

Gulf of Maine Ocean Data Partnership

Hosted by Gulf of Maine Ocean Observing System (GoMOOS)

Work Plan

December 2004

Member Organizations

Bedford Institute of Oceanography
Centre for Marine Biodiversity
Coastal Ocean Observation and Analysis – UNH
Gulf of Maine Area Census of Marine Life
Gulf of Maine Council on the Marine Environment
Gulf of Maine Ocean Observing System
Huntsman Marine Science Centre
Maine Department of Marine Resources
Massachusetts Coastal Zone Management
New Hampshire Department of Environmental Services
NOAA – Coastal Services Center
NOAA – Northeast Fisheries Science Center
St. Andrews Biological Station
Stellwagen Bank National Marine Sanctuary
Tufts University School of Veterinary Medicine/SEANet
USGS – Woods Hole Science Center
Wells National Estuarine Research Reserve
EPA/ORD/NHEERL/Atlantic Ecology Division (pending)
Geological Survey of Canada (pending)
Woods Hole Oceanographic Institution (pending)

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Gulf of Maine Ocean Data Partnership Work Plan

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1. Introduction

The Gulf of Maine Ocean Data Partnership, hereafter referred to as the Data Partnership, is an international effort to promote and coordinate the sharing, linking, electronic dissemination, and use of data from the Gulf of Maine region. Members of the Data Partnership include governmental agencies, intergovernmental organizations, and academic, research, or other nonprofit entities. Each member organization is engaged in the collection of physical, biological, chemical, or geologic data on the Gulf of Maine. The host for the Data Partnership is the Gulf of Maine Ocean Observing System (GoMOOS).

The Data Partnership is a coordinated effort to enable users throughout the Gulf of Maine region and beyond to discover and put to use the vast and growing quantities of data in databases housed at agencies throughout the Northeastern United States and Canada. Through the coordinated access to the respective databases, the partners wish to advance a truly integrated ocean observing system in the Gulf of Maine.

The purpose of this work plan is to outline the tasks necessary for full implementation of the Data Partnership.

2. Purpose and Desired Outcomes

Through this partnership we will determine practical approaches to coordinating data. During calendar year 2005, the Data Partnership will initiate four activities to further this mission. At the time of this publication, some members may have completed several of these steps.

- Members will examine their ability to authenticate their data and resolve any issues prior to moving a product forward to the next step.
- Members will be encouraged to publish FGDC-compliant metadata records to one or more national clearinghouses, which will enable discovery of their data in a standard fashion,
- We will develop a set of recommendations to ensure that all partners can serve their data via the internet,
- We will tackle the challenge of interoperability, stressing standardization within disciplines and use of existing protocols for data sharing. To facilitate this process a web client may be developed at the host location.

At the end of the first year of the partnership, we intend to enable real time, on-demand download of data products from across the spectrum of data providers. As the partnership moves forward into subsequent years, we anticipate adding new projects to grow our ability to integrate data products across disciplines and standards.

3. Background

Several of the activities described below have established the feasibility of discipline-specific data sharing within the Gulf of Maine. The Data Partnership will move beyond these initiatives to enable a multidisciplinary approach to data sharing and integration.

The Data Partnership will advocate the use of open standards to enable interoperability of data and information. Wherever practicable, the Data Partnership will leverage existing standards and technologies. The World Wide Web Consortium (W3C) has developed such technologies (specifications, guidelines, software, and tools), which continue to extend the Web in fundamental ways that will serve the Data Partnership. Discipline-specific applications of these technologies continue to emerge in various disciplines. The EPA, for example, is creating the National Environmental Information Exchange Network (www.exchangenetwork.net) using W3C-compliant technologies. Likewise, the Census of Marine Life is using W3C-compliant services in a different configuration to create the Ocean Biogeographic Information System (OBIS), which is especially well-suited to taxonomy of marine organisms. A major challenge for the Data Partnership will be to make these discipline-specific implementations interoperable with one another. A comparable challenge will involve working with partners that have relatively little experience with sharing data over the Internet.

The Open Geospatial Consortium (OGC) offers important advances in achieving interoperability between the multiple disciplines. The OGC is a non-profit, international, voluntary consensus standards organization that is leading the development of standards for geospatial web services. The OGC standards take an important step beyond the W3C specifications by including geospatial information that is critical to virtually all of the environmental sciences. Geospatial referencing is a common theme between all members of the Data Partnership, which signals the importance of the OGC specifications.

Recent data sharing efforts in the Gulf of Maine using OGC specifications:

FGDC/GeoConnections Gulf of Maine Framework Data Project was completed in summer 2004 by GoMOOS and its lead Canadian partner, DM Solutions Group. The objectives included enabling of a Gulf of Maine spatial data infrastructure based on the OGC specifications for web services. The project involved building U.S.-Canadian relationships for data integration, enabling effective integration of datasets across international borders, and demonstration of a “real world” application using integrated data. Online at www.gomoos.org/fgdc/bin/view/Main/ProjectOverview.

The Gulf of Maine Mapping Portal (GoMMaP) is one of the primary outcomes of the FGDC/GeoConnections project. The GoMMaP web site (www.gommap.org) provides a single point of access to a wide variety of data products in map form. The organizations involved in the project “publish” their data products to the web with a set of conventions for web mapping services that are compliant with OGC specifications (www.opengeospatial.org). The GoMMaP site is designed to serve as a resource for organizations that would like to contribute geographic data, or those that would like to add mapping content to a website. GoMOOS maintains the GoMMaP website, which features a map viewer, a map builder and online tools that enable users to customize maps for their own purposes.

The Integrated Ocean Observing System (IOOS) includes a variety of demonstration projects for data dissemination and aggregation over the internet. GoMOOS is involved in one such nationwide project that uses OGC-compliant web services. For more information, see www.openioos.org.

Institutional Examples

GoMOOS: GoMOOS serves data collected from its data acquisition program, which includes an array of buoys in the Gulf of Maine collecting real-time observations of a variety of environmental variables. Data are stored in a format (NetCDF) that facilitates creation of an archive. The archival data can be accessed with a web-service protocol (OPeNDAP) that is in common use by the atmospheric and climate modeling community. The NetCDF/OPeNDAP combination has limited value because there is no widely adopted standard for organizing the buoy data in NetCDF (GoMOOS uses an in-house data model based on the CF convention developed by Unidata at the University Consortium for Atmospheric Research).

As a result, GoMOOS employs several methods to facilitate data dissemination. GoMOOS maintains a Relational Database Management System (RDBMS) to organize the data and to create real-time data products over the Internet. The RDBMS allows the GoMOOS web site to serve a variety of browser-based graphical user interfaces for on-line visualization, download in CSV and other ASCII formats, etc. The GoMOOS RDBMS is spatially enabled, which allows many of the data products to leverage web-based Geographic Information System (GIS) capabilities. GoMOOS maintains an OGC-compliant server for GoMOOS buoy data and other non-GoMOOS data sources (e.g., NOAA/National Data Buoy Center (NDBC) buoy data, NOAA National Hurricane Center storm tracks, NOAA/National Ocean Service (NOS) water levels, and others.) GoMOOS exports real-time data to the NOAA/NDBC using their MODEM software kit. GoMOOS also maintains other data-export mechanisms and formats for various clients, including RSS, FTP and others.

Department of Fisheries and Oceans (DFO) and NOAA/Northeast Fisheries Science Center (NEFSC): DFO serves a growing variety of fisheries data using a web-services approach used by members of the Census of Marine Life program and the associated OBIS. OBIS uses a web-service implementation known as Distributed Generic Information Retrieval (DiGIR) and an associated data model (Darwin Core 2) that is well suited to fisheries-related information content. DFO maintains an Oracle RDBMS for its own data and also maintains a direct connection to the Oracle RDBMS housed at the Northeast Fisheries Science Center. DFO will be serving both the DFO and NEFSC data with DiGIR. DFO also serves a variety of data products using OGC web services.

Gulf of Maine Biogeographic Information System (GMBIS): The Gulf of Maine Area Program of the Census of Marine Life, based at the University of Southern Maine, serves data sets from NMFS, DFO, the World Wildlife Fund, and other sources to enable easy access to and integrated analysis and visualization of these data. The data are stored in a RDBMS and made available on the Internet using a variety of browser-based tools. The purpose is to promote the understanding of the biogeography of the Gulf of Maine. GMBIS will be linked to the Gulf of

Maine Ocean Observing System and the global Ocean Biogeographic Information System (www.iobis.org).

4. Organizational Parameters

Partner

A partner in the Data Partnership is an organization or individual within an organization that monitors, observes, or makes measurements of or relating to the Gulf of Maine and that supplies the resulting data for research, operations, decision-making, or other purposes; or an organization that represents organizations that supply such data; or an organization whose mission includes disseminating such data. In an effort to bring a wide selection of data products to the greater policy-making community, the Data Partnership will work to ensure that each relevant disciplinary sector is represented. This includes, but is not limited to, physical sciences, biology, oceanography, culture, geology and the environment. Outreach activities will be ongoing to bring new members to the partnership as they are identified.

To join the partnership, members must sign the Memorandum of Understanding (MOU) and be in possession of either an ongoing or completed data collection effort related to the Gulf of Maine or be an entity that coordinates the distribution of resulting data sets. The partnership seeks to access data that may be disseminated among partners and to the general public. The Data Partnership understands that some organizations may be unable to sign the MOU; therefore we define an alternate category of Adjunct member. Adjunct members may not vote at meetings of the governing board; however we value their technical collaboration in forwarding the goals of the partnership. As part of the first year activities of the Data Partnership, a partnership member guide will be created outlining the ongoing responsibilities of members.

Governing Board

The governing board of the Data Partnership consists of one voting member of each member organization. The governing board recognizes the authority of each member to designate an alternate to vote at meetings on the occasion that the voting member must be absent. The governing board does not recognize any proxy voting process, nor will it vote by email on any substantive issue. The governing board will meet yearly to review project status and proposals and conduct any necessary business.

The governing board of the Data Partnership will appoint an executive committee consisting of a Chair, Vice Chair, Secretary, Treasurer, and 2 standing committee chairs (Technical Committee and Outreach Committee). These appointments will be for 3-year terms. The Host will also have a seat on the executive committee, but the Host will not vote on partnership business.

Executive Committee

The Executive Committee will act in the intervals between meetings of the full Governing Board of the Data Partnership. It will have all the authority of the Governing Board other than:

- Amending the Memorandum of Understanding that has created the Data Partnership;

- Amending or repealing any resolution or formal action taken by the Governing Board;
- Adopting an annual budget for the Data Partnership, although it may make reasonable amendments to an adopted budget;
- Selecting or discontinuing a relationship with a host, as described in the Memorandum of Understanding;
- Dissolving the Data Partnership;
- Selling or otherwise disposing of property or assets, if any, of the Data Partnership;
- Making any decision or action reserved by the Memorandum of Understanding exclusively to the Governing Board.

The Executive Committee may delegate authority to the host as needed to carry out directives of the Data Partnership. It will keep complete records of its meetings and actions, which shall be reported to and open to inspection by the Governing Board. The current host for the Data Partnership is the Gulf of Maine Ocean Observing System (GoMOOS), which will employ any staff for the partnership and may house a portal or data server in the future.

The Executive Committee elected at the Fall 2004 meeting of the Data Partnership’s Governing Board is:

<i>Chair</i>	David Mountain	NOAA/NMFS
<i>Vice-Chair</i>	Robert Branton	Canadian Department of Fisheries and Oceans
<i>Secretary</i>	Dan Sampson	Mass Coastal Zone Management
<i>Treasurer</i>	Linda Mercer	Maine Department of Marine Resources
<i>Technical Committee</i>	Debra Soule	NH Department of Environmental Services
<i>Outreach Committee</i>	Evan Richert	University of Southern Maine
<i>Host</i>	Philip Bogden	GoMOOS

Technical and Outreach Committees

The technical committee and the outreach committee will meet in person or by conference call as needed to complete the projects defined in this work plan. The host organization will help to organize and conduct meetings and maintain a record of progress throughout the year. Member organizations will be responsible to appoint members to these subcommittees as requested. Subcommittee members may be individuals other than governing board members.

Outreach Committee

The outreach committee will seek new member organizations throughout the Gulf of Maine Region. The committee will contact potential members and introduce the partnership and the MOU. The outreach committee has the authority to recommend membership for any organizations meeting the partnership criteria.

Technical Committee

The technical committee will assist the host organization in ensuring all partners have the support necessary to accomplish the first-year goals outlined in this workplan. The technical committee will focus the majority of its efforts on the topic of data integration and interoperability.

5. Project Descriptions

The first year's activity of the Data Partnership will include the following four activities. The first two projects are considered to be partner-level activities, largely to be completed with an individual partner's resources. The second two projects will be managed through the partnership.

Project 1: Data Assurance

The Data Partnership assumes that each partner is ultimately responsible for quality assurance and quality control of the data they share. The Data Partnership will recognize and respect the ownership rights for the data provided by each partner.

The Data Partnership will develop recommended procedures for tracking the primary data provider, documenting the history of any value-added processing or data manipulation, and assuring appropriate attribution to the partner responsible for supplying the data or added value. Partners will be expected to adhere to the following criteria:

- Each partner will notify the Data Partnership of any issues related to ownership of data or data products that they contribute.
- Partners that acquire data externally or from an associated agency will indicate the original data source in a manner that can be automatically traced by partnership activities.
- Partners will contribute and maintain the best available representation of their data.
- Each partner will be responsible for making sure that the datasets are updated, remedying any problems in a timely manner as they arise.
- To the extent that a partner can not fulfill any of these responsibilities, the partner will work with the technical committee to develop an alternative solution.

Products and Milestones

The technical committee will recommend criteria to establish authority of data or data products to be provided by partners. The recommendation will address a species list, a parameter list, a gazetteer and other similar mechanisms to insure consistency among data sets.

The criteria will be incorporated into a Data Partnership partner's guide.

The partners will review the recommended criteria and estimate the cost required for compliance.

Implementation Costs/Requirements

The costs for this step will be internal to the partner's organization. If resources are available, the Partnership will provide assistance to partners in achieving compliance. The outcome of this step will be each partner's ability to create the metadata related to data authentication during the discovery phase.

Project 2: Data Discovery

Discovery of data sets/collections can be automated by having data providers "register" their data with either the FGDC's Geospatial One Stop for data in the U. S., the GeoConnections Discovery Portal for data in Canada, or both, as appropriate. For more information, see the section "Register your data" at www.gommap.org/gommap/gommap_howto_publish.html.

Use of these existing data discovery portals will enable the partnership to focus its technical resources on the more complex issues of data aggregation and interoperability. The data partnership is currently compiling an inventory of available partner contributions which will be published on the partnership's internet site, linked through the GoMOOS home page (www.gomoos.org). Appendix B shows the template used to develop this inventory. Some of these data collections are already registered at the GeoConnections portal. The surveys will enable the remaining partners to easily input their data either individually or with the help of a staff person at the host location.

The ability to aggregate data from multiple providers will require metadata-manipulation capabilities. Where practicable, partners will work toward interoperability at the metadata level, which will involve documentation of metadata practices, controlled vocabularies, etc. The goal is neither to develop a metadata standard, nor to impose a single standard on all the partners. Rather, the goal is to enable the host of the Data Partnership to translate between the various standards in use at any point in time. Where appropriate, the Data Partnership will encourage implementation of recommendations coming out of the Marine Metadata Initiative (www.marinemetadata.org), or similar organizations involved with community standards.

Products and Milestones

A pilot project registering selected data sets will be conducted to estimate the cost of accomplishing registration as a service by the Partnership in conjunction with the partners.

The Technical Committee will recommend a set of guidelines for constructing metadata in order to promote consistency between data sets registered by the Data Partnership.

To the extent they are able, partners will register their data sets with FGDC or GeoConnections as a Data Partnership contribution.

Implementation Costs/Requirements

The cost of the pilot project will be assumed by the Partnership. The personnel costs associated with registering data will be internal to the partner's organization. If resources are available, the Partnership will provide assistance to the partners in registering their data sets.

Project 3: Data Accessibility

The Data Partnership will pursue mechanisms for data-access and discovery at partner institutions that have minimal impact on existing data management and archival activities. The Data Partnership can provide a forum for exchanging ideas about common practices in data management and archival activities with the expectation that partners will benefit from their collective experiences. However, the primary focus of the Data Partnership will be enabling dynamic and distributed data access, discovery and aggregation via the internet.

The Data Partnership will develop and recommend a set of best practices for dynamic data access. We will pursue community standards whenever possible and advocate the use of web services, as recommended in by the Ocean.US Data Management and Communication (DMAC) plan. The outcome of this step will be the accessibility of as many data sets from as many partners as possible.

Data Access Methods

No single access method will suit all data types and systems, and the various methods are not likely to be interoperable with one another. Therefore, GoMOOS, as host of the Data Partnership, will have the responsibility of maintaining operating versions for the various methods so as to enable data discovery, aggregation, and integration of data and data products between partners. To keep the overall program as scalable and cost effective as possible, we will minimize the number of access methods used. The most common methods in use now include those listed below, however the partnership will work towards identifying and implementing the best long term solutions.

OPeNDAP – Middleware technology endorsed by the first Ocean.US, DMAC provides a client/server mechanism. OPeNDAP allows server-side subsampling of large data sets, and is particularly well suited to data that are organized on multi-dimensional grids commonly used in environmental computer-model simulations. OPeNDAP provides and enforces no semantic metadata standards (the climate and atmospheric modeling community uses the CF conventions developed by Unidata). Weaknesses: Scalability of the method relies on existence of a data model. Such models do not exist for many kinds of ocean data (mooring data, hydrographic profiles, etc.). OPeNDAP is not well suited to relational database access (unless all the data are stored in a single table or view).

Open Geospatial Consortium (OGC) Web Services – An evolving suite of web-service specifications tailored to common GIS data formats (raster, vector and coverage). OGC methods

continue to evolve and gain popularity outside the typical GIS communities. A growing number of both proprietary (e.g., ESRI) and Open Source software tools employ the specifications, which often means that legacy GIS systems can become OGC compliant with ease and low cost. OGC-compliant web services facilitate access to spatially enabled relational databases systems. Weaknesses: Existing versions of the OGC protocols are best suited for Internet web mapping and standard GIS data models, but actual data access methods are relatively new and not well supported for oceanographic applications (e.g., representation of long time series is awkward).

The Exchange Network – EPA’s approach to creating the Exchange Network (www.exchangenetwork.net) is based on W3C-compliant web services. Although the exchange network is specifically geared for the kinds of data commonly used in the EPA, their approach to data exchange, and the technologies involved, may be extended to other kinds of environmental data. In this sense, the EPA’s approach to data exchange is very much consistent with the guidelines recommended for partners in the Data Partnership.

DiGIR (Distributed Generic Information Retrieval) – This is the access method of the Census of Marine Life information system, namely, OBIS. DiGIR employs a W3C-compliant approach to sharing data from dissimilar databases using web services. A so-called “DiGIR Provider” is a web service that uses SOAP (for example) to translate XML requests into RDBMS queries on a local database. A “DiGIR client” can act as a web interface to multiple data providers that manage their respective “DiGIR Provider” server software. OBIS participants use an OBIS schema/data model based on the Darwin Core Version 2 community standard (www.iobis.org/technical.shtml).

Meteorological and Oceanographic Data Exchange Module (MODEM) – NDBC offers regional observing systems, such as GoMOOS, their MODEM toolkit. The toolkit includes a C program that packages data into a standard ASCII format (with WMO header, etc.) that can be easily ingested by the NDBC. The provider then sends the ASCII file via FTP to the NDBC server. NDBC performs real-time QA/QC and then disseminates the data to various clients via the Global Telecommunications System (GTS). Weaknesses: The data model employed by the MODEM toolkit is not easily extensible. This approach is well-suited to real-time data delivery, but of limited value for more careful scientific analyses. The transport mechanism (FTP) is not a web service in the technical sense. This is a partner by partner, (one off), individual arrangement, rather than a scalable solution for data access in the larger community.

Oracle RDBMS direct access – NEFSC is using a proprietary Oracle access protocol that allows remote connection of two Oracle databases. This access method is used by NEFSC for a copy of its database that sits outside a firewall. DFO will be providing access to this data using DiGIR. Weaknesses: The proprietary Oracle protocol prevents use by non-Oracle clients, so data access relies upon an intermediary such as DFO. This is also a partner by partner, (one off) individual arrangement, rather than a scalable solution for data access in the larger community.

Products and Milestones

The Technical Committee will recommend a set of information management standards to promote compatibility between data sets.

Partners, as their capabilities allow, will serve their registered data sets through one of the standard access protocols.

Implementation Costs/Requirements

The costs for this step will be shared by the partners and the Data Partnership. The costs will vary between partners and may involve investment in hardware and software and in programmer time to implement the data access methods and prepare data sets for access. In-kind contributions contributing to the success of this project also may be made by various partners (e.g., the BIO Digger provider service). Some partners have the necessary network infrastructure and the necessary technical expertise to accomplish this step. Other partners have neither. To the extent resource allow the Data Partnership will assist partners in accomplishing this step.

Project 4: Data Interoperability

The rationale for undertaking the first three steps of this work plan is to allow the partners' data sets to be shared for integrated displays and analyses - to benefit the individual partners and the Gulf of Maine community at large. The development of web-based tools to provide this interoperability requires sophisticated programming and is beyond the in-house capabilities of many of the partners. The design, development, and implementation of interoperability tools is, therefore, is an activity best undertaken at the Partnership level.

Products and Milestones

The Data Partnership will create a web-based portal to demonstrate the inter-disciplinary data sharing and integration of the data sets served by the partners. This portal will be based on that developed for the FGDC project: (www.gommap.org/gommap/index.html). Two additional requirements for this portal are the ability to download data to the client and within the GIS capabilities to perform some relational analyses of the data sets.

A pilot project will be conducted to demonstrate the integration of the four projects - Assurance, Discovery, Accessibility and Interoperability – using the DFO and NMFS trawl survey data sets.

The Data Partnership will develop a list of capabilities desired by the partners for data sharing and integration, to guide the development of future interoperability tools.

The technical committee will recommend procedures to insure compatibility of data sets made available for display or analysis within an interoperability tool. This may include recommendation of a core set of information management standards.

Implementation Costs/Requirements

The costs of this step will be borne by the Data Partnership. Voluntary assistance from technical staff of the partners may contribute to this effort, as well. Funds to support this activity have been included in a proposal currently under review and evaluation. GoMOOS will likely have funds to support some of the initial implementation costs in 2005.

6. Finances and Development

First-year start up costs for the partnership will be born by the individual members and through grants and other funding as available. There will be no formal dues structure, but rather a mutual understanding of costs to carry out the partnership and informal consideration by each partner to contribute toward the costs. Over the longer term, the Partnership may vote to implement a dues structure, thereby formalizing the partnership into a binding contract and creating an independent fiscal entity. However, this may create complications for governmental agencies that are restricted from binding themselves to another organization. Alternately, the partnership may move to incorporate their efforts into another suitable fiscal entity.

To facilitate the completion of the activities outlined in this workplan, the host organization, GoMOOS, will arrange for a staff person either by contract or by employment and for technical support services. Funding for this position will be sought through the joint efforts of partners to apply for grants that can support development of the Data Partnership as an indispensable step toward an Integrated Ocean Observing System and toward an understanding of the biogeography of the Gulf of Maine region for the purpose of ecosystem-based management. The minimum support requirement for 2005 through 2007 is estimated to be a 20-hour/week partnership coordinator, plus technical support to develop portal capabilities and to assist partners in readying their data bases for reporting. The estimated annual cost for this minimum support requirement is approximately \$100,000 per year. The host will assist committees and the general partnership with communication, meeting facilitation, and information dissemination.

Additional expenses anticipated to be incurred by the partnership include computer equipment, travel, and communication expenses as well as the support cost of hosting data or a data portal as necessary. As expenses are identified, the Partnership will pursue external sources of funding.

Appendix A: Glossary of Acronyms

ASCII	American Standard Code for Information Interchange
CF convention	Climate and Forecast (CF) Metadata Convention
CoML	Census of Marine Life
CSV	Comma separated value
DiGIR	Distributed Generic Information Retrieval
DFO	Department of Fisheries and Oceans
DMAC	Ocean.US Data Management and Communication
DODS	Distributed Oceanographic Data System
EPA	Environmental Protection Agency
ESRI	<i>Provider of GIS and mapping software</i>
FGDC	Federal Geographic Data Committee
FTP	File Transfer Protocol
GIS	Geographic Information System
GMBIS	Gulf of Maine Biogeographic Information System
GoMMaP	Gulf of Maine Mapping Portal
GoMOOS	Gulf of Maine Ocean Observing System
GTS	Global Telecommunications System
IOOS	Integrated Ocean Observing System
MODEM	Meteorological and Oceanographic Data Exchange Module
MOU	Memorandum of Understanding
NBDC	National Buoy Data Center
NEFSC	Northeast Fisheries Science Center
NetCDF	Network Common Data Form
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OBIS	Ocean Biogeographic Information System
OGC	Open Geospatial Consortium
OPeNDAP	<i>OPeNDAP is a framework that simplifies all aspects of scientific data networking.</i>
RDBMS	Relational Database Management System
RSS	<i>RSS is a format for syndicating news and the content of news-like sites, including major news sites like Wired, news-oriented community sites like Slashdot, and personal weblogs.</i>
W3C	World Wide Web Consortium
XML	Extensible Markup Language

Appendix B: Sample Data Discovery Survey for Member Organizations

Organization name General contact Contact phone/email	
Database name(s) or title(s) Publisher/Originator Publication date	
General Organizational Description Abstract/Purpose of data collection	
Time Period of Content: Calendar Date(s) or Beginning/ Ending Date	
Status: Maintenance/Update Frequency	
Spatial domain/Location description: West/East/North/South Bounding Coordinates	
Data access constraints, if any Institutional use constraints, if any Other constraints or limitations of data?	
Online location/address if available	
Metadata Standards in use for database(s)	
File size/ Number of records	
Sampling design/sampling strategy for data collection	
Method to serve	
Database type(s), or file format	

Appendix C: Websites referenced

www.exchangenetwork.net	National Environmental Information Exchange Network
www.gomoos.org/fgdc/bin/view/Main/ProjectOverview	Data integration example
www.gommap.org	Gulf of Maine Mapping Portal
www.opengeospatial.org	Web mapping conventions
www.openioos.org	Integrated Ocean Observing System
www.iobis.org	Global Ocean Biogeographic Information System
www.gommap.org/gommap/gommap_howto_publish.html	Data registration information on GeoConnections
www.gomoos.org	GoMOOS home page
www.marinemetadata.org	Marine Metadata Initiative
www.exchangenetwork.net	EPA effort in data sharing
www.iobis.org/technical.shtml	OBIS data model
www.gommap.org/gommap/index.html	FGDC project portal