Web; and for over a year there were effectively two GLINs, each providing slightly different information resources.

That common theme is not likely to go away. The pace of change in information interchange is increasing rather than decreasing. The last 10 years have seen several waves of approaches in this area, including distributed computing, client-server computing, and three-tier computing. To this I would add the constant tug-of-war between open versus proprietary software, and crises of the moment, such as the Year 2000 problem. The picture is further complicated by organizational and political shifts like the ebb and flow of funding, partnerships, and rivalries.

This was one key lesson I learned from my study of the Gulf of Maine case: the need to adapt to rapid change in the broader technological and organizational context. Other lessons arose from comparing the Gulf of Maine's experience with similar efforts in other areas, such as the Great Lakes and the Pacific Northwest.

In all three of these cases, people I spoke with had started out seeking to build a one-stop shopping system: "come to us for all your data on the Gulf of Maine, the Great Lakes, the Pacific Northwest." But somewhere along the way, they found that there were one, two, three other groups proclaiming the same thing. What does that mean? Well, you can consider it to be rivalry or duplication, or you can decide to actually learn from each other, figure out each other's strengths, and decide how to contribute to a network that has no "hub," or to an organizational structure that's more like a "ring" than a "pyramid."

A related challenge in all of these cases was learning how to be interdependent between organizations. When a simple "one-stop," pyramid model proves inadequate, it is tempting to give up and adopt a "laissez-faire" approach: let everyone continue doing what they do; just get their data in digital form and later we will figure out how to handle it. However, reconciling information coming from different independent sources is far from easy: so as you decide how to enable people to exchange information over the network, you need to establish standards and protocols; some shared vocabulary that will let you do something meaningful jointly.

One pattern I found in the Gulf of Maine case and elsewhere: people started by building a "scaffolding," a "mock-up" of what they really wanted to do; but then found it hard to go from the "mock-up" to the full-blown infrastructure that they really wanted. For instance, the Gulf of Maine system, EDIMS, was originally described as a regionally distributed data set. For starters, however, it was built as a centralized system -- and it never managed to outgrow that. In the Great Lakes, GLIN was intended to link online data services all over the region, in support of environmental assessments and decisions. But the initial GLIN consisted of a lot of static pages, essentially electronic brochures; and it took more time and effort than expected to put online a set of useful data sources aimed at GLIN's longer-term goals.

Another lesson I learned was that regional information-sharing initiatives need a clear statement of what it is they are trying to accomplish -- a "creed" of sorts. Because the creed and purpose may not be obvious to all, a major challenge is to articulate the shared norms and goals that will

unite partners in supporting the joint work. They also need one or more “evangelists” to articulate the creed, proclaim it to the world, and enlist followers. Thirdly, they need some kind of a “miracle worker” to fulfill the promise that the evangelist is proclaiming. For instance, GLIN had a fairly clear statement of what it was all about; and two members of its Advisory Board were very active in persuading and cajoling Great Lakes organizations to get involved with regional networking. And a few very smart people worked hard to make GLIN happen as promised, by building and maintaining hundreds of webpages on dozens of servers in the region.

In studying these cases, I often found that people had quite different views of what it meant to share information. From what I have heard in the last day or so of this meeting, this is certainly true of the Gulf of Maine. For some, it is primarily a question of broad outreach and public participation. For others, it may be a matter of making sure one’s information is accurate and well documented so outsiders will use it properly. For some it may not consist of exchanging data, but of learning from like-minded colleagues across organizational boundaries. For others, it is primarily a question of building sophisticated network tools to suit all audiences and all data. None of these views are unreasonable or even inappropriate; the challenge is to reconcile several views in a single design, without however trying to be everything to everyone. Considering multiple views allows the design to be responsive to multiple purposes as it grows and evolves.

One last lesson I learned from studying these cases is a technological one, which I am currently pursuing in my own research. The sharing of digital information has traditionally rested on the exchange and conversion of data sets -- documents, databases, maps, and the like. To facilitate the interchange of these data, we have often talked of standard file formats such as ASCII and the Spatial Data Transfer Standard (SDTS). But a more promising model for the future, which is finally becoming feasible, is online data services, in which users or software systems can query remote data sources to find their answers, without ever having to obtain, unpack, or make sense of the data package itself. A growing number of such services may be found on the World Wide Web nowadays; examples include the U.S. Environmental Protection Agency’s EnviroMapper (www.epa.gov/surf2/locate), GeoVision’s MapQuest (www.mapquest.com), parcel tracking at FedEx (www.fedex.com), address-matching at Etak (www.geocode.com); earth imagery at Microsoft (terraserver.microsoft.com); and several geo-spatial data servers underway at MIT (ortho.mit.edu, coast.mit.edu, silo.mit.edu). Services such as these represent a promising direction in our ability to harness information from many sources, to suit many purposes. The growth of such services into a coherent infrastructure will depend not on standard data formats, but on consensus-based, non-proprietary interfaces between clients and servers. I expect that the growth of data services, together with sophisticated catalog services, will play a major part in turning today’s messy, disorganized World Wide Web into a valuable distributed information resource.

So, what is different today compared to just a few years ago when Gulf of Maine information sharing was last being discussed with today’s vigor? Plenty. First, a lot more information is available online, often for free. In the United States, the last few years have seen massive collections of public data becoming available from the National Oceanographic and Atmospheric Administration (NOAA), the National Aeronautical and Space Administration (NASA), the U.S. Geological Survey (USGS), the Census Bureau, the Department of Agriculture, and other. Many

initiatives similar to this one at various scales are under way; the Gulf of Maine effort is no longer the lone pioneer that it was five or ten years ago. This increases the complexity of the effort; but it also provides a rich collection of information that everyone can use as an underlying base for communications and analysis.

Second, today no one needs to wonder which basic network protocol to use: the world has agreed to use the Internet's World Wide Web. However, despite widespread adoption of this low-level protocol, there is still no real consensus on what higher-level technologies or standards to use to provide data services, to distribute geodata online, to express data queries, and so on. Earlier Drew Parkin talked about StreamNet being on the "bleeding edge;" his team found that prepackaged solutions only got them part way to their goal, and they had to blaze their own trail technologically even though they had no such intentions at the outset. Similarly, in building a meaningful data infrastructure in the Gulf of Maine within the next five years, I expect that some of your technology will be on this bleeding edge, where the choices are not yet obvious, and where not all of what you will need is available in shrink-wrapped form.

Third, another recent development -- still unfolding actually -- is the Digital Earth Initiative announced by Al Gore in January, 1998 (holodeck.gsfc.nasa.gov/digitalearth/intro.html; digitalearth.gsfc.nasa.gov). This is the initiative from which I borrow the term "digital Gulf of Maine." He said, "I believe we need a digital earth, a multi-resolution, 3-dimensional representation of the planet into which we can embed vast quantities of georeferenced data." Gore envisioned a vastly detailed collection of data coming from multiple sources at once, and a "virtual reality" user interface that would let you zoom into any part of the Earth down to one-meter resolution. Intertwined data services, numerical models, and user interfaces would let you go back in history and forward into forecasts to find out about the ecology, history and economy of any spot in the world. He recognized that this is an ambitious project: "Like the World Wide Web, it would require the grassroots efforts of hundreds of thousands of individuals, companies, university researchers and government organizations." Sound familiar? This is just the sort of language that many proponents of regional information networks have been using -- only this one is intended to be two or three orders of magnitude larger and more complex. Gore suggested that the Digital Earth could become a "co-laboratory," a laboratory without walls, with applications in virtual diplomacy, crime fighting, preserving biodiversity, predicting climate change, or increasing agricultural productivity. He proposed sponsoring a testbed with participation from government, industry, and academia, which would focus on an application such as education and the environment, as well as looking at the tough technical issues of interoperability and policy issues such as preserving privacy in that sort of environment. If this initiative comes to fruition as described in Gore's speech, it will be a likely backdrop source of ideas, resources, and guidance for a Gulf of Maine regional information sharing infrastructure.

Another part of today's picture: certain organizations exist to provide you with advice, experience, standards, and interfaces, to help you make sensible choices out on the "bleeding edge." In the United States, the Federal Geographic Data Committee (FGDC), at www.fgdc.gov, is coordinating the growth of a National Spatial Data Infrastructure (NSDI) through federal and state efforts. The NSDI includes a clearinghouse for locating digital geographic information, and a framework of base data including roads, rivers, railroads, and aerial photos, on which everyone

else can “pin” their more specialized data. The FGDC also promotes and shapes a variety of standards, inter-organizational partnerships, and funding opportunities. I have brought with me an FGDC publication, called “The Value of Metadata,” (Appendix 9), and information on several relevant funding opportunities.

Another organization that is helping people like you make sensible choices in information sharing is the OpenGIS Consortium (opengis.org), essentially a software-industry counterpart to the FGDC. The OpenGIS Consortium is developing consensus-based software interfaces that will allow any software clients to draw on any geographic data servers. To date they have defined interfaces for simple geographic features; currently underway are interfaces for geographic images and data catalogs. Finally, the World Wide Web Consortium (w3.org) shapes Web-related standards such as HTML and HTTP, and related web policy issues such as the regulation of online content and privacy.

These organizations are the ones to watch as you make your choices of technology, standards, and interfaces, within a data-rich, organizationally complex, constantly changing world. The current context, although much more complex than that of five years ago, offers many more resources (technologies, data, standards, expertise, and funds); however, Web-based data interchange is still not something you can buy off the shelf.

So, given the history of information sharing in the Gulf of Maine and elsewhere, and given the current context, what are some keys for success? First, if I may jump into some technological remarks, I think that a successful information infrastructure will have to be designed and built not all at once, but as independent component services with widely accepted, non-proprietary interfaces. These interfaces are analogous to the standard electrical plugs, and matching wall outlets, that we count on to power our appliances. Instead of standardizing data into homogeneous rigid data formats, I suggest standardizing the language that software systems use to express and fulfill requests. Compared with traditional large, monolithic system designs, component-based systems impose much less risk: you can try out things piece by piece and get early results (or early failures) and either build on them or change strategies before committing yourself too far. Components also afford the flexibility to swap out certain parts of the system to meet your inevitably changing needs over time. I am trying to follow this component-based approach in building a coastal orthophoto server: this approach allows the server to meet the needs of a wide spectrum of users, from the novice to the expert, and to support both internal and external data distribution.

Some more keys for success. I do not think you should make a definitive choice between incremental versus non-incremental kinds of change. To quote the ancient verse, there is a time for everything; in this case, a time for incremental change and a time for leaps of faith. Sometimes you will need to build on the technologies, resources, and organizational structures you have, and sometimes you will need to free yourself of them and leap forward to start building from scratch what you want five years down the road.

Avoid the intractable burden of “laissez-faire” approaches: impose just enough vocabulary standards, protocols, and interfaces that people can contribute data or services without also

burdening you with a mess to clean up. Some might go to the other extreme, seeking to impose rigid standards on everyone; but my sense is that most in this room are more prone to "let a thousand flowers bloom," and to avoid imposing any rules because they might discourage some from participating. That could prove troublesome. I encourage you to think about what standards and protocols will be needed to get you to a shared information environment that it scaleable, i.e. one whose data holdings and audience size can grow much faster than its personnel requirements.

On a related note, do not mistake the scaffolding, the initial proof of concept, for the real thing. Decisions on data and interface standards are a particularly important aspect of this: simply collecting data (or browser bookmarks in the age of the Web) will not "naturally" add up to a coherent, useful information resource. A lot of consensus decisions, standards, and system design will be required to reach this larger goal.

Finally, in talking with various people involved with Gulf of Maine data sharing, I sensed that perhaps too few resources and too little expertise were being applied to the problem. So, do not underestimate the job. It is a big job. A complex, expensive job. It will take a lot of time, a lot of attention; a lot of lost sleep, perhaps, for some. It will take real commitments of your time and resources, and of your organization's influence among its peers. So, mobilize all the resources you can get -- not just technical expertise, but organizational savvy as well.

So, given all that, are we ready? Here are the questions that I would have you ponder as you think about whether or not you are ready.

Is there such a thing as a set of clear, shared goals that can form the basis for a shared information system? I attended a Gulf of Maine Citizen's Workshop a couple of years ago in Portland; it was intended for regular folks; citizens as opposed to scientists, governments, or what-have-you. But the hotel's marquis parsed it differently. It said, "Welcome Gulf of Maine Citizens." I thought, is there any such thing as a Gulf of Maine citizen? Are there values shared by a critical mass of people who consider themselves citizens of the Gulf of Maine first, over and above their individual state or province?

Related to that is my second question. Does this regional information sharing effort have firm commitments from its participants? I think one of the weaknesses of prior attempts was that committee members came together largely out of their own personal interest. Most participating agencies contributed only in-kind, part-time staff efforts: although willing to send people to meetings, they could rarely afford to have them do much between meetings, and they generally did not stand behind them with signatory commitments. The committees therefore had little real influence on the agencies that they were supposed to be guiding, and the progress of the inter-agency effort remained slow.

Finally, are there adequate partnerships with related efforts in industry, government, and academia? As I mentioned, you are no longer the first group of people trying to do this in the Gulf of Maine. Five or ten years ago you might have been the pioneers; but now there are lots of other people doing related, overlapping kinds of things. So, this needs to be done within a context of partnerships, with industry, government and academia, with no one clearly in charge

but everyone pitching in within a loose structure of standards and common goals.

So those are my thoughts. You have set before you a complex challenge, but one with great rewards if you can pull it off. The task is no longer nearly as simple as it once was, but if you can tap into the resources now available to you, your chances of building something lasting and valuable are better than ever. I wish you all the best as you bring together the necessary participants, and begin harnessing the power of Web-based information to protect and enhance the Gulf of Maine's natural resources and the welfare of its people. Thank you.

Question Session

MR. SCHROEDER: I think that bringing up the issue of citizenship was really pertinent and very important. Consciousness of who we are and how we relate around non-standard jurisdictions is a big part of forging the relationships that will be necessary as well as those that grow logically.

DR. EVANS: Actually, my remark about citizens was an informal one, but the notion of interjurisdictional decisions is relatively new and unfamiliar turf in this particular corner of the world. Most of the people who are making these policy decisions are making them within their own state or provincial boundaries. One of the challenges is to define a shared goal for the region, based on a widely recognized interdependence between the people in the region. In the Pacific Northwest, it was rather easy to define such a goal. Salmon go up and down rivers. They do not care when they cross the state line from Washington to Idaho. So, the folks on either side of the state lines had to talk to each other, even though they did not particularly want to at first. In the Gulf of Maine, I do not yet see anything quite as obvious or strong as the salmon example. Certainly, some interdependencies exist: ocean currents flow all over the place, and make political jurisdictions moot; but that is not obvious to people, and must be articulated. Once you have identified an important interdependence, you need to put that into clear words so that everyone can understand.

MS. REID: As a representative here today for the Gulf of Maine Coastal Monitoring Network, that is one of the ways we are trying to become the citizens of the Gulf of Maine. We are channeling money from the Gulf of Maine Council into education and outreach and monitoring restoration efforts around the Gulf of Maine.

SUMMARY OF WORKING GROUP DISCUSSIONS

In order to move closer to developing an Action Plan for enhancing data and information exchange in the Gulf of Maine, the workshop participants were split into two working groups and asked to address the following questions:

1. Who are the users?
2. Who are the natural partners?
3. What will the users do with the information?
4. What is the capacity of the users?
5. What are they willing to contribute?
6. What should happen next?

The groups met for approximately 45 minutes to brainstorm on these questions. Each group selected a facilitator and a rapporteur to provide a synopsis of the discussion.

Working Group 1 Summary
Chairperson and Rapporteur, Ted Diers
Summarized by: Heather Tausig

The group identified possible users of an electronic information exchange system to include **citizen water quality monitoring groups, researchers, fishermen, government employees such as coastal and marine managers and marine educators**. They then discussed what kind of information various groups would likely access as well as provide via an electronic information exchange.

The types of information that citizen monitoring groups would be looking for in an information exchange include: land use; current and historic water quality data; local significant natural resources; point source pollution threats; quality control issues; quality assurance requirements; actions and results of neighboring watershed monitoring groups (e.g., peer experiences, contaminants in the watershed, proximity to another watershed); stakeholders; data contributors; institutional and government agency resources; network of support services; funding sources; and volunteer resources such as monitoring methodologies and equipment information.

Citizen monitoring groups would contribute various types of data, including water quality, land use and threats to significant resources. With this information, they could inform public policy makers, network with other monitoring groups, establish and maintain a baseline and ongoing changes, use it as an educational tool, and/or raise public awareness.

The technical capacity of citizen monitoring groups currently or in the foreseeable year is highly variable. Their ability to contribute to a data and information exchange would be limited by time and resources. The natural partners of this user group include regional planning organizations, coastal zone programs, university cooperative extension programs and research reserves.

The types of information that researchers would be looking for in an exchange include: primary data sources, raw data, spatial information, similar peer works, funding sources, contextual background data from other disciplines, and contributions from community groups and others.

Using this information, the researchers could publish works, conduct their own research, influence policy decisions, generate products, and collaborate with other researchers. Researchers have the capacity to contribute a lot to the system, however, their willingness to contribute will vary among individuals.

The types of information fishermen could utilize through a Gulf of Maine information exchange would be meteorological data; oceanographic conditions (e.g., temperature, salinity, currents, tides); environmental factors (e.g., red tides, fisheries statistics such as population estimates for various species); essential fish habitat (e.g., location of spawning areas); water quality data; regulatory closures (e.g., shellfish beds and fishing areas); market price; recent legislation; new developments in gear technology; database variables for creating their own management plans; co-management knowledge and experiences; other fishing grounds; contact data for other fishermen and researchers; and details about job re-training and counseling programs.

This information is useful to the fishermen in a myriad of ways because it enables them to improve their safety record, economic profits, efficiency, and their capacity to participate in management and help develop management plans. In return, fishermen could provide information and data on fisheries, physical and historic information as well as observer data on marine mammals, turtles, and other species. Oceanographic parameters could also be confirmed. Fishermen can provide both long-term and short-term data and information. If there were assurances that the information collected was going to be used by managers then they would be more willing to get involved in the data collection process.

Government users, including coastal and marine managers, would use a Gulf of Maine information exchange for environmental, historical, spatial, and water quality data as well as information on industry trends; land use patterns; resources; legislation; public and press concerns; models from elsewhere; new research; statistics; reference documents; stakeholders; funding opportunities; etc. These data would be used for lawmaking; managing and planning; educating; synthesizing; analyzing; facilitating; funding more data; and distributing information and improving enforcement.

Government users would contribute information on strategic planning, rules and regulations, grants and funding sources, infrastructure, and monitoring. Their capacity to contribute to the exchange is medium to high.

Educators' needs include: basic information on the Gulf of Maine, environmental and public health, curriculum materials, etc.

High priority items for all of the user groups include environmental, statistical, habitat, historical and socio-economic data, both raw and synthesized, as well as information on peer groups; land use patterns and trends; health; population and economic trends; community precedents; habitats; legislation/regulations/jurisdiction; available resources and reference materials; funding opportunities; community and other precedents; training opportunities and conferences; and basic information on the Gulf of Maine.

One way to facilitate an information exchange for these important items would be to understand and refine standards for data dissemination on the Internet. There are national standards that many people are not aware of. A first step in the Gulf of Maine information exchange should involve researching whether current information exchange projects conform to national standards, before we continue to build on them.

Understanding how to connect various organizations with similar needs is important. The group recommended the establishment of a research committee, to assess what is out there now and what could be linked in, keeping in mind the users and the possibility of identifying new users.

Finally, it was recommended that the workshop organizers list the collaborations that have arisen from this workshop in the Final Report.

Working Group 2 Summary
Chairperson, Lissa Widoff; Rapporteur, Dean Meggison
Summarized by: Patrice M. Farrey

Group 2 spent the first minutes discussing a laundry list of users and possible contributors, along the lines of who would do what, when and where. The group identified the following as the potential users of a data and information exchange in the Gulf of Maine: marine industry, including both commercial and community developers, commercial fishermen and the tourism and recreation sectors; educators; government representatives, including legislators, law enforcement personnel, and local, state, and federal managers; non-profits, including conservation groups, citizens groups, and others; and the local, national and international public.

In assessing what the users would do with the data and information system, the group decided that it was necessary to define the system. Through these discussions, the group went off task and proceeded to take a look at what sorts of things need to occur in order for the users to access and utilize available resources. The group also asked what the advantages of such a system would be. A list of generalities and specifics was then prepared.

The group decided that there was a need for a two-way information exchange. Users will not just pull up what they want and wander off; rather they will pull the information up, use it and then provide feedback on how it can be improved. This two-way flow of information would support the efforts of non-profits and local level initiatives.

The group agreed that a “front door approach” should be used in developing this information and data exchange. Once a user walks through the door, the initial distribution and technical assistance would direct him or her to either data or information, and would then provide an explanation of how to access the appropriate channels to assist his/her search. The group envisioned this happening through a website format, with the capacity to provide some form of technical assistance at various points in the system. The system would have centralized access, but decentralized maintenance. According to the results of the Gulf of Maine Information User Survey, forty-four percent of respondents indicated that time was the biggest obstacle to the existing system. The creation of a “front door” would address this issue.

This exchange will not only manage and synthesize existing information, but encourage new information resources. The data will be standardized to increase access. The exchange will create a demand or a market for some of the existing sources that are available. Collaborations within this data and information exchange will occur naturally. The phrase, “If you build it, they will come,” applies here. The system would serve as a broad clearinghouse for points of entry, distribution and technical assistance.

It is important to consider how the success of the system will be measured. After considerable discussion, the group proposed that the system should be considered a success if 1) better informed decisions are being made by policy makers, and 2) useful products are starting to be created by the data holders, and the data is more useful and accessible to a wide range of users.

The group recommended taking an incremental approach to developing this data and information exchange. This data and information exchange should make maximum use of what is already out there, including the information at the local level, regional, state, and federal levels. It is important not to reinvent the wheel.

In discussing various scenarios based on an incremental approach, the group decided to offer a list of "next steps," to illustrate the types of actions which could be taken in implementing an incremental approach:

1. Reconstruct or construct the Gulf of Maine webpage for the general public (include issue-based forums where people with concerns could get together and chat, either in real-time or a synchronization over time);
2. Create linkages to existing pages and to additional pages as they become available in order to provide basic factual information about the Gulf of Maine;
3. Begin to define the level of complexity of searches that are necessary to meet the needs of the users;
4. Develop a Gulf of Maine search engine; and
5. Establish a spatial/GIS component to the system.

This incremental approach was thrown out there as a hypothetical scenario, not as a bottom-line recommendation. The group used it to illustrate the steps one might encounter through this approach. An advantage of this approach is that it is possible to get the ball rolling immediately, because the first few steps are not cost prohibitive. If these steps prove successful, there will be an opportunity to raise additional funds to implement the latter steps. If the initial steps are not successful, this approach allows the flexibility to develop and reach a new strategy.

Finally, the group discussed where we go from here. It will be necessary to identify a logical organizational leader to convene a volunteer advisory group or action committee to continue these discussions. This role would best be served by a non-partisan regional organization.

SUMMARY OF FUNDING OPTIONS DISCUSSION

A panel which shared insights about funding opportunities for information/data technology projects included the following individuals, Robbin Peach, executive director, *Massachusetts Environmental Trust;* Thomas Siegel, director of information services/technology, *Associated Grantmakers;* Peter Shelley, vice president, *Conservation Law Foundation;* Rob Stuart, director, *Rockefeller Technology Project; a*nd Jed Wright, biologist, *Gulf of Maine Project, U.S. Fish and Wildlife Service*.

Recommendations for potential fundees generated during this session included:

- Clearly define "what" they are creating;
- Explain what is going to change as a result of this effort and include some clear measures of success (benchmarks);
- Overcome an errant selling problem of seeking funding for a process not a product – a process of communication, data and information exchange;
- Rather than seeking a technology grant, consider building electronic communication or data and information exchange into an existing grant proposal;
- Demonstrate ability to generate additional revenues to keep effort going, given high start-up costs;
- Demonstrate how technology will be used by user groups;
- Include funding to cover technology training costs;
- Demonstrate that the effort focuses on solving real problems;
- Demonstrate that the process will be user-friendly;
- Ensure that the user group is involved in the development process;
- For funding agencies not normally inclined to fund technology-related projects, byproducts of technology (e.g., reports, papers, educational materials, etc.) are a good idea to include in grant proposals; and
- Funders themselves may be a good candidate for a test case. Get them excited about electronic data/information exchange and they may be willing to fund other efforts and able to help link funders with grant recipients.

Associated Grantmakers stated that a list of funding organizations are available on their webpage and offered to assist interested parties in establishing webpages.

Appendices

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APPENDIX 2. Survey Results: Top Three Issues in the Gulf of Maine

Please choose what you think are the top three issues in the Gulf of Maine:	*Overall*		*Non-profits*		*Educators*	
a) Impact of chemical pollutants on the ocean (pathogens, biocides, dioxins/furans, mercury, etc.)	59	30%	9	24%	20	34%
b) **Loss of regionally significant coastal habitats**	76	38%	14	38%	24	41%
c) Introduction of non-indigenous species to the Gulf (ballast water discharge)	10	5%	1	3%	5	8%
d) Limited awareness of environmental health threats due to toxic pollution	15	7%	0	0	10	17%
e) Lack of data and information sharing	30	15%	5	14%	5	8%
f) Insufficient data and information about the Gulf of Maine	20	10%	5	14%	5	8%
g) Loss of essential fish habitats	48	24%	11	30%	8	14%
h) Impacts of aquaculture on habitat	8	4%	1	3%	2	3%
i) Loss of salt marshes	25	12%	2	5%	12	20%
j) **Impacts of coastal development on the ocean resources**	70	35%	11	30%	21	36%
k) Impact of tourism & recreation activities on ocean resources	10	5%	4	11%	4	7%
l) Impact of mobile fishing gear on the seafloor	18	9%	3	8%	3	5%
m) Impact of tidal and freshwater obstructions (dams) on ocean resources	9	4%	3	8%	1	2%
n) **Impact of overfishing on fish stocks**	88	44%	24	65%	24	41%
o) Impact of marine debris (plastics, lost fishing gear) on birds and mammals	14	7%	4	11%	8	14%
p) Inadequate citizen stewardship and responsibility for the environment	45	22%	11	30%	10	17%
q) Harvesting of low-trophic species	2	<1%	0	0	2	3%
r) Other	22	11%	3	8%	1	2%
s) No response	6	3%	0	0	2	3%

APPENDIX 3. Atlantic Coastal Zone Info (newsletter)

APPENDIX 4. Gulf of Maine Survey of Electronic Environmental Data & Information Users

APPENDIX 5. Computer Session Handout from Bruce Tripp

Gulf of Maine Data & Information on the WWW

Bruce W. Tripp, WHOI Rinehart Coastal Research Center

General

Information available on the Web is prepared at the discretion of the originating organization and is designed to meet the needs of that organization. Usually, an outside user will have to search through several websites in order to assemble sufficient information to meet individual user needs. This is no different than traditional searches using library reference sources. A few websites are collected here to help "*Out of the Fog*" participants get started.

1. GOM Organizations

Often, in addition to their own website, organizations will assemble links to data and information sources that are relevant to their individual missions and interests. Some Gulf of Maine scientific organizations include:

- Regional Association for Research on the Gulf of Maine
  http://www-nml.dartmouth.edu/rargom/rargom.html
- New England Aquarium
  http://www.neaq.org/
- Woods Hole Oceanographic Institution
  http://www.whoi.edu
- Regional NOAA Sea Grant Programs
  MIT: http://web.mit.edu/seagrant/www/
  WHOI: http://www.whoi.edu/seagrant/
- U. Maine Darling Center
  http://server.dmc.maine.edu/
- Stellwagen Bank Marine Sanctuary
  http://vineyard.usgs.gov/

2. Data & Information Networks

To meet inter-institutional information needs, some groups have established networks for data and information sharing. Two such networks in the Gulf of Maine are presently under development:

- EDIMS
  http://www.gulfofmaine.org/
- REDIMS
  http://oracle.er.usgs.gov/GoMaine/

3. Coastal Research Projects

Recently, research projects have adopted web tools as one way to make their research results accessible to a wider audience. The content of these sites varies from raw data (and even live data streams from in-situ measurements) to summaries of individual projects. A collection of these sites includes:

- Georges Bank GLOBEC
  http://globec.whoi.edu/globec.html
- EcoHab-GoM
  http://crusty.er.usgs.gov/ecohab/
- "Red Tide" and Harmful Algal Blooms
  http://www.redtide.whoi.edu/hab/
- NOAA Status & Trends Program-monitoring
  http://www-orca.nos.noaa.gov/projects/nsandt/nsandt.html

4. General Interest

Some sites that are not specifically related to the Gulf of Maine may have relevant and interesting general information on coastal science and resource management issues.

- Year of the Ocean
  http://www.yoto98.noaa.gov/
- U. Md. Inst. of Environmental Economics
  http://kabir.cbl.cees.edu/miiee/miiee.html
- Pesticides in U.S. Waters
  http://water.wr.usgs.gov/pnsp/
- U.S. EPA National Estuary Program
  http://www.epa.gov/nep/
- U.S. EPA Watershed Indicators
  http://www.epa.gov/surf/iwi/
- NOAA GOM Pollution Sources Inventory
  http://www-orca.nos.noaa.gov/projects/gomaine/

APPENDIX 6. Computer Session Handout from John Evans

Gulf of Maine online coastal and marine geodata

Gulf of Maine Regional Information Systems Workshop — Wednesday, April 4, 1998

John D. Evans, Ph.D. — *jdevans@mit.edu* — http://mit.edu/jdevans
M.I.T. Dept. Of Urban Studies and Planning

1. Good starting points

Specialized compendia & resource lists make excellent bookmarks. A few examples:

- Maine Harbors: **www.maineharbors.com**
- Atlantic Coastal Zone Database Directory: **is.dal.ca/aczisc/aczisc.htm**
- Gulf of Maine data links: **www.gulfofmaine.org/links/#mar**
  oracle.er.usgs.gov/GoMaine

Some general-purpose lists can be useful as well, e.g.

- The New York Times Navigator: **www.nyt.com/learning/general/navigator**

2. Maps on the Web: Good examples

- USGS Stellwagen Bank Information System: **vineyard.er.usgs.gov** (online atlas)
- Environment Canada's shellfish closure maps: **www.ns.doe.ca/epb/sfish/maps/class.html** (graphical interface to easily-usable maps)
- Nautical charts server: **mapfinder.nos.noaa.gov** (full set of reduced-resolution charts)
- Rich Signell's Gulf of Maine page: **crusty.er.usgs.gov** (animated ocean-process models)

3. Interactive map servers on the Web: Good examples

- General-purpose map servers: **maps.altavista.com** / **www.mapsonus.com** / **www.mapquest.com**
- Addresses and demographic maps: **tiger.census.gov** (the granddaddy of Web map servers)
- Microsoft's satellite image server: **www.terraserver.com**
- MIT's orthophoto servers: **coast.mit.edu** , **ortho.mit.edu**
- Antique maps/charts: NOAA: **anchor.ncd.noaa.gov**
  Library of Congress: **memory.loc.gov**

4. Making sense (and use) of it all

For comparison, a few other regional information systems:

- Pacific Northwest StreamNet: **www.streamnet.org**
- Great Lakes Information Network: **www.great-lakes.net**
- Gulf of Mexico Program: **www.gmpo.gov**
- Chesapeake Bay Information Management System: **www.chesapeakebay.net**

Standards and interfaces:

- US Gov't: Federal Geographic Data Committee: **www.fgdc.gov**
- GIS Industry: OpenGIS Consortium: **www.opengis.org**

5. Search strategies revisited

Keyword-search engines: **altavista.com** / **hotbot.com** / **yahoo.com**

- Use **very specific keywords** (e.g., "shellfish closure areas Atlantic" instead of "shellfish") to narrow down the number of "hits"
- Most search engines let you **require** keywords & **group** keywords: read the help pages
- Improvements to the brute-force keyword search:
- AltaVista's concierge, "**Jeeves**" (kicks in when you ask AltaVista a question)
- Northern Light's Custom Search Folders (**www.northernlight.com**)

Geographic searches:

These are still somewhat embryonic — so start with fairly general keywords (e.g., "fishing")

- On AltaVista et al., use special keywords to find certain **data-types**, e.g.,

  "**.e00**" (Arc/Info export file) — "**.shp**" (ESRI shapefile)

  "**.tab** " (MapInfo table) — "**esrimap.dll**" (ArcView Internet Map Server)

- NOAA's ESDIM server: **www.esdim.noaa.gov/NOAAServer**
- The U.S. National Geospatial Clearinghouse: **www.fgdc.gov/clearinghouse**
- ESRI's Data Hound: **www.esri.com/datahound**

APPENDIX 7. CA&DS Framework

APPENDIX 8. GLIN Fact Sheet

APPENDIX 9. The Value of Metadata

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