



NATIONAL MARINE SANCTUARIES TM

US Geological Survey NOAA/National Marine Sanctuary Program's Seabed Mapping Initiative

2002-2003 Annual Report

A Joint Initiative of the US Geological Survey and NOAA/National Ocean Service's National
Marine Sanctuary Program, supported by the
Center for Coastal and Ocean Mapping at the University of New Hampshire



NOAA Ocean Service





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SANCTUARIES TM

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Executive Summary

Background and Need for Action

Sanctuaries need seabed maps to support management, research, monitoring and education. These must be comprehensive and accurate at ecologically relevant scales to effectively meet this need. In the past, seabed mapping in the sanctuaries has been done opportunistically, with individual sites collaborating with scientists from the US Geological Survey, generally with inadequate funds cobbled together from various sources. While excellent maps have been developed from these local collaborations, these products vary widely in how the data was collected, how much groundtruthing was done, how the data was interpreted, scale, resolution, and extent of coverage. USGS and NMSP agreed that these maps could be developed more effectively and efficiently.

Agreement and First Steps

In response, the USGS and NMSP signed a Memorandum of Agreement in 2002 outlining a path toward achieving this efficiency. As a first step, the agreement identified the need to convene a panel of seabed mapping experts to meet with sanctuary managers and scientists to arrive at a consensus on what sort of maps the sanctuaries needed that would best serve their needs. The agreement also directed USGS and NMSP to develop a joint funding proposal, to be submitted as part of a future budget process at both NOAA and USGS, to fund this joint initiative.

A preliminary needs assessment was conducted to identify existing maps and data available for the sites, and develop some clearer idea of sites needs with regard to priorities for data to be collected, what scale and resolution of maps would be most desirable, and how should the Sanctuary Program most efficiently organize this mapping effort across the NMS System. The result of the survey suggested that the Program has about 1/3 of the area designated as national marine sanctuary in waters of the US EEZ mapped to a level and extent that is useful to sanctuary managers and scientists. The survey also indicated that some regional or national coordination of seabed mapping within the NMSP was useful and appropriate, and that more training was needed for site staff so that they could use the maps most effectively in their management, research, monitoring and education activities at the sites.

Initiative “at-a-glance”

- Guided by 2002 MOU between US Geological Survey and National Marine Sanctuary Program.
- Goal to effectively and efficiently map the seabed of national marine sanctuaries in support of management, research, monitoring, education and enforcement.
- Expert workshop held in November 2002 to clarify sanctuary mapping needs and initiative goals.
- Workshop recommended 100% coverage using swath bathymetry (acoustic or optical) with resolution of 10 meters horizontal and 10's of centimeters vertical, with 1 meter resolution for special areas within sanctuaries.
- Enhanced needs assessment being conducted to establish program-wide priorities.
- Interim priorities identified for Office of Coast Survey for opportunistic mapping.
- Working with other NOAA elements to expand USGS seabed mapping partnership.

UNH Workshop: Findings and Recommendations

In order to address the first element of this agreement, a workshop was held at the University of New Hampshire in November of 2002, hosted by the Center for Coastal and Ocean Mapping/Joint Hydrography Center. This workshop brought together experts from the Center, USGS, NOAA and the academic community with NMSP managers and scientists to identify the critical elements of appropriate and useful seabed maps, and how to best acquire such data and maps.

A consensus was reached by the participants at the workshop that the Sanctuaries should be mapped completely, 100% coverage, using either acoustic or optical swath mapping technologies (multibeam, sidescan sonar, LIDAR), to a resolution of 10's of meters horizontal and 10's of centimeters vertical, which was generally consistent with the resolution of existing multibeam maps available at a few of the sites. The backscatter data, which provides some measure of bottom hardness (mud or rock, for example) must be interpreted and groundtruthed (according to a methodology to be developed...none currently exists) using regional habitat characterization schemes adopted by consensus within that region, but having elements which allow inter-comparability among the schemes selected). Areas within each sanctuary will be identified and prioritized for higher resolution mapping (around horizontal 1 m or "optical" resolution...that which can only be mapped using video data, or more advanced technology – such as laser line scan or some recent advancements in multibeam technology). National priorities will be identified for base and higher resolution mapping, established on the basis of whether sites already meet the 100% coverage goal, and sites and areas within those sites where significant management needs (zone monitoring, designated research areas, impact assessment, etc.) are driving the collection of this information.

Next Steps

It was agreed at the Workshop that a more detailed site assessment and prioritization process should be initiated as soon as possible. Starting with information collected through the existing site survey, a team of mapping experts, will be assembled from CCOM, Coast Survey, USGS, NCCOS and the academic community to meet with site personnel from each of the sanctuaries. This team, in collaboration with site personnel, will review existing map data and products, and develop a plan for what data must be collected and interpreted to meet the "100%" goal, as well as identifying and prioritizing needs for higher resolution area mapping. Once priorities are identified, costs for acquisition and interpretation will be estimated, and necessary collaborations and partnerships proposed to achieve greatest efficiency. Plans are underway to complete the enhanced assessment, if possible, with existing resources in FY03, completing the assessment in early FY04.

Current Status

Armed with clear priorities and mapping targets, the actual mapping would be undertaken starting in FY05 or FY06 if the NMSP and USGS are successful at securing the support and funding of their respective agencies. Since the Workshop, the NMSP prepared a funding proposal, that has been incorporated a larger NOAA-wide seabed mapping initiative involving NMFS, Coast Survey, Office for Exploration, and a number of other NOAA offices and programs. This proposal is being reviewed by NOAA Leadership. Planning for FY06 is slated to begin shortly, and NMSP intends to work with potential NOAA partners on another proposal for this budget cycle.

For further information on this Initiative, please contact Brad Barr at Brad.Barr@noaa.gov

Introduction

The simple fact is that when you don't have a map, you're more likely to get lost.

National marine sanctuaries are discrete areas of the marine environment determined to be of special national significance and are managed consistent with this designation. Sanctuaries are exclusively located below the surface of the ocean, which presents a particular challenge for sanctuary managers to "see" what it is they need to protect and manage. They can, for a short time, penetrate this realm by scuba diving or using advanced underwater technology like manned submersibles or remotely operated vehicles (which are most safely and effectively deployed when areas to be explored have been mapped), but effective management requires that some sort of map be produced to help identify the areas and resources being managed.

On land, there is a long tradition of mapmaking, and there are few places in the terrestrial world where relatively excellent maps are not available. However, mapping the ocean is another thing. Until quite recently, maps of the seabed were developed from casting a lead weight on a line over the side and measuring the length of the line. Take enough of these soundings, and you can get some idea of what the seabed might look like. The technologies to effectively map the seabed are just emerging, are expensive, and are changing rapidly. The expertise needed to collect and interpret this information is evolving so quickly that it is difficult for those responsible for managing sanctuaries to keep up. Fortunately, we have partners to help us with this daunting task.

Initiative Background

Since almost the beginning of the National Marine Sanctuary Program in the early 1970's, the Program has looked to the US Geological Survey for help in mapping national marine sanctuaries, and the USGS has been an extraordinarily good partner. Individual sanctuaries have developed partnerships with offices and elements of the USGS to tackle the challenge of producing high-quality, high-resolution seabed maps, utilizing the latest technologies, and applying their expertise in mapping and data interpretation. There have been such partnerships formed at many of the 13 national marine sanctuaries, and the maps developed out of those partnerships have been very useful management tools. However, these site-based initiatives have been opportunistic, with funding cobbled together from a variety of sources, with few sites having the good fortune to be able to have sufficient resources to map the entire sanctuary. With budgets tightening

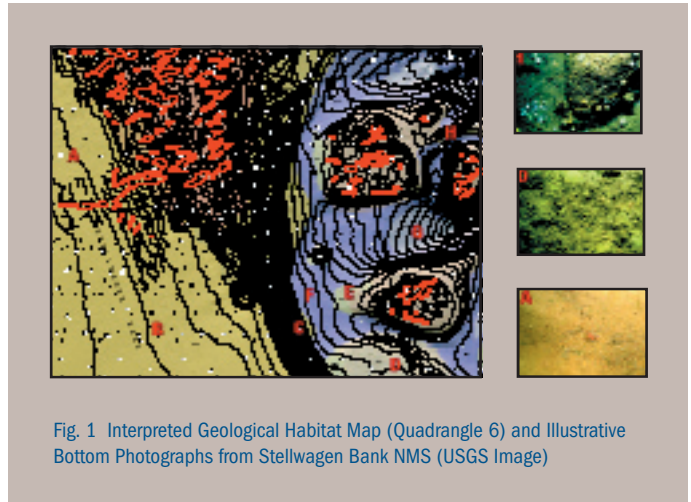


Fig. 1 Interpreted Geological Habitat Map (Quadrangle 6) and Illustrative Bottom Photographs from Stellwagen Bank NMS (USGS Image)

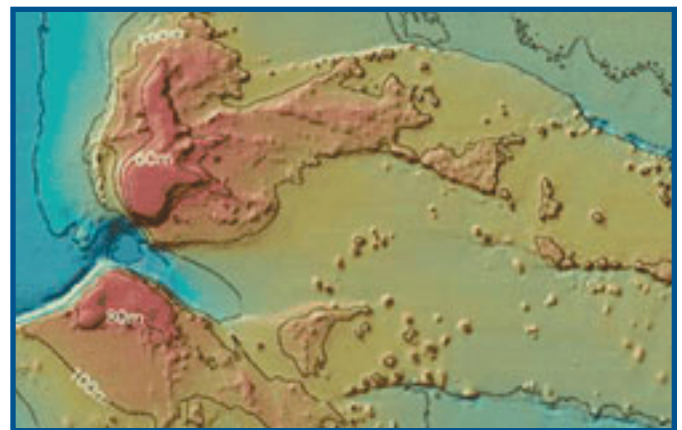


Fig. 2 Multibeam Map of Flower Garden Banks NMS (USGS Image)

and resources becoming even more limited, the USGS and NMSP recognized that a more programmatic, more planned and purposeful sanctuary mapping program needed to be developed and implemented.

In April 2002, USGS and NOAA Sanctuaries signed a Memorandum of Understanding to begin to move toward the development of a plan of action for mapping the seabed in national marine sanctuaries. The agreement directed USGS and NOAA Sanctuaries to review and inventory existing mapping efforts in Sanctuaries, develop guidelines and protocols for seabed (habitat) mapping in NMS (as model for MPA mapping generally), and craft and implement a joint funding initiative to develop maps for all NMS and Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve (CRER) consistent with guidelines/protocols developed jointly by experts from USGS and other Sanctuary partners in collaboration with sanctuary managers.

Preliminary Seabed Mapping Inventory and Survey

In order to address the requirement in the MOU that the existing mapping efforts in the sanctuaries be inventoried and reviewed, a survey was prepared. This survey focused on two issues, existing map data and products, and an attempt to better understand the needs, desires, and recommendations of sanctuary managers with regard to seabed maps and mapping.

The survey addressed needs for seabed mapping related to management of natural resources (a separate analysis for mapping needs related to submerged cultural resources is being developed). With regard to the availability of mapping products at the sites, the inventory provided information on site-specific maps and data, and information on the characteristics of that data in terms of resolution, coverage, technology used to collect the data, and some information on the extent and type of groundtruthing available.

In summary, about 45% of the area within the boundaries of the national marine sanctuaries has been mapped using multibeam or other swath mapping technology. A small percentage of this area, has been groundtruthed with either diver surveys, ROV or submersible video data, and/or physical samples.

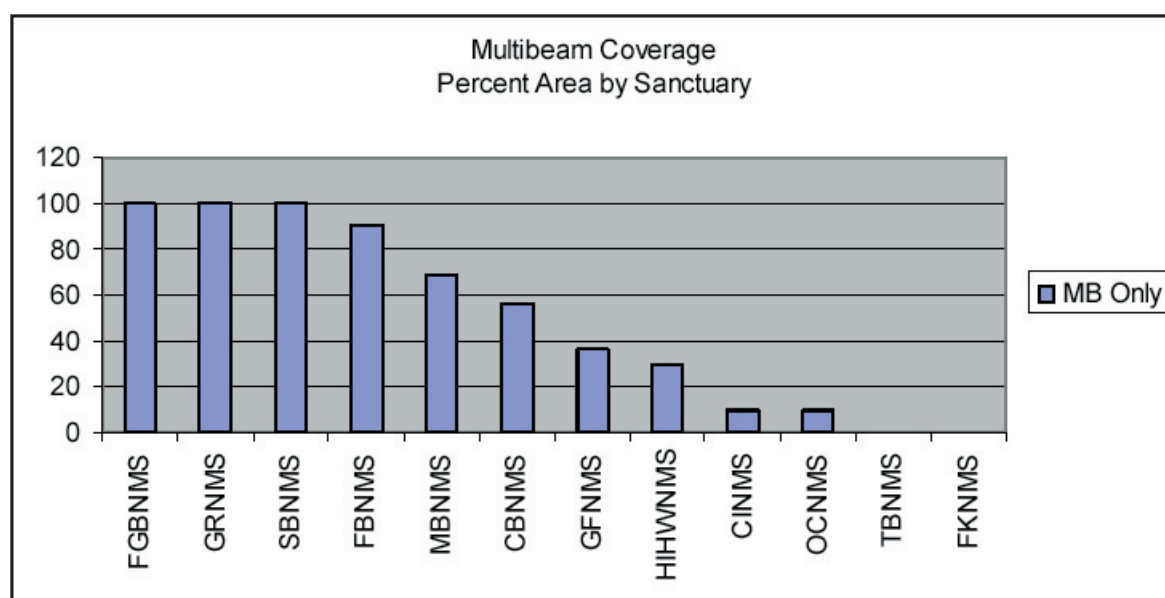


Fig. 3 Existing Multibeam Coverage in NMSS (Image - Christine Taylor, NMSS)

There was nearly unanimous agreement among the Sanctuary staff responding to the needs survey that the current mapping does not meet management, research, monitoring, or education needs at the majority of the sites. The most frequent concerns expressed about the maps was that they lacked appropriate resolution, could not identify features of interest, because those features were too small to be seen on the available maps. Other attributes mentioned as inadequate were lack of full area coverage, that available groundtruthing was not sufficient to characterize habitats with confidence, and map products were not readily available in appropriate or useful formats. Managers observed that for most areas in sanctuaries that had been mapped using swath technology (multibeam or side scan sonar), the existing horizontal resolution of 10's of meters (or better for side scan) was adequate, but in some special areas (designated protection zones, or places where research was being conducted, for example), being able to see features of one meter or less would be required in order to manage and monitor those areas effectively and efficiently.

Map attributes that were deemed important included a wide variety of things from sub-bottom data to mapping human activities. The list of desired attributes was extensive and varied broadly from sanctuary to sanctuary. Given the costs associated with the collection of this data is significant, some future prioritization will be required.

The needs assessment also addressed issues of staff support, training and technology. While there was less consensus on these issues, there seemed to be support for acquiring dedicated staff with expertise in mapping and map visualization either regionally or at Headquarters. Building basic skills in the use and application of maps to address management questions, for site staff, was recommended.

The last major topic to be addressed in the needs assessment was the issue of how to characterize sanctuary habitats. For those sanctuaries that have entered this arena, there have been a number of different paths taken, and some new directions being considered. If there was any consensus reached among those responding, it was that some inter-comparability among schemes used would be useful and appropriate, but requiring some national or even regional characterization methodology is unnecessary. So long as each site has habitats characterized in a way that fully supports management, research, monitoring and education needs, some post hoc methodology for inter-site comparisons could be developed so long as the map data and metadata was available in some accessible database.

The UNH Workshop

As the first step in developing a plan of action, a workshop was held 19-21 November, 2002 at the University of New Hampshire, hosted by the Center for Coastal and Ocean Mapping (CCOM). Participants represented both the headquarters and site personnel from the National Marine Sanctuary System, the Biogeography Team from NOAA's National Centers for Coastal and Ocean Science, the National Marine Fisheries Service, the NOAA Office of Coast Survey. Also participating was the North Atlantic and Great Lakes National Undersea Research Center, and experts in seabed mapping from USGS offices across the country. Massachusetts Office of Coastal Zone Management was also represented. The Canadian Department of Fisheries and Oceans and the Geological Survey of Canada were also invited to take advantage of their considerable seabed mapping experience and expertise. A good part of the staff from CCOM participated in various sessions at the Workshop, and made presentations that set the stage for later discussions. Their talks offered the participants a basic understanding of mapping technologies, capabilities, and limitations, some sense of the cutting-edge work related to seabed mapping going on at CCOM, and what the manager's needed to know in order to more effectively address and respond to the central question driving the workshop..."What does the NMS System want and need for seabed maps?" The second day of the workshop was devoted to discussion of issues related to this question "what do we want and need to support management, research, monitoring, education/outreach and biogeographic studies?" Presentations were made by NMS and partner agency scientists and managers offering perspectives

on the “what do we want” question from sanctuary managers, research coordinators, educators, and a special focus on mapping needs to support the NCCOS biogeography projects in NMS. Other issues addressed were developing some direction and strategy for groundtruthing and habitat characterization. The third day, perhaps the most challenging, revolved around integration and synthesis of the previous two days’ discussions, working toward the development of strategy for next steps.

Workshop Findings/ Recommendations

The consensus goal emerging from the workshop, based on technological considerations and informed by input from participants and feedback from the preliminary site survey results, was 100% coverage of all the NMS and CRER with optical (LIDAR) and/or acoustic (multibeam and sidescan) bathymetry and backscatter maps, at a horizontal resolution in the 10’s of meters (for most of our sites, given generally encountered depth ranges -- and resolution being a function of depth -- will be around 10 meters horizontal, 10’s of centimeters vertical).

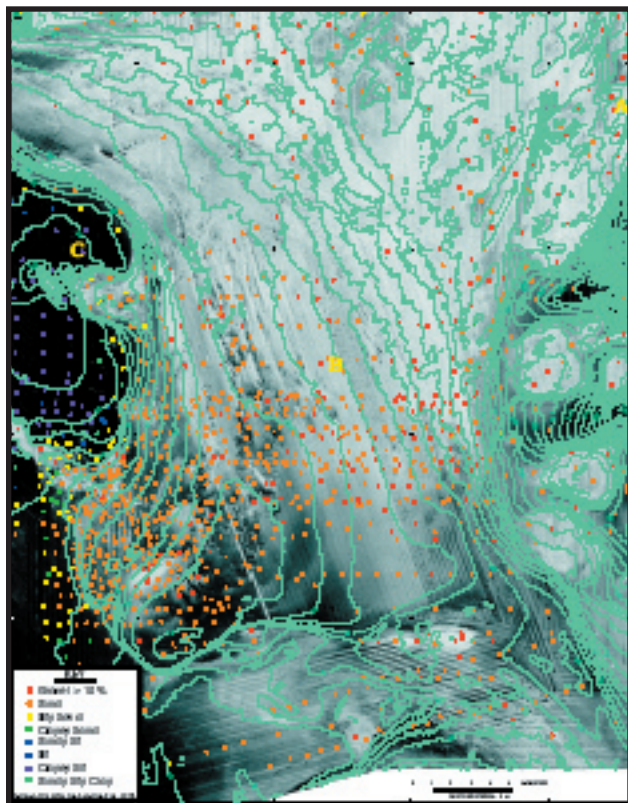


Fig 4. Backscatter and Groundtruthing Sample Locations at SBNMS (USGS)

Backscatter data will be collected, interpreted and groundtruthed. There are what might be called “customary methodologies” for groundtruthing that vary with mapping objectives and bottom characteristics, but are largely ad hoc and few approaches have been documented. A standardized groundtruthing methodology will be developed for this Initiative.

Benthic habitats will be characterized using regional habitat characterization schemes adopted by consensus within that region, but having elements which allow inter comparability among the schemes selected). Areas within each site will be identified and prioritized for higher resolution mapping (c. horizontal 1 m or “optical” resolution...that which can only be mapped using video data, or more advanced technology – such as laser line scan or some recent advancements in multibeam technology).

National priorities will be identified for base and higher resolution mapping, established on the basis of whether sites already meet the 100% coverage goal, and those where significant management needs (zone monitoring, designated research areas, impact assessment, etc.) are driving the collection of this information. This prioritization exercise will be undertaken as part of a more extensive needs assessment that will be conducted as the next step in our process.

A more extensive and site/region focused needs assessment will be undertaken, Starting with information collected through the existing site survey, a team of mapping experts, will be assembled from CCOM, Coast Survey, USGS, NCCOS and the academic community to meet with site personnel from each of the sanctuaries. This team, in collaboration with site personnel, will review existing map data and products, and develop a plan for what data must be collected and interpreted to meet the “100%” goal, as well as identifying and prioritizing needs for higher resolution area mapping. Once priorities are identified, costs for acquisition and interpretation will be estimated, and necessary collaborations and partnerships proposed to achieve greatest efficiency. We hope to do this Phase

2 Needs Assessment, if possible, with existing resources in FY03 and FY04, completing the assessment in early FY04.

Next Steps

Consistent with the USGS/NMS MOU goal of developing an interagency funding proposal for this initiative, we are proposing to cast the strategy in a collaborative management framework. The agencies to be involved and potential roles, include:

NMSP – field support, site selection, classification, ground truthing, products

NOAA Coast Survey – data collection, interpretation

NCCOS – classification, 5-yr biogeography plan

USGS – map data groundtruthing, interpretation, and classification

UNH CCOM/Joint Hydrographic Center – technical expertise, mapping, academic linkage, consultation

NMFS – adjacent areas (deep hard bottoms)

OE – funding, ground truthing, academic linkage

NURP – ground truthing, academic linkage

OMAO – vessel time, mapping, vessel mod/outfitting

The initiative would start with the enhanced needs assessment, as described above, and be followed by the actual collection and interpretation of seabed data, depending on when actual funds are realized. Given the lead time needed to fully develop the initiative, get concurrence from the partner agencies and NOAA and USGS leadership, and implement the strategy, we are potentially looking at a target date for beginning Phase 2 implementation in FY 05 or 06. The enhanced needs assessment, and ongoing work (such as the NWHI efforts, and work at other sites driven by operational needs and funds) would continue and be guided by the developing initiative.

Phase 1 - Reconnaissance and Assessment

Needs assessment, base maps based on topography and imagery (100% at appropriate scale - bathymetry and backscatter with feature recognition specs, other swath imaging) – hierarchical approach to scale and effort, initial interpretation and segmentation (acoustic), targeted ground truthing and second level geologic and biologic interpretation

Projected Products from Phase 1:

- Enhanced Needs Assessment for NMS System (detailed analysis and synthesis of what we have and what we need to meet “100%” goal)
- Priorization of Higher Resolution Mapping Targets
- Groundtruthing Protocols
- “Making the Case for NMS Seabed Mapping” – a document targeted at decision makers that provides justification for USGS/NMSP Mapping initiative, identifies how this information will be used to enhance management of NMS through examples from the Sanctuary System and beyond.
- Performance-based contracts (specs) at all stages of imaging and classification
- Recommendations for habitat characterization strategy and protocols

It is anticipated that Phase 1 would be completed in Late FY04 or early FY05.

Phase 2 – Product Development and Classification

(combining data streams), ground truthing, interpretive product development (including education and outreach), adjacent habitats.

Projected Products for Phase 2:

- 100% coverage maps for entire NMS System
- National strategy for acquiring Hi-Res Mapping Targets.

Phase 2 would begin in FY05 or FY06, depending on when funding is made available to begin implementation. At this time, a consolidated NOAA-wide FY05 initiative on seabed mapping has been drafted which includes recommended funding for this NMS initiative. An FY06 NOAA-wide proposal is also anticipated, and NMS will participate in its development. NMS is also working with USGS and other interested partners to encourage the development of coordinated funding proposals within the partner agency budget strategies for FY05 and 06.

Opportunistic Mapping by the Office of Coast Survey

Recently, the Office of Coast Survey made an offer to conduct limited mapping projects in national marine sanctuaries when NOAA hydrographic ships were transiting through or nearby sanctuaries. In response to this offer, the ONMS has identified priorities for this opportunistic mapping, and has transmitted this information to the OCS to assist them in their planning. Figures 5-8 identify these priority areas for opportunistic mapping.

ONMS has also entered into discussions with OCS regarding potentially available time on NOAA’s hydrographic ships and charter vessels to conduct needed mapping. Such shiptime would be requested through the normal shiptime allocation process. As a first step, ONMS has been allocated approximately 14 days of shiptime in FY 04 directed at mapping in the high priority areas of the Flower Garden Banks and Florida Keys National Marine Sanctuaries.

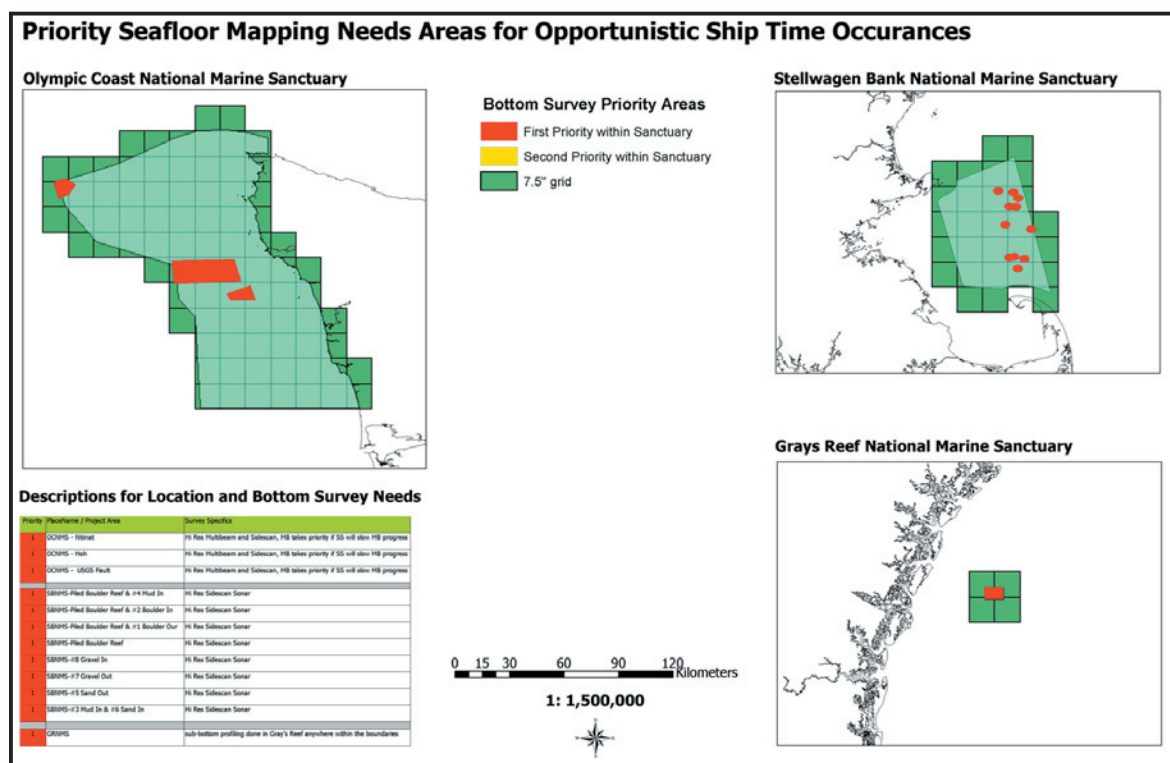


Fig. 5 – Opportunistic Priority areas for Olympic Coast, Stellwagen and Gray’s Reef NMS

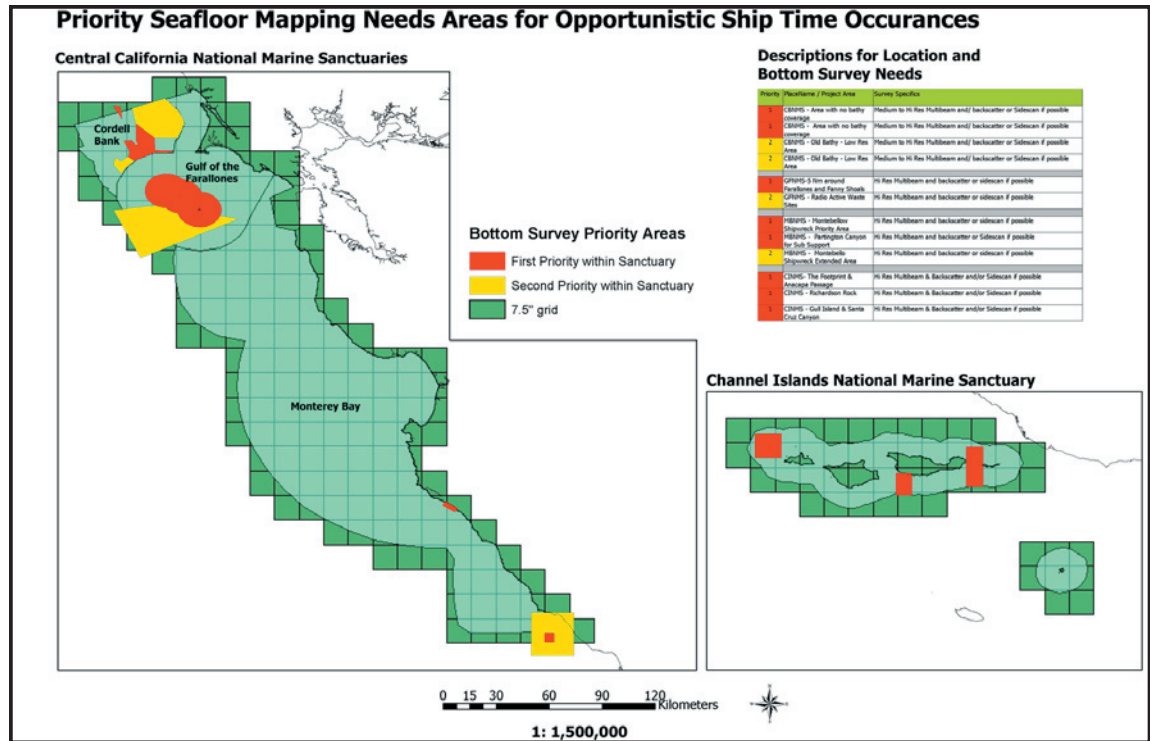


Fig. 6 – Opportunistic Priority Areas for Sanctuaries off California

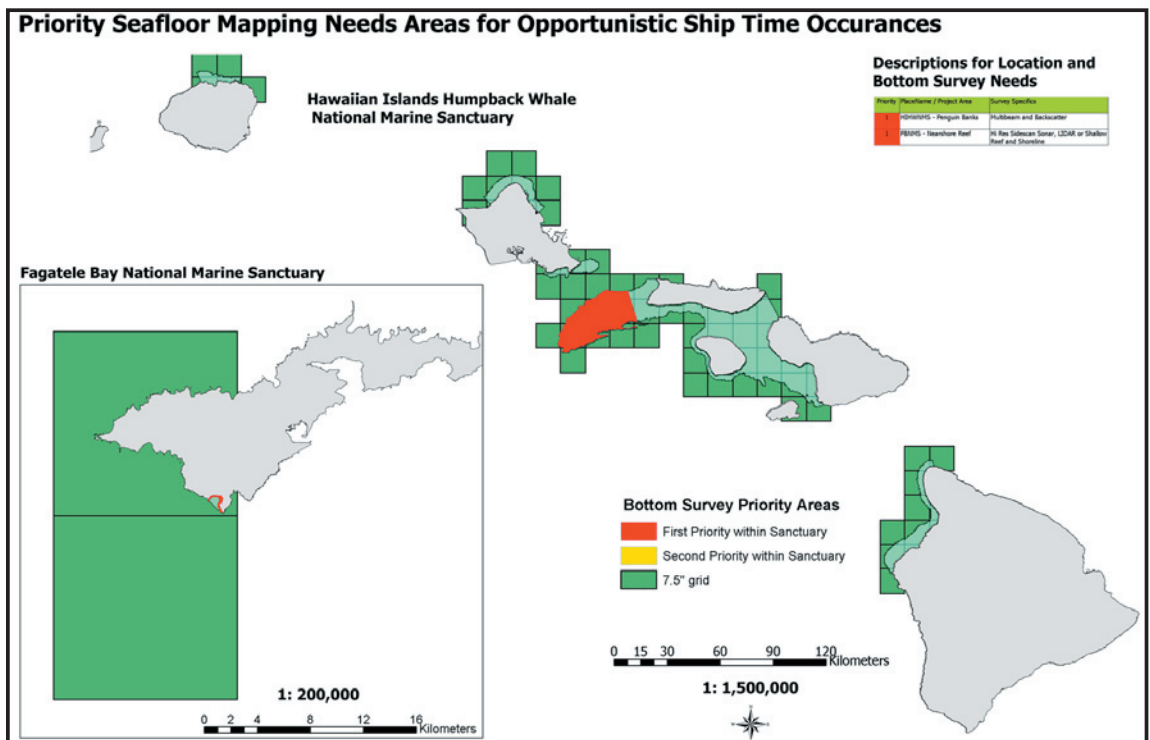


Fig. 7 – Opportunistic Mapping Priorities for Western Pacific Sanctuaries

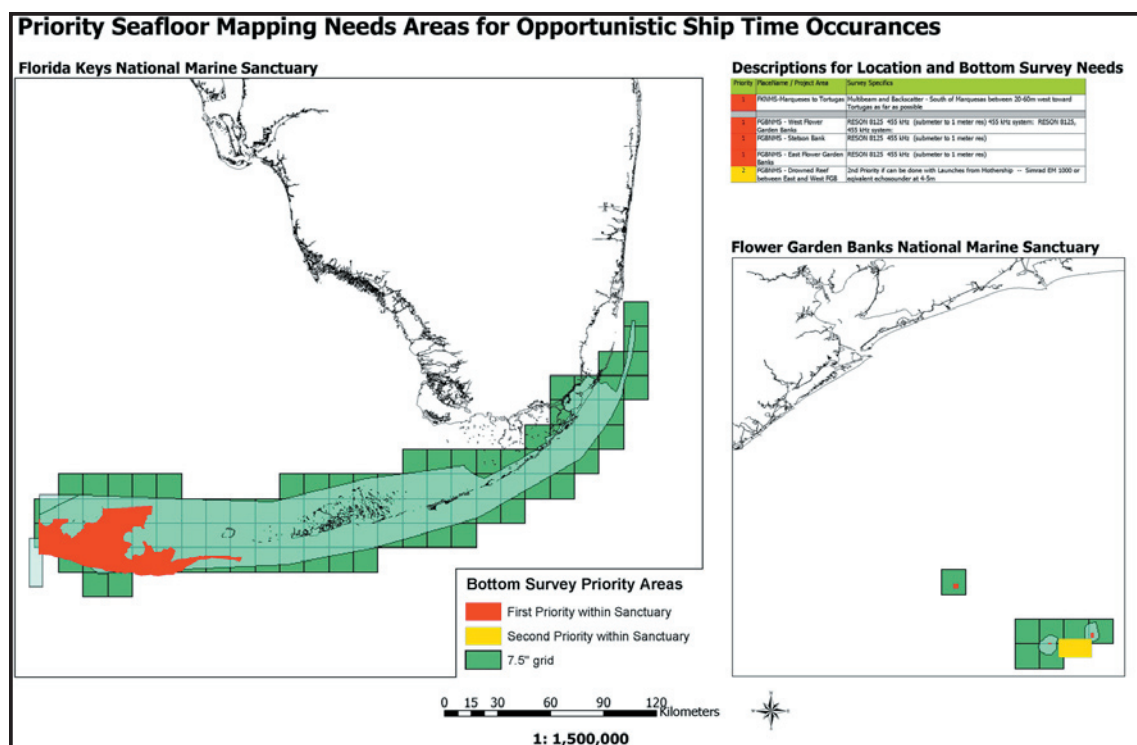


Fig. 8 – Opportunistic Mapping Priorities for Southeast US Sanctuaries

Expanding the Partnership

Building on the very successful collaboration between Sanctuaries and USGS, ONMS is participating in the development of a framework for broader collaboration to include other NOAA elements with a need for and interest in seabed mapping. Led by NOAA Fisheries, the work focuses on developing opportunities for collaboration with USGS to provide high quality seabed mapping data to support the NOAA resource management needs. A number of working groups have been formed to support this collaboration, and a workshop is planned for early in FY 04 to help refine the work plan and illuminate the full suite of opportunities for coordination.

It is likely that the joint funding proposal objective under the second part of the ONMS/USGS MOU, will be addressed in the context of this larger NOAA-wide initiative under development. Targeting FY 05, NOAA is seeking around \$2 million for its collaborative seabed mapping needs, and USGS has proposed up to \$5 million to support this partnership. Planning has also begun for a joint proposal for FY 06.

Concluding Observations

The Workshop participants reached full consensus that it is essential for the NMSP to work with USGS, NMFS, OCS, NCCOS and other key partners in developing the best seabed maps possible for the National Marine Sanctuaries. Designated because they are of “special national significance”, where else but National Marine Sanctuaries would be a higher priority for NOAA?

In addition to the intrinsic value of Sanctuaries and NOAA’s responsibility to provide effective stewardship for these areas and the resources they support, the need for such an initiative is more than justified.



- 2000 NMSA Reauthorization directs the NMSP to “fully characterize” sites. Such a characterization could not be done effectively without appropriate seabed mapping.
- Almost half of the area designated as national marine sanctuary has been mapped consistent with the “100% goal.” A good start, but still much to do to meet this goal.
- Robust conservation science is critical to insure effective management of sanctuary resources, and mapping is an essential element of conservation science and effective monitoring in the national marine sanctuaries.
- This initiative provides an excellent opportunity to enhance effective collaboration between NMFS and the NMSP. More generally, it engages and furthers NOAA focus on collaborative management as a tool to foster greater collaboration within NOAA and among partner agencies.
- This mapping effort will serve a large number of identified sanctuary program needs, including boundaries, reserves, SHIELDS (site-focused contingency planning), risk assessment, damage assessment, and restoration.
- The Pew Oceans Commission, US Ocean Policy Commission and the ongoing NAS Ocean and Coastal Mapping Panel will all likely give high priority to and emphasis on seabed mapping
- A legitimate goal of the program is to use sanctuaries as an effective way to begin mapping the entire U.S. EEZ, a goal NOS and NMFS have adopted.

Much work remains to attain the goals identified at the Workshop, and finding the necessary funding will be a considerable challenge. However, without a map, you are more likely to get lost, waste valuable time and resources, and take a lot longer to find your destination. The American public, who have given NOAA responsibility for effective stewardship of these areas of special national significance, deserve no less than the best maps possible. The benefits are undeniably much greater than the cost, and appropriate alternatives are unavailable. Getting lost is no longer an option.



**MEMORANDUM OF UNDERSTANDING
BETWEEN THE
U.S. GEOLOGICAL SURVEY
OF THE
DEPARTMENT OF THE INTERIOR
AND THE
NATIONAL MARINE SANCTUARY PROGRAM
NATIONAL OCEAN SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**

NOS Agreement Number: MOA-2002-039

I. Purpose and Scope

The purpose of this Memorandum of Agreement (MOA) between the National Marine Sanctuary Program (NMSP), National Ocean Service, National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) is to facilitate cooperation and coordination related to operational and science programs. Specifically this Agreement is in support of the scientific information needs of marine protected areas and will facilitate efforts by the NMSP and USGS scientists and managers to address the Nation's need for consistent and appropriate habitat maps of coastal and ocean environments. This Agreement will foster and coordinate the development of standards and protocols for habitat mapping, joint program planning and implementation, joint outreach efforts and products, and joint budget initiatives for NMSP and USGS programs having complementary goals, and/or purpose. Emphasis will be on developing coordinated approaches and priorities resulting in more efficient and effective programs and funding success of agency budget initiatives and other funding opportunities. This will be accomplished through the establishment of technical and management level working groups including NMSP and USGS technical, research and management personnel.

The scope of this Agreement includes cooperation and collaboration activities in the fields of physical and geographic sciences, environmental studies, resource management, and spatial data management. Activities will range from exchange of technical information and services, studies of mutual interest, and coordination of new and existing programs within NOAA, NMSP, and USGS organizational missions

II. Reference Authorities

This Agreement facilitates the implementation of Article IV of the umbrella MOU between USGS and NOAA dated July 26, 1999.

National Marine Sanctuary Program Authority: National Marine Sanctuary Act (NMSA), 16 U.S.C. 1442 (a), which allows the NMSP to enter into cooperative agreements, contracts, or other agreements with, or make grants to, states, local governments, regional agencies, interstate agencies, or other persons to carry out the purpose and policies of this title. And 16 U.S.C. 1442 (e), which allows the NMSP to enter into an agreement with a state or Federal agency to use the personnel, services, or facilities of such an agency on a reimbursable or non-reimbursable basis, to assist in carrying out the purposes and policies of the NMSA.

USGS Authority: U.S. Code, Title 43, Section 31, et seq. (USGS Organic Act of March 3, 1879, as amended):

This Agreement is also in furtherance of and consistent with Section 4 of Executive Order No. 13158, Marine Protected Areas (MPA), directing Federal agencies, particularly within NOAA and relevant agencies of the Department of the Interior, to “coordinate and share information, tools, and strategies, and provide guidance... to further enhance and expand protection of existing MPAs and to establish or recommend new MPAs, as appropriate.”

III. Responsibilities

Under the terms of the referenced MOU, it is hereby agreed that NMSP and USGS personnel will be assigned to develop coordinated science programs and joint budget initiatives addressing the design, development and production of coastal and ocean habitat maps related to NMSP and USGS organizational missions.

NMSP and USGS will:

Develop terms and conditions for the establishment of joint working groups to:

- develop guidelines and protocols for habitat mapping programs responsive to mission objectives. A technical working group, with some management representation, will be assembled to define standardized methods, approaches, and products reflecting resource management needs and available technical capabilities. This technical working group will complete this task within twelve months of the signing of this Annex.
- facilitate joint program planning and implementation and develop joint funding initiatives. A management working group, informed by the technical working group as to technical objectives and constraints, will develop priorities and plans for collaborative activities and funding opportunities. This management working group will produce a report within twelve months of the receipt, by the USGS Associate Director for Geology and the Director of the NMSP, of the report from the technical working group containing a strategy for implementing the recommendations of the technical working group regarding the development of habitat maps for the national marine sanctuaries and coral reef ecosystem reserve.

NMSP and USGS will jointly identify external participants deemed necessary to meet working group objectives.

NMSP will:

- Assign appropriate NMSP personnel to workgroups and provide required support (salary and benefits, personnel management, administrative support, travel orders, etc.) for NMSP participants.

USGS will:

- Assign appropriate USGS personnel to workgroups and provide required support (salary and benefits, personnel management, administrative support, travel orders, etc.) for USGS participants.

IV. Production and/or Delivery Schedules

An annual implementation plan describing the planned activities and anticipated accomplishments and results of each working group will be delivered to the Director of the NMSP and the USGS Associate Director for Geology on August 30 of each year.

An annual report summarizing the activities and accomplishments of the previous fiscal year will be delivered to the Director of the NMSP and the USGS Associate Director for Geology on December 1 of each year.

V. Modification/Cancellation Provision

This Agreement may be amended or canceled at any time through the written mutual consent of the involved

agencies. The parties will review this Agreement at least once every three years to determine whether it should be revised, reviewed, or canceled. It may be subject to reconsideration at such times as may be required and as agreed to by the parties entering into the agreement.

VI. Publication

The results of the NMSP and USGS collaboration may be published cooperatively or by either agency separately as long as there is acknowledgment of each agency's involvement. Manuscripts prepared for publication by either party shall be submitted to the other party for review, comments and suggestions (not to be interpreted as veto power) prior to publication. Either party to this Agreement shall be free to use any of the results obtained during the activities subject to this Agreement.

VII. Other Provisions

This Agreement defines in general terms the basis on which the parties will cooperate, and as such does not constitute a financial obligation to serve as the basis for expenditures. This Agreement does not involve the transfer of funds nor does it obligate the parties to extend appropriations or to enter into any agreements, contracts, or other obligations.

Expenditures of funds, human resources, equipment, supplies, facilities, training, public information, and expertise will be provided by amendments to this Agreement. All responsibilities under this Agreement are subject to availability of appropriated funds.

VIII. Resolution of Disagreements

Nothing herein is intended to conflict with current NOAA, NMSP or USGS directives. If the terms of this agreement are inconsistent with the directives of either of the agencies entering into this Annex, then those portions which are determined to be inconsistent shall be invalid; but the remaining terms and conditions not affected by inconsistency shall remain in full force and effect.

Should disagreements arise as to the interpretation of the provisions of this Annex, or amendments or revisions thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each party and presented to the other party for consideration. If agreement on interpretation is not reached within thirty days, the parties shall forward the written presentation of the disagreement to respective higher officials for appropriate resolution.

IX. Period of Agreement

The terms of this Agreement will become effective after being signed by the approving officials. The terms of this Annex will remain in effect through September 30, 2006, unless either terminated by (1) written mutual agreement, (2) 30 days advanced written notice by either party, or (3) the completion of the operation/terms of this Agreement.

X. Approval

This Agreement will become effective after being signed by both Parties.

Appendix 2: Workshop Agenda and List of Participants

USGS/NMSP Seabed Mapping Technical Working Group

"What do we want? -- What do we need?"

Center for Coastal and Ocean Mapping/Joint Hydrography Center
University of New Hampshire, Durham, NH
19-21 November, 2002

"You can't always get what you want, but if you try, you're gonna find, you're gonna get what you need."
Mick Jagger, Rolling Stones.

19 November, 2002

- 13:00** *Welcome:* Larry Mayer, Co-Director, CCOM/JHC
John Haines, USGS
Charge to Workshop Participants: Brad Barr, NMSS
~ Context for Workshop - MOU
~ Workshop Goals
~ Structure and Agenda
~ Desired Products
- 15:00** *Defining the Universe of Possibilities: A Primer on Available Technologies (USGS/CCOM)*
- What technologies are available, what are the limitations, groundtruthing techniques, Available map visualization tools, what are the relative costs of acquisition and visualization.
- 18:00** *Tour of CCOM/JHC, Demonstrations of Data Visualization Techniques under development at CCOM*

20 November, 2002

- 09:00** *What Do We Currently Have Available for Seabed Maps in the NMSS?* Christine Taylor, NMSP
- Inventory from NMS Site Survey and existing info from sites and HQ Mapping Team Experience...base maps and data layers.
- 10:00** *What Do NMSS Scientists Want and Need?* Steve Gittings, NMSP
- Needs extracted from NMSS Science and Monitoring Plans.
- 11:30** *What do Biogeographers Want and Need?* Mark Monaco/Tim Battista, NOAA/NCCOS
- Lessons learned from ongoing biogeographic analyses being conducted in the NMSS.
- 13:00** *What Sanctuary Educators and Outreach Specialists Want and Need?* Reed Bohne, GRNMS
- Needs extracted from NMS Education and Outreach Plan

and examples from GRNMS and other sites in NMSS.

14:00 What Sanctuary Managers/Superintendents Want and Need? Brad Barr, NMSP

Needs and desires extracted from NMS Seabed Mapping Site Survey

15:30 Special Needs for Habitat Characterization. Page Valentine, USGS (and others as needed)

How should we approach habitat characterization? What are the models in use in the NMSS and elsewhere, or are being developed?

16:30 Groundtruthing Data Brad Barr, NMSP

How has groundtruthing been done for existing data in NMSS? Are there protocols available for guiding this essential part of the work? Are they appropriate? If not, should they be developed?

21 November, 2002

09:00 *Group Discussion:* Integration and Synthesis Facilitator: Brad Barr, NMSP

From the previous day's presentations and discussion, can we clearly articulate, in sufficient detail, what it is the NMSS needs for seabed maps to support its multiple missions? If not, what additional information must we gather and analyze? What can we conclude about mapping support, visualization technology and needed training.

11:30 Next Steps and Wrap Up: Brad Barr , facilitator Seek consensus on products to be developed, and Identify groups and individuals to work toward their development.

Workshop Participants

NOAA

Brad Barr	NMSP
Pam Plakas	NMSP
Steve Gittings	NMSP
Christine Taylor	NMSP
James Lindholm	NMSP/SBNMS
Doug Weaver	NMSP/FGBNMS
Steve Intelmann	NMSP/OCNMS
Mark Monaco	NCCOS
Tim Battista,	NCCOS
Tom Noji	NMFS
Rick Brennan	Coast Survey
Guy Noll	Coast Survey
Gerd Glang	Coast Survey



US Geological Survey

John Haines	USGS/HQ
Page Valentine	USGS/WHFC
Kathy Scanlon	USGS/WHFC
Guy Cochrane	USGS/Menlo Park

National Undersea Research Centers

Kevin Joy	NURC/NAGL
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CCOM/JHC

Larry Mayer	CCOM/JHC
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Additional CCOM/JHC Staff

MA Coastal Zone Management

Megan Tyrell	CSC Fellow
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Department of Fisheries and Oceans Canada

Derek Fenton	Coastal and Ocean Management Office
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Geological Survey of Canada

Bob Courtney	GSC
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