

**ECOSYSTEM BASED MANAGEMENT (EBM) WORKING GROUP  
Williams Coast Guard Building**

**Boston, MA  
9:30am to 5:00pm  
19 June 2004**

**MEETING SUMMARY**

***ACTION: Changes to the 12 April 2004 Stellwagen Bank National Marine Sanctuary (SBNMS) EBM WG Meeting Summary***

The Working Group (WG) accepted the summary of the meeting held on 12 April 2004, with the following revisions:

- Page 6, **Action Plan Scenario 3A – Sustainable Extraction: Sustainable Use and Protection Option**, first Comment to *Question 1*, wording was changed from “WG members noted...” to “Some WG members noted...”

***ACTION: Changes to the 3 June 2004 SBNMS EBM WG Meeting Summary***

The WG requested that the following revisions be made to the summary of the EBM WG meeting held on 3 June 2004:

- Page 13, **Fishing Usage Chart of SBNMS**, question and answer to *Question 4*, was change from:

*"Question 4:* If the sanctuary wants and identifies areas that should be no fishing areas, is there a possibility of a trade for areas that are currently closed?

Answer: Yes that is a possibility."

to:

*"Question 4:* Is there a possibility for realignment for areas that are currently closed?

Answer: Yes that is a possibility through a process that goes through the sanctuary and the NEFMC."

***ACTION: Renaming of Three Scenarios***

The WG decided that the names for each scenario was potentially misleading and should be renamed. Each Scenario was renamed as follows:

- Wilderness Scenario is renamed to Plan A.
- Middle Path Scenario is renamed to Plan B.
- Sustainable Use is renamed to Plan C.

***ACTION: Fill In Plan B Missing Text***

Ben Cowie-Haskell will fill in details and text for strategies and activities in the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B of this document.

***ACTION: Next Meeting***

The next EBM WG meeting will be held on 10 August 2004, at the Williams Coast Guard Building in Boston, MA.

***AGREEMENT: Renaming of Three Scenarios***

The WG decided that the names for each scenario was potentially misleading and should be renamed. Each Scenario was renamed as follows:

- Wilderness Scenario is renamed to Plan A.
- Middle Path Scenario is renamed to Plan B.
- Sustainable Use is renamed to Plan C.

***AGREEMENT: Strategy EBM.1- Establish a research steering committee***

The WG, after amending associate activities, approved Strategy EBM.1 of the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B of this document.

***AGREEMENT: Strategy EBM.2- Establish a collaborative research consortium***

The WG, after amending associate activities, approved Strategy EBM.2 of the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B of this document.

***AGREEMENT: Strategy EBM.3- Establish a data management program***

The WG, after amending associate activities, approved Strategy EBM.3 of the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B of this document.

***AGREEMENT: Strategy EBM.4- Understand Ecosystem Structure and function***

The WG, after amending associate activities, approved Strategy EBM.4 of the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B of this document.

**Working Group Attendees (June 3, 2004):**

<b>Name</b>	<b>WG Seat / Affiliation</b>	<b>Attendance</b>
John Williamson	SAC Chair	Present
Ben Cowie-Haskell	Team Lead (SBNMS)	Present
David Wiley	Co-Lead (SBNMS)	Not-Present
Peter Auster	UConn, NURC	Present
Les Kaufman	Boston University	Not-Present
Ed Barrett	MA Fisherman's Partnership	Present
Priscilla Brooks	CLF	Present
Susan Farady	The Ocean Conservancy	Present
Jerry Hill	Yankee Fleet	Not-Present
David Pierce	MA DMF	Present
Tony Wilbur	MA CZM	Not-Present
Dave Casoni	Commercial Fishing Industry	Present
Tom DePersia	Big Fish II Sportfishing Charters	Present
Larry Madin	WHOI	Present
Jon Brodziak	NOAA Fisheries	Not-Present
Deirdre Kimball	NOAA Fisheries	Present
Paul Howard	NEFMC	Not-Present
Chris Kellogg	Alternate for Paul Howard	Present
Jason Burtner	Alternate for Tony Wilbur	Present
<b><i>Others Present</i></b>		
David Bergeron	MA Fishermen's Partnership	Present
Richard Taylor	Coastal Ocean Observation & Analysis UNH	Present
Timothy Feehan	PSGS	Present

**WELCOME AND ADOPTION OF AGENDA**

John Williamson, WG Chair welcomed the WG and opened the meeting. The agenda for the meeting was presented and approved by the WG. The Chair also asked for final corrections to the summary for the 12 April 2004, meeting of the EBM WG. The WG accepted the summary, pending the corrections offered by WG members. The summary for the 3 June 2004 was also reviewed, and the Chair asked for corrections. Final approval of the 3 June 2004 meeting summary was postponed until the next meeting.

**OLD BUSINESS AND ACTION ITEMS**

**Review of WG Role and Responsibility**

The WG Chair presented the following as a summarized review of the role and responsibility of the WG:

- Any member of a WG may request a break or caucus to consult with other colleagues or constituents attending the meeting. The leadership of the group may also request or suggest a caucus.
- The focus of the WG will be working toward producing draft strategies and activities that eventually will comprise Issue-based Action Plans that address the respective issue or problem.

- The goal of the WG is to reach agreement on recommendations that will be forwarded to the Sanctuary Advisory Council (SAC). Thus, each WG member will be expected to:
  - make the best effort possible to reach agreement
  - share the responsibility of ensuring the success of the process and the quality of the outcome
  - keep the WG informed regarding constraints on your decision-making authority on behalf of your agency or constituency
  - keep your agency or constituency informed about the perspectives, concerns and interests of the WG
  - actively participate in discussions
  - avoid characterizing the motives of others
  - refrain from distracting others through side conversations
- Each member has an obligation to articulate interests and build agreements by negotiating a recommendation for adoption by the SAC. In exchange, each member has the right to expect:
  - a full articulation of agreement and areas of disagreement, if any
  - an opportunity to revisit issues on grounds of substantial new information that becomes available during the WG's deliberations
- In the event that one or more members disagree on a specific aspect of an issue, the recommendation will be forwarded to the SAC indicating points of agreement and points of disagreement. In the case of an incomplete recommendation from a WG (anything less than full agreement), the sanctuary will develop that portion of the recommended Action Plan. It is understood that members should voice their concerns with specific elements of the developing Action Plan along the way, rather than waiting until a final recommendation has been developed.
- When unable to support a unanimous agreement, a member has an obligation to demonstrate that the item at issue is a matter of such principle or importance that his or her constituent's interest would be substantially and adversely affected by the proposed decision. In addition, it is the responsibility of the dissenting party to: 1) state the reason(s) underlying their withholding of agreement in sufficient detail, and 2) offer an alternative suggestion that satisfactorily addresses not only their concerns and interests, but also those of other members of the WG as well.
- The recommendations to be forwarded by the WG are not intended to be determined by a majority vote. A clear, definitive record of the WG discussion will be essential when the SAC reviews WG recommendations. Communication of what the pro's and con's of a recommendation will be invaluable as the sanctuary develops the draft Management Plan.

It was decided that in addition to the points listed above, any issue that was identified as not meeting the WG's obligation to the public should be brought to the attention of the WG by any member. In addition, for the sake of the meeting process, all table discussion during the meeting would be reserved for WG members only.

### **Scenario Renaming**

During discussion concerning the three scenarios presented at the 3 June 2004 meeting, it was decided by the WG that the names were misleading and should be renamed. From this point forward, the EBM WG scenarios will be referred to as follows:

- Wilderness Scenario is renamed to Plan A.
- Middle Path Scenario is renamed to Plan B.
- Sustainable Use is renamed to Plan C.

## **Action Plan Assignment**

Ben Cowie-Haskell, based on EBM WG member comments indicating a majority favoring Plan B, produced a revised version of Plan B. This revised scenario incorporates comments made by WG members that were delivered after the EBM WG meeting on 3 June 2004. All comments were made to indicate which plan was favorable, as well as to identify those parts of each plan that could be incorporated into the revised Plan B. Plan B, as revised by Mr. Cowie-Haskell is presented in the Presentations section of this document.

## **PRESENTATIONS**

WG members raised concern over why Plan B was being presented and whether Plans A and C were still options. Ben Cowie-Haskell and John Williamson explained that the informal straw poll taken at the previous meeting indicated that consensus could be possible on a modified version of Plan B. WG member comments sent to Ben at the conclusion of the previous meeting further strengthened this idea. Common elements for both Plan A and Plan C were also included in the modified version of Plan B. Other WG members indicated that since Plan B had the possibility of consensus, the group had agreed at the last meeting to modify Plan B and review it during this meeting. It was determined that Plan B would be reviewed and altered to see if a consensus agreement could be reached and if not, identify those areas of disagreement. Plans A and C were still options and would be reviewed during the next EBM WG meeting.

### **Plan B**

Ben Cowie-Haskell reviewed the "Plan B Action Plan". This plan was developed after WG member comments indicated that such a plan could be acceptable. Following the direction of member comments, items from both Plan A and Plan C were included. Plan B is based on balancing protection and extraction by managing the sanctuary with the following objectives:

- Comply with the purposes and policies of the National Marine Sanctuaries Act
- Understand ecosystem structure and function
- Recognize the interconnectedness with larger ecosystem
- Recognize our uncertainty of how systems function
- Manage adaptively
- Maintain public accessibility to SBNMS
- Achieve environmental sustainability of sanctuary resources
- Maintain and enhance biological diversity and ecological integrity
- Reduce habitat impacts by users
- Establish a process for creating a zoning scheme

Plan B, as originally presented to the WG is shown in Appendix A of this document.

### *Questions & Answers*

**Question 1:** How does the membership of the proposed research consortium differ from the research steering committee?

**Answer:** The membership of the Research Steering Committee would be assembled by the SAC while the membership of the Cooperative Research Consortium would be research driven. The Consortium would have a core membership, based on an ability to make a contribution to furthering understanding, with a network of regional expertise that could conduct their work over the Internet or through email, with occasional meetings.

**Question 2:** With the proposed Data Management Program, will there be an exclusive or proprietary use policy in place that would include a set timeframe to keep data proprietary before releasing it to the public?

**Answer:** Such a policy would be a good idea. It can be added as an Activity.

**Comment:** A WG member added that an exclusive use policy is currently being used in the U.S. Global Ocean Ecosystems Dynamics (GLOBEC) program and the Joint Global Ocean Flux Study (JGOFS).

**Question 3:** Is it possible that parts from Strategies 4 and 5 could be combined?

**Answer:** Yes, the items dealing with ecological integrity could be infused with Strategy 4.

**Comment:** WG members stated that reorganizing Strategies 4 and 5 would be favorable. Activities such as defining "ecological integrity" would need to be completed before other activities could be started.

## **ACTION PLAN DEVELOPMENT**

Before opening discussion on the "Plan B Action Plan", it was reorganized according to the WG suggestions that Strategies 4 and 5 had activities that could be grouped together. After it was reordered, the Chair then opened discussion on the "Revised and Reordered Plan B Action Plan" which can be found in Appendix B at the end of this document. All additions suggested by the WG are marked in **BLUE** and deletions are marked in **RED** font. Issues raised during this discussion are noted below. The WG began the review from the Goal Statement and was able to discuss Strategies 1, 2, 3, and 4 in completion; however, Strategy 5 was covered only to Activity 5e. The remaining activities in Strategy 5, as well as the remaining strategies, will be reviewed at the next meeting of the EBM WG. The introductory material was not reviewed at this meeting.

### **Issue 1: Strategy EBM.1- Establish a research steering committee**

With research as an important goal for the sanctuary, the WG agreed that a research steering committee, established by the SAC, would be beneficial. The WG accepted Strategy EBM.1 as written in Appendix B. The potential partners section of this Strategy will be completed by Ben Cowie-Haskell.

### **Issue 2: Strategy EBM.2- Establish a collaborative research consortium**

Understanding how the sanctuary works would be an ongoing endeavor that would require a research consortium to be established, bringing regional expertise together to focus on specific research programs. Such a consortium would be more informal than a research steering committee, meeting infrequently, and enabling members to correspond through the Internet and email. After some clarification, the WG accepted Strategy EBM.2 as written in Appendix B.

**Discussion:** Some WG members were uncertain how a research consortium would differ from a research steering committee. The questions from the group focused on how membership would differ. The membership of the research steering committee would be determined by the SAC to advise on overall monitoring and research programs. The research consortium, however, would consist of a smaller, core membership to foster networking among the various regional expertise and would focus on specific research projects. Knowledge would be shared between the SAC, sanctuary staff and other interested parties.

### **Issue 3: Strategy EBM.3- Establish a data management program**

The large amounts of data that could potentially be generated through many research projects should be supported by a system that would integrate, process, synthesize and analyze the data. This would require multiple activities to insure proper development and function. The first activity is to "design an information management system." This should be developed by year 1 with the partnership of researchers, managers, academia and the public. The specifics of this activity are yet to be developed by SBNMS staff. The second activity is to "process existing data." The specifics of this activity are yet to be developed by SBNMS staff. Third is to "upgrade SBNMS system for internal individual querying." Again, specific details need to be developed. The fourth activity is to "design and implement a web portal for public access to databases," the details of which are to be completed by SBNMS staff.

WG members also suggested the addition of more activities to this strategy. With the amount and importance of data to be generated, some quality assurance/quality control (QA/QC) program should be implemented. This was added as an Activity. In order to encourage participation in the data management program by individual researchers, some method should be in place to ensure the exclusive use of collected data by those scientists that conducted the research. A set time period should be established for the exclusive use of proprietary data. Provisions for establishing a proprietary use policy was added as an Activity. Managing a program of this size would require full time help. The need for a full-time employee to manage this program was added as an Activity. Further details for these added activities will be completed by SBNMS staff.

Although the specifics for these activities need to be developed by Ben Cowie-Haskell, the WG agreed with the reasoning behind Strategy EBM.3 and accepted it as presented in Appendix B of this document.

**Discussion:** WG members determined that QA/QC was a priority to ensure the accuracy of data integrated into the proposed data management program. Along with QA/QC proprietary information must be accounted for and some system put in place to ensure that the exclusive use of this data would be protected for a set time period. Members of the WG pointed out that such a proprietary use policy has been established for the GLOBEC and JGOFS data programs. WG members were also concerned that managing this process would require a full-time employee at the SBNMS offices to manage the program.

### **Issue 4: Strategy EBM.4- Understand Ecosystem Structure and function**

The WG felt that Strategy EBM.4 was more understandable in its reordered format. Activities to help understand ecosystem structure and function could now be developed that could lay the groundwork for the next Strategy. To understand ecosystem structure and function, and to protect the ecological integrity of the sanctuary, a working definition of "ecological integrity" must first be established and must be flexible in order to develop over time. Such a definition should also include metrics by which ecological integrity could be measured. The WG agreed with this idea, developed wording to this effect, and approved Activity 4a. In addition to ecological integrity, developing appropriate measures of diversity, as well as processes that mediate patterns of diversity was considered by the WG as an important activity and agreed with Activity 4b. The WG considered that the descriptive sentence for Activity 4b redundant to the other strategies mentioned above. This sentence was struck. After amendments were made, the WG approved Activity 4b.

To continue to understand ecosystem structure and function, both a long-term monitoring project and a directed research project should be established. The long-term monitoring project's establishment would develop a comprehensive understanding of changes in ecosystem status, and monitoring of socioeconomic dynamics related to management actions. Wording was developed to reflect this idea and to change the status and partners for the program. After changes were made the WG approved Activity

4c. Activity 4d established the directed research project which would complement the monitoring program by investigating patterns identified through monitoring. After amendments were made, Activity 4d was approved by the WG. Additional research done in collaboration with the commercial and recreational fishing industries was also identified as a need. This was addressed by Activity 4e. The WG felt it was important to provide an example of work currently being done to provide a framework for this project. The WG made amendments, altered the status and potential partners and approved Activity 4e.

The WG agreed that an ecosystem model should be developed that would link patterns of diversity with ecological processes. Such a model should be dynamic, with a static model being developed in the initial phases of this Activity. Wording was developed by the WG to reflect this idea, and changes were made to the status and potential partners before being approved as Activity 4f.

Activity 4g, stating that benthic habitats should be classified and mapped was approved by the WG after inserting the examples of video, sediment sampling and other means as methods of groundtruthing. The WG also agreed that the movements of organisms over landscape features should be understood. Such movements should be described that occur within the sanctuary, as well as those movements that occur between the sanctuary and the surrounding environment. Wording was developed for Activity 4h that reflected this idea. The WG also amended the status of this activity to indicate that such work was ongoing. After amendments were made, the WG approved Activity 4h. For further understanding the life history of organisms, Activity 4j states that predictive larval recruitment, dispersal and connectivity models should be developed. Activity 4j was approved by the WG after adding a statement indicating that data could be used from various sources and removing the sentence mentioning the use of such data to determine the size and location of managed areas. Activity 4k expands on the use of predictive models by stating that an internal oceanographic circulation model should be developed. The WG agreed that such a model would help predict egg and larval transport, and the fate and effect of nutrients and pollutants. Wording was added and Activity 4k was approved by the WG.

For Activity 4l, the WG agreed that pollutant loadings should be quantified. Wording was added to include quantifying pollutant loading on flora and fauna, and to include loadings from global sources. After amendments were made, the WG approved Activity 4l. The WG also agreed that an integrated ocean observing system should be established. This was stated as Activity 4m and was approved by the WG after a specific list of parameters was changed to "...identified to aid in ecosystem based management."

During discussion occurring over Strategy EBM.5, Activity 4n "Assess Bycatch" was added to Strategy EBM.4. Specific details concerning Activity 4n would be completed by SBNMS staff, and the Activity was approved by the WG.

With all Activities approved, the WG approved Strategy EBM.4 as written in Appendix B of this document.

***Discussion:*** While discussing Strategy EBM.4, WG members raised concern that Activities calling for the establishment of monitoring or research programs should not state details on what should be monitored or researched. Such details would be considered by the proposed research steering committee and cooperative research consortium. There was also some discussion concerning whether a static or dynamic model to link patterns of diversity with ecological processes should be developed. It was decided that in order for a dynamic model to be developed, a static model had to be made anyway.

Another research concern raised by WG members was to include habitats surrounding the sanctuary when studying the movements of organisms. WG members agreed that to fully understand the ecosystem as a whole, the sanctuary should be viewed as part of the overall Gulf of Maine ecosystem when describing the movements of organisms. It was also agreed that seafloor effects from natural disturbances be identified and understood.

**Issue 5: Strategy EBM.5- Protect Ecological Integrity**

Strategy EBM.5 contained activities to establish methods for protecting ecological integrity based on information gathered through Strategy EBM.4, as well as information that is currently known. Activity 5a states that a working group should be established that would evaluate the possibility of zoning within the sanctuary. The WG agreed with the intent of the activity, but was unsure of providing specific detail as to what such a zoning scheme would be used for and if to incorporate the current "sliver" of the Western Gulf of Maine (WGOM) closed area that overlaps the sanctuary boundary. It was determined that the proposed working group, whose membership would be selected by the SAC, would make such determinations. The WG agreed with the intent of Activity 5a and approved that such an activity should be included; however, a rewording of the Activity would be required by sanctuary staff. Activity 5b proposed the establishment of a monitoring plan to determine the efficacy of any zoning scheme developed through Activity 5a. The WG determined that this Activity could be integrated into both Activity 4c and Activity 5a.

The WG identified sand eels as an important forage species within the sanctuary and agreed that future exploitation of this species should not be encouraged within the SBNMS. There is currently no effort underway to harvest sand eels in the SBNMS, therefore the WG agreed with the recommended permanent ban on the exploitation of sand eels, as provided by Activity 5c. WG members also recommended that each New England state should be requested to implement the same ban on possession and landings of sand eels. After some revision, Activity 5c was approved.

Activity 5d proposed maintaining optimum fishery yields at target fishing mortality rates. WG members determined that this activity recommended fishing restrictions and management which should be under the control of the National Marine Fisheries Service (NMFS) and the New England Fishery Management Council (NEFMC). Because of this, the WG agreed to strike Activity 5d.

As presented, Activity 5e recommended to reduce bycatch. The WG determined that bycatch would first have to be assessed. Because of this, the WG developed Activity 4n to Strategy EBM.4. Activity 5e was reworded and approved by the WG.

Due to time constraints, not all activities for Strategy EBM.5 were reviewed. Descriptive text for Strategy EBM.5 would be provided by Ben Cowie-Haskell. Final WG approval of Strategy EBM.5, and the rest of Plan B was delayed until the next meeting of the EBM WG. The Strategies and Activities that were reviewed by the WG can be found in Appendix B of this document.

**Discussion:** There was much discussion concerning Strategy EBM.5 and how ecological integrity should be protected. Some WG members, considering that the sanctuary was already zoned by fishing restrictions in the WGOM "sliver" that overlaps sanctuary boundaries, supported the development of a zoning scheme for the SBNMS. Other members did not support the development of a zoning scheme by the EBM WG. However, the WG agreed that a separate working group could be developed to evaluate the possibility of a zoning scheme within the sanctuary. WG members also agreed that the proposed working group should have the latitude to determine what, if any, zoning scheme should be used and what objectives such a scheme should meet.

Concern was also raised about banning the exploitation of sand eels. Though not opposed to such a ban, WG members were concerned that this activity could set a precedent that could be applied to other species found within the SBNMS. The regulation of bycatch also raised concern from WG members. Bycatch, considering ecological integrity, could be seen as another source of mortality that needed to be reduced; however, other WG members felt that bycatch was an issue for fisheries management already regulated by the NEFMC.

## **NEW BUSINESS**

### **Next Meeting**

The next EBM WG meeting will be held on 10 August 2004, at the Williams Coast Guard Building in Boston, MA.

## **FINAL COMMENTS**

Meeting adjourned at 5:00 pm.

*Gerry E. Studds* Stellwagen Bank National Marine Sanctuary  
 Management Plan Review  
**Ecosystem-based Management Working Group – Draft Agenda**

**Date:** 19 July 2004  
**Location:** Williams Coast Guard Building  
 2<sup>nd</sup> Floor Conference Room  
 408 Atlantic Ave.  
 Boston, MA  
 781-424-0699

TIME	TOPICS AND OBJECTIVES
9:00-9:45	<ul style="list-style-type: none"> <li>• <b>Welcome</b> (coffee and pastries provided)</li> <li>• <b>Progress update</b> <ul style="list-style-type: none"> <li>• Review and approval of meeting summary</li> </ul> </li> </ul> <b>Discussion Leader:</b> John Williamson
9:45-10:30	<ul style="list-style-type: none"> <li>• <b>Presentation: Revised Draft Middle Path Action Plan</b> Ben Cowie-Haskell</li> </ul> <b>Objective:</b> Understand goal and details of action plan
10:30-12:00	<b>Roundtable discussion: Developing a consensus Action Plan</b> <b>Discussion Leader:</b> John Williamson <b>Objective:</b> Agree on an action plan
12:00-12:30	<b>Lunch</b> (provided)
12:30-4:30	<b>Roundtable discussion continued</b> <b>Discussion Leader:</b> John Williamson <b>Objective:</b> Agree on an action plan
4:30-5:00	<b>Reiterate agreements and next steps</b> <b>Discussion Leader:</b> John Williamson

## APPENDIX A

### REVISED PLAN B

For consideration by EBMWG at July 19, 2004 meeting

#### Overview

The National Marine Sanctuary Act (NMSA) provides authority to the National Marine Sanctuaries “for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities...” The NMSA directs the Sanctuary to “maintain the natural biological communities in the national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes;...”, as well as, “create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques;...”, while at the same time “facilitating uses to the extent compatible with the primary purpose of resource protection...”

Meeting these obligations requires an understanding of ecosystem-based management (EBM) and ways EBM might be implemented within the SBNMS.

As the Sanctuary is not an ecosystem unto itself but rather part of the much larger Gulf of Maine ecosystem, the application of EBM to the SBNMS can be approached along two parallel tracks. First, the application of EBM at the SBNMS will involve the intensive collaboration with other regional agencies charged with managing components of the ecosystem beyond the Sanctuary boundaries. Second, for management within the Sanctuary boundaries, the guiding principles of EBM can be used in an ecosystem-based management approach where an obvious sub-set of the larger Gulf of Maine ecosystem is being managed.

There are no comprehensive EBM plans in the southern Gulf of Maine at this time. The SBNMS currently regulates the mining of sand and gravel, disturbance of the seafloor (with the exception of fishing activity), and dumping of waste material within its boundaries. Fisheries management in the Federal waters of the region is conducted on a species by species basis. Similarly, though the Atlantic Large Whale Take Reduction Team has grouped a number of large cetaceans under its auspices, the Marine Mammal Protection Act is also enforced on a species by species basis.

#### Description of the Issues

The public comment scoping process conducted by SBNMS in 1998, and again in 2002, identified several concerns relative to need for comprehensive ecosystem protection and conservation of biological diversity at the SBNMS. Issues raised during public scoping were summarized as follows:

- 1.C Need for comprehensive ecosystem protection
  - 1.C.1. Zoning in the SBNMS including no-take zones
  - 1.C.2 Ecosystem-based management practices
  - 1.C.3 Boundary Modification

This action plan addresses these public issues comprehensively.

#### Issue Statement

Ecosystem-based management (EBM) arose in the late 20<sup>th</sup> century to address the pervasive scientific uncertainty inherent in natural systems and the failures of single species management approaches to adequately address that uncertainty. The concept of an ecosystem, on which any discussion of ecosystem-based management depends, can be defined as a biological community together with its associated

physical environment. In the context of the marine environment, this would include all marine organisms including humans as well as the physical properties of the water column and the seafloor.

Where “traditional” resource management has focused on managing commodities (such as fish), the goal of EBM is to manage the *sources* from which these commodities come, i.e. the ecosystems that support the fish. In so far as it is human activities that are actually managed, the distribution and effects of human uses of the ecosystem are also critical components of EBM.

### **Goal**

The ecosystem-based management working group considered the many definitions of ecosystem-based management within the context of the sanctuary’s situation and came to consensus on the following definition and goal:

*Ecosystem-based sanctuary management (EBSM) integrates knowledge of ecological interrelationships [with existing societal values] to manage impacts within sanctuary boundaries. The general goal of EBSM is to protect the ecological integrity of the Stellwagen Bank National Marine Sanctuary while recognizing that the sanctuary is nested within Gulf of Maine large marine ecosystem. Effective implementation of EBSM should: (1) consider ecological processes that operate both inside and outside sanctuary boundaries, (2) recognize the importance of species and habitat diversity, and (3) accommodate human uses and associated benefits within the context of conservation requirements.*

### **Objectives**

The objectives of this plan are to:

- Comply with the purposes and policies of the National Marine Sanctuaries Act
- Understand ecosystem structure and function
- Recognize the interconnectedness with larger ecosystem
- Recognize our uncertainty of how systems function
- Manage adaptively
- Maintain public accessibility to SBNMS
- Achieve environmental sustainability of sanctuary resources
- Maintain and enhance biological diversity and ecological integrity
- Reduce habitat impacts by users
- Establish a process for creating a zoning scheme

### **Addressing the Issues – Strategies For This Action Plan**

The ecosystem-based management working group developed the following research and management strategies to begin implementing EBM and establishing the infrastructure and framework of its continued development. The strategies are ordered according to those that facilitate science, those that help us to understand ecological integrity, those that help us to understand external threats to sanctuary resources, and those that address a possible boundary expansion. Measures to evaluate the performance of strategies and their associated activities are listed at the end of each strategy/activity group.

#### *STRATEGIES RELATED TO FACILITATING SCIENCE*

##### **STRATEGY EBM.1- ESTABLISH A RESEARCH STEERING COMMITTEE**

The committee should be a working group of the Sanctuary Advisory Council that will assist in developing a research and monitoring plan for the SBNMS, recommending parameters for monitoring that are easily measurable and can serve as biological reference points, and developing an operational and

quantifiable definition of ecological integrity. Membership should be comprised of members from SBNMS staff, NEFMC staff, NEFSC staff, academia, fishing industry, and conservation organizations.

*Activities designated for this strategy include:*

**Establish steering committee.** The Sanctuary Advisory Council must establish the steering committee as a working group so that outside members can participate.

Status: Completed by year 1.

Potential partners: researchers, managers

Strategy Performance measure: Research steering committee is established by SAC within 1 year.

### **STRATEGY EBM.2- ESTABLISH A COLLABORATIVE RESEARCH CONSORTIUM**

The consortium shall be composed of academic, government, fishermen, and private interests who seek to understand how the sanctuary functions. The consortium is a more informal body than the steering committee and its purpose is to further the knowledge of the sanctuary system by fostering collaborative research between users and researchers on topics such as marine mammal acoustics, prey dynamics, oceanography, water quality changes, fish movement, etc.

*Activities designated for this strategy include:*

**Convene sanctuary science symposium.** The science coordinator shall organize a symposium on sanctuary science for the purpose of laying the foundation for a consortium and identifying the high priority issues that need to be investigated. This may become a biannual symposium.

Status: Completed by year 1.

Potential partners: researchers, managers, academia, public

**Initiate consortium.** The science coordinator shall initiate the consortium through email/listserv and a website specifically designed to foster the sharing of ideas and posting of results.

Status: Completed by year 2.

Potential partners: researchers, managers, academia, public

### **STRATEGY EBM.3- ESTABLISH A DATA MANAGEMENT PROGRAM**

Using SBNMS' existing infrastructure capacity with outside software expertise, the sanctuary will develop a system with which to integrate, process, synthesize, and analyze scientific data. To maximize the utility of such a system, the user should be able to connect across the system for individual querying of all available data sets. The system will be made available for practical application on both an intuitive and expert level.

The objective of this system is to develop a well-designed information management and dissemination tool to facilitate science-based management. The system is designed to be widely applicable and accessible to SBNMS staff, scientists, decisionmakers, and the public. By setting up a database on an in-house server, SBNMS can expand the range and uses of existing data. Additionally, any user will be able to bring in a database, upload it into the sanctuary's system, and carry out any type of data analysis or processing from statistical analysis to support for management decisions.

*Activities designated for this strategy include:*

**Design an information management system.** To be completed.

Status: Completed by year 1.

Potential partners: researchers, managers, academia, public

**Process existing data.** To be completed.

**Upgrade SBNMS system for internal individual querying.** To be completed.

**Design and implement a web portal for public access to databases.** To be completed.

Strategy Performance measure: Information management system with public access shall be operational within 3 years.

*STRATEGIES RELATED TO UNDERSTANDING ECOLOGICAL INTEGRITY*

**STRATEGY EBM.4- PROTECT ECOLOGICAL INTEGRITY**

The primary goal of EBM is to protect the ecological integrity of the sanctuary. While ecological integrity has not been defined by the working group various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. The objective of this strategy is to develop an operational definition of ecological integrity that can be evaluated and monitored over time.

*Activities designated for this strategy include:*

**Develop a conceptual ecosystem model showing the functional relationships between species and the transfer of energy through the system.**

A contract will be let for a systems ecologist to assess existing trophic cascade models currently being used in the Gulf of Maine or elsewhere and determine suitability for SBNMS and produce a draft model for the SBNMS. The research steering committee will then review the model and make recommendations to SBNMS.

Status: Completed by year 2.

Potential partners: research steering committee, academia, contractors

**Establish a zoning scheme (including fully protected reserve(s)).** In order to protect ecological integrity a zoning scheme shall be established that minimizes fishing gear impacts in 22% of the SBNMS and establishes a permanent, fully protected reference area in some portion of the aforementioned 22% area. The zoning scheme shall be designed to meet the following objectives:

- Conserving and enhancing species diversity
- Conserving and enhancing genetic diversity
- Protecting a range of representative habitat types
- Protecting critical and sensitive habitats (including but not limited to spawning, juvenile, and nursery areas)

- Improving understanding of SBNMS marine system such as understanding the structure and function of a minimally disturbed habitat and understanding the effects of human exploitation on ecosystem structure and function.

The zoning scheme shall be recommended to the SBNMS by a zoning working group within two years of the implementation of the final management plan as defined by the publication date for the Federal Register Notice notifying the public of the availability of the final management plan. The zoning working group shall be established by the SAC at its November 2004 meeting for the purpose of reviewing and evaluating data and information as it becomes available through various venues (eg. Omnibus Essential Fish Habitat process, sanctuary efforts) and making a recommendation to the SAC and ultimately to the sanctuary superintendent. The membership of the zoning working group shall be of representative stakeholder groups (users and non-users) similar to the EBMWG. The zoning working group shall begin meeting in January 2005 in order to efficiently utilize the time that the final management plan is in preparation.

Status: Completed by year 2.

Potential partners: stakeholders (users and non-users)

**Develop zone monitoring plan.** The research steering committee in cooperation with the sanctuary science coordinator shall design a monitoring program that determines the efficacy of the zoning scheme for enhancing and maintaining ecological integrity. The zone monitoring program shall be implemented prior to and for at least 10 years after the implementation of the zoning scheme.

Status: Completed by year 2.

Potential partners: stakeholders (users and non-users)

**Develop an operational definition of ecological integrity.** Ecological integrity is a term that is location and scale dependent. It is both an intuitive and a technical term. For example, if sand eels are absent from the sanctuary for a year then a seasoned observer would have to question the ecological integrity of the sanctuary system. An ecologist would wonder the same thing but would ask what role do the sand eels play in the structure and functioning of the ecosystem and what is the history of their abundance. While ecological integrity has not yet been defined by for the SBNMS various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. Many questions need to be asked and answered before the SBNMS can develop an operational definition of ecological integrity that can be evaluated and monitored over time.

Status: draft operational definition by year 5.

Potential partners: research steering committee, consortium, fishermen, other users

**Develop appropriate measures of biodiversity.** Continue long-term research surveys and develop appropriate analyses.

Status: Completed by year 4.

Potential partners: research steering committee, academia, consortium

**Implement a permanent ban on the exploitation of sand eels (*Ammodytes* spp.).** Sand eels are a keystone species in the sanctuary and are currently unexploited. Sand eels are a critical forage species for baleen whales, groundfish, and pelagic fish and are an important component of the ecological integrity of the SBNMS. In the past there has been small scale fishery for sand eels in the Massachusetts Bay area for

bait and there is currently a sand eel fishery in the North Sea. This activity will be implemented by the NEFMC at the request of the SBNMS.

Status: Completed by year 1.

Potential partners: NEFMC

**Maintain optimum fishery yields at target fishing mortality rate.** Through use of closed areas, trip limits, days-at-sea restrictions, and other measures, optimum fishery yields shall be achieved within the SBNMS. This activity will be implemented by the NEFMC.

Status: Completed by year 4.

Potential partners: NEFMC

**Reduce bycatch.** Bycatch of target and non-target species shall be reduced in the SBNMS. This activity will be implemented by the NEFMC.

Status: Completed by year 3.

Potential partners: NEFMC

**Require vessel monitoring systems (VMS).** VMS shall be required for all recreational for-hire and commercial fishing vessels in the sanctuary. This requirement is necessary in order to fully understand the level of exploitation in the sanctuary, the socioeconomic impacts of regulations, the spatial distribution of effort, and the effort adjacent to closed areas. This activity will be implemented by the NEFMC.

Status: Completed by year 2.

Potential partners: stakeholders (users and non-users)

**Require automated identification systems (AIS).** AIS shall be required for all vessels not involved in commercial fishing or recreational for-hire fishing. This requirement is necessary in order to fully understand the spatial distribution of uses, the socioeconomic impact of regulations, and the activity in and around closed areas. This activity will be implemented by the US Coast Guard.

Status: Completed by year 3.

Potential partners: US Coast Guard

Strategy performance measures:

1. 22% of SBNMS shall be designated as a Level II closure and some portion of the 22% shall be designated as a fully protected reference area within 4 years.
2. A zone monitoring plan shall be implemented within 2 years of final management plan implementation and zone monitoring results (pre-zoning scheme) shall be available within 4 years.
3. A draft operational definition of ecological integrity shall be developed within 5 years.
4. All commercial and recreational vessels using the SBNMS shall have a vessel monitoring system or automatic identification system within 2 years.
5. Fishery yield shall not exceed 16,100 mt for Gulf of Maine cod and other stocks and fishing mortality on these stocks shall not exceed  $F=0.23$  within 4 years. [check with Jon on this]
6. At-sea observers to measure bycatch rates and discards of target and non-target species shall be used on 20% of sanctuary fishing vessels of all types within 2 years.
7. Time series of biodiversity indices by year 3

## **EBM 5- UNDERSTAND ECOSYSTEM STRUCTURE AND FUNCTION**

**Establish a long-term monitoring program.** This program shall discern changes in both the natural and social systems of the sanctuary. This program shall include the following: direct observations of human uses and cetacean distribution for one year through standardized shipboard sampling conducted every 3-5 years, monitoring of a suite of indicators that provide a comprehensive picture of ecosystem condition, and monitoring of socioeconomic changes due to management actions.

Status: Completed by year 3.

Potential partners: US Coast Guard

**Establish a directed research program.** This program shall complement the monitoring program by addressing specific questions that arise from the monitoring such as how the ecosystem functions including how people effect it and are affected by it. The research steering committee should advise on the questions to be answered.

Status: Completed by year 3.

Potential partners: US Coast Guard

**Establish a collaborative research program with fishermen.** Work with the Massachusetts Fishermen's Partnership in institutionalizing the Fishermen's Initiative for Scientific Habitat and Ecosystem Research (FISHER Initiative) within the SBNMS. One potential project is to map anecdotal observations of species distributions and trends acquired through oral interviews.

Status: Completed by year 2.

Potential partners: MFP

**Classify and map benthic habitats.** The SBNMS currently has high resolution multibeam imagery of the entire SBNMS. However, benthic habitats have not been classified or mapped based on the multibeam data and groundtruthing data. These data would greatly facilitate planning and resource management efforts.

Status: Completed by year 4.

Potential partners: USGS, academia, consortium, MFP

**Understand movements of fish over landscape features.** Complete ongoing research, including cooperative research, to tag and track Atlantic cod.

Status: Completed by year 3.

Potential partners: contractors, academia, consortium, MFP

**Understand effect of storm and tidal events on benthic habitats.** Conduct FISHER Initiative to investigate the impacts of storm and tidal events on sand lance habitat and the physical oceanography of Massachusetts Bay.

Status: Completed by year 3.

Potential partners: MFP

**Develop predictive larval recruitment, dispersal, and connectivity models.** Models shall include sources, sinks, larval concentrations, and larval behaviors. This information will be useful in determining the size and location of managed areas.

Status: Completed by year 3.

Potential partners: Academia

**Develop an internal oceanographic circulation model** for the sanctuary that will interface with other models and will tie together local, regional, and larger-scale patterns. Development of this model is essential to understand and predict the fate and effect of nutrients, pollutants, and larval transport.

Status: Completed by year 4.

Potential partners: Academia, GoMOOS

**Quantify pollutant loadings.** The relative importance of natural and anthropogenic nutrient and other pollutant loadings to sanctuary waters from local, subregional (Mass Bay), and regional (Gulf of Maine) sources shall be quantified.

Status: Completed by year 5.

Potential partners: Academia, MWRA, USGS

**Establish an integrated ocean observing system.** This system shall collect real-time data at multiple depths on critical oceanographic and biological parameters such as: Temperature (air and water), Atmospheric pressure, Wave height, Conductivity, Irradiance, Chlorophyll, Current velocity and direction, Ambient noise, Suspended sediments, Dissolved nutrients, Fish abundance, Plankton abundance, and Cetacean abundance. The system could be a subset of the Gulf of Maine Ocean Observing System and would be implemented with a combination of surface buoys and seafloor sensors.

Status: Completed by year 5.

Potential partners: GoMOOS, academia, fishermen, shippers

*Strategy performance measures:*

1. Trend analysis of suite of indicator species shall be analyzed by year 3 and completed thereafter on an annual basis.
2. Nutrient loadings in the sanctuary from local and farfield sources shall be quantified by year 5.
3. The dispersal rate and trajectories of model larvae under various environmental conditions shall be quantified by year 3.
4. The movement rates and distances of cod and redfish over gravel and boulder habitats during all seasons shall be quantified by year 4.
5. Real-time oceanographic and meteorological data shall be provided via the web for at least two locations within the SBNMS by year 5.
6. Benthic habitats in the entire sanctuary shall be mapped at a scale of 1:60,000 or better by year 5.

*STRATEGIES RELATED TO A POSSIBLE BOUNDARY EXPANSION*

**EBM 6- EVALUATE THE NEED AND FEASIBILITY FOR EXPANDING THE SANCTUARY BOUNDARY.**

This strategy is intended to evaluate the need for and feasibility of expanding the SBNMS boundary to include more of Jeffrey's Ledge. The reason for this is that herring on Jeffrey's Ledge may act as a "buffer" prey for predator species in times of low sand eel abundance on Stellwagen Bank. If results

indicate that expansion is warranted, action should be taken by the SAC and the SBNMS to expand the sanctuary boundaries to include more of Jeffrey's Ledge.

Status: Completed by year 5.

Potential partners:

Strategy performance measures:

1. Understand the relationship of herring on Jeffrey's Ledge with humpback whales in the SBNMS by year 5.
2. Characterize the ecology and socioeconomics of Jeffrey's Ledge by year 5.

**EBM 7- IMPLEMENT 10-YEAR MORATORIUM ON TRAWLING AND SEINING FOR ATLANTIC AND RIVER HERRING.** Request that the NEFMC implement a 10-year moratorium on trawling and seining for herring in the SBNMS in order to discern the effects of the herring fishery on sanctuary resources.

Status: Completed by year 3.

Potential partners: NEFMC

Strategy performance measures:

1. Statistical comparison of trend analysis of herring stocks with and without fishing by year 5.
2. Statistical comparison of predator behavior around fished and unfished herring schools by year 5.

*STRATEGIES RELATED TO UNDERSTANDING AND MITIGATING EXTERNAL THREATS*

**EBM 8- EVALUATE AND MITIGATE EXTERNAL INFLUENCES ON THE SBNMS.**

*Activities designated for this strategy include:*

**Assess the extent of invasive species.** The sanctuary is an open system and is vulnerable to invasion by exotic species. The presence or absence and extent of invasive species is currently unknown. If invasive species exist the threats they pose must be evaluated.

Status: Completed by year 5.

Potential partners: EPA, volunteer divers, academia

**Eliminate ballast water exchange.** Discharges of ballast water in the Sanctuary is a source of invasive species and must be curtailed.

Status: Completed by year 2.

Potential partners: EPA, shipping industry

**Enforce existing watershed protection measures.** Fully enforce the Clean Air and Clean Water acts to reduce watershed inputs to the sanctuary. Implement watershed management to minimize turbidity and diminish coastal runoff, including, but not limited to , nutrient plumes from rivers. Such management strategies may include, for example, requiring forested easements along all watersheds.

Status: Completed by year 2.

Potential partners: EPA, state coastal management programs,

**Implement speed restrictions.** Vessels traversing the sanctuary should be limited to 13 knots (the mortality threshold for ship-whale collisions).

Status: Completed by year 4.

Potential partners: NMFS, SAC, shipping industry

**Mitigate impacts from pipelines, cables, and conduits.** Any use or crossing of the sanctuary for cables, pipelines, or conduits must be subject to review and assessed for costs to cover continuing impact monitoring for the lifetime of the easement.

Status: Completed by year 1.

Potential partners: SAC, NMSP

Strategy performance measures:

1. Enumerate invasive species and map their extent by year 5.
2. Eliminate ballast water discharges by year 3.
3. Reduce vessel speed to 13 knots by year 4.

## APPENDIX B

### *REVISED AND REORDERED PLAN B ACTION PLAN* For consideration by EBMWG at July 19, 2004 meeting

#### **Overview**

The National Marine Sanctuary Act (NMSA) provides authority to the National Marine Sanctuaries “for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities...” The NMSA directs the Sanctuary to “maintain the natural biological communities in the national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes;...”, as well as, “create models of, and incentives for, ways to conserve and manage these areas, including the application of innovative management techniques;...”, while at the same time “facilitating uses to the extent compatible with the primary purpose of resource protection...”

Meeting these obligations requires an understanding of ecosystem-based management (EBM) and ways EBM might be implemented within the SBNMS.

As the Sanctuary is not an ecosystem unto itself but rather part of the much larger Gulf of Maine ecosystem, the application of EBM to the SBNMS can be approached along two parallel tracks. First, the application of EBM at the SBNMS will involve the intensive collaboration with other regional agencies charged with managing components of the ecosystem beyond the Sanctuary boundaries. Second, for management within the Sanctuary boundaries, the guiding principles of EBM can be used in an ecosystem-based management approach where an obvious sub-set of the larger Gulf of Maine ecosystem is being managed.

There are no comprehensive EBM plans in the southern Gulf of Maine at this time. The SBNMS currently regulates the mining of sand and gravel, disturbance of the seafloor (with the exception of fishing activity), and dumping of waste material within its boundaries. Fisheries management in the Federal waters of the region is conducted on a species by species basis. Similarly, though the Atlantic Large Whale Take Reduction Team has grouped a number of large cetaceans under its auspices, the Marine Mammal Protection Act is also enforced on a species by species basis.

#### **Description of the Issues**

The public comment scoping process conducted by SBNMS in 1998, and again in 2002, identified several concerns relative to need for comprehensive ecosystem protection and conservation of biological diversity at the SBNMS. Issues raised during public scoping were summarized as follows:

- 1.C Need for comprehensive ecosystem protection
  - 1.C.1. Zoning in the SBNMS including no-take zones
  - 1.C.2 Ecosystem-based management practices
  - 1.C.3 Boundary Modification

This action plan addresses these public issues comprehensively.

#### *Issue Statement*

Ecosystem-based management (EBM) arose in the late 20<sup>th</sup> century to address the pervasive scientific uncertainty inherent in natural systems and the failures of single species management approaches to adequately address that uncertainty. The concept of an ecosystem, on which any discussion of ecosystem-based management depends, can be defined as a biological community together with its associated

physical environment. In the context of the marine environment, this would include all marine organisms including humans as well as the physical properties of the water column and the seafloor.

Where “traditional” resource management has focused on managing commodities (such as fish), the goal of EBM is to manage the *sources* from which these commodities come, i.e. the ecosystems that support the fish. In so far as it is human activities that are actually managed, the distribution and effects of human uses of the ecosystem are also critical components of EBM.

### **Goal**

The ecosystem-based management working group considered the many definitions of ecosystem-based management within the context of the sanctuary’s situation and came to consensus on the following definition and goal:

*Ecosystem-based sanctuary management (EBSM) integrates knowledge of ecological interrelationships [with existing societal values] to manage impacts within sanctuary boundaries. The general goal of EBSM is to protect the ecological integrity of the Stellwagen Bank National Marine Sanctuary while recognizing that the sanctuary is nested within Gulf of Maine large marine ecosystem. Effective implementation of EBSM should: (1) consider ecological processes that operate both inside and outside sanctuary boundaries, (2) recognize the importance of species and habitat diversity, and (3) accommodate human uses and associated benefits within the context of conservation requirements.*

### **Objectives**

The objectives of this plan are to:

- Comply with the purposes and policies of the National Marine Sanctuaries Act
- Understand ecosystem structure and function
- Recognize the interconnectedness with larger ecosystem
- Recognize our uncertainty of how systems function
- Manage adaptively
- Maintain public accessibility to SBNMS
- Achieve environmental sustainability of sanctuary resources
- Maintain and enhance biological diversity and ecological integrity
- Reduce habitat impacts by users
- Establish a process for creating a zoning scheme

### **Addressing the Issues – Strategies For This Action Plan**

The ecosystem-based management working group developed the following research and management strategies to begin implementing EBM and establishing the infrastructure and framework of its continued development. The strategies are ordered according to those that facilitate science, those that help us to understand ecological integrity, those that help us to understand external threats to sanctuary resources, and those that address a possible boundary expansion. Measures to evaluate the performance of strategies and their associated activities are listed at the end of each strategy/activity group.

#### *STRATEGIES RELATED TO FACILITATING SCIENCE*

##### **STRATEGY EBM.1- ESTABLISH A RESEARCH STEERING COMMITTEE**

The committee should be a working group of the Sanctuary Advisory Council that will assist in developing a research and monitoring plan for the SBNMS, recommending parameters for monitoring that are easily measurable and can serve as biological reference points, and developing an operational and

quantifiable definition of ecological integrity. Membership should be comprised of members from SBNMS staff, NEFMC staff, NEFSC staff, academia, fishing industry, and conservation organizations.

*Activities designated for this strategy include:*

**Establish steering committee.** The Sanctuary Advisory Council must establish the steering committee as a working group so that outside members can participate.

Status: Completed by year 1.

Potential partners: researchers, managers

Strategy Performance measure: Research steering committee is established by SAC within 1 year.

**STRATEGY EBM.2- ESTABLISH A COLLABORATIVE RESEARCH CONSORTIUM**

The consortium shall be composed of academic, government, fishermen, and private interests who seek to understand how the sanctuary functions. The consortium is a more informal body than the steering committee and its purpose is to further the knowledge of the sanctuary system by fostering collaborative research between users and researchers on topics such as marine mammal acoustics, prey dynamics, oceanography, water quality changes, fish movement, etc.

*Activities designated for this strategy include:*

**Convene sanctuary science symposium.** The science coordinator shall organize a symposium on sanctuary science for the purpose of laying the foundation for a consortium and identifying the high priority issues that need to be investigated. This may become a biannual symposium **the objective of which is to share knowledge with the SAC, Sanctuary Staff and other interested parties.**

Status: Completed by year 1.

Potential partners: researchers, managers, academia, public

**Initiate consortium.** The science coordinator shall initiate the consortium through email/listserv and a website specifically designed to foster the sharing of ideas and posting of results.

Status: Completed by year 2.

Potential partners: researchers, managers, academia, public

**STRATEGY EBM.3- ESTABLISH A DATA MANAGEMENT PROGRAM**

Using SBNMS' existing infrastructure capacity with outside software expertise, the sanctuary will develop a system with which to integrate, process, synthesize, and analyze scientific data. To maximize the utility of such a system, the user should be able to connect across the system for individual querying of all available data sets. The system will be made available for practical application on both an intuitive and expert level.

The objective of this system is to develop a well-designed information management and dissemination tool to facilitate science-based management. The system is designed to be widely applicable and accessible to SBNMS staff, scientists, decisionmakers, and the public. By setting up a database on an in-house server, SBNMS can expand the range and uses of existing data. Additionally, any user will be able to bring in a database, upload it into the sanctuary's system, and carry out any type of data analysis or processing from statistical analysis to support for management decisions.

*Activities designated for this strategy include:*

**Establish QA/QC program**

**Establish proprietary use policy**

**Establish FTE data manager**

**Design an information management system.** To be completed.

Status: Completed by year 1.

Potential partners: researchers, managers, academia, public

**Process existing data.** To be completed.

**Upgrade SBNMS system for internal individual querying.** To be completed.

**Design and implement a web portal for public access to databases.** To be completed.

Strategy Performance measure: Information management system with public access shall be operational within 3 years.

*STRATEGIES RELATED TO UNDERSTANDING ~~ECOLOGICAL INTEGRITY~~ ECOSYSTEM  
STRUCTURE AND FUNCTION*

**STRATEGY EBM.4- ~~PROTECT ECOLOGICAL INTEGRITY~~ UNDERSTAND ECOSYSTEM STRUCTURE AND  
FUNCTION**

**[descriptive text needed here]** ~~The primary goal of EBM is to protect the ecological integrity of the sanctuary. While ecological integrity has not been defined by the working group various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. The objective of this strategy is to develop an operational definition of ecological integrity that can be evaluated and monitored over time.~~

*Activities designated for this strategy include:*

**4a Develop an operational definition of ecological integrity. The primary goal of EBM is to protect the ecological integrity of the sanctuary. While ecological integrity has not been defined by the working group various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. The objective of this activity is to develop an operational definition of ecological integrity that can be evaluated and monitored over time.**

Ecological integrity is a term that is location and scale dependent. It is both an intuitive and a technical term. ~~For example, if sand eels are absent from the sanctuary for a year then a seasoned observer would have to question the ecological integrity of the sanctuary system. An ecologist would wonder the same thing but would ask what role do the sand eels play in the structure and functioning of the ecosystem and what is the history of their abundance.~~ While ecological integrity has not yet been

defined by for the SBNMS various definitions point to the notion of maintaining the wholeness of an ecosystem, or portion thereof, such that the system's native diversity and functioning are likely to persist. Many questions need to be asked and answered before the SBNMS can develop an operational definition of ecological integrity and determine the metrics that can be evaluated and monitored over time.

Status: **draft operational definition and metrics for measuring ecological integrity by year 1.**  
Potential partners: research steering committee, ~~academia, contractors~~ consortium, fishermen, other users

**4b Develop appropriate measures of biodiversity and those processes that mediate patterns of diversity.** ~~Continue long-term research surveys and develop appropriate analyses.~~

Status: Completed by year 1.  
Potential partners: research steering committee, academia, consortium

**4c Establish a long-term monitoring program.** This program shall discern changes in both the natural and social systems of the sanctuary. This program shall ~~include the following: direct observations of human uses and cetacean distribution for one year through standardized shipboard sampling conducted every 3-5 years, monitoring of a suite of indicators that provide a comprehensive picture of develop a comprehensive understanding of changes in , and monitoring of socioeconomic changes due to management actions.~~ ecosystem ~~condition~~status, and monitoring of socioeconomic dynamics related to management actions.

Status: ~~Completed~~Initiated by year ~~32~~.  
Potential partners: ~~US Coast Guard~~research steering committee, consortium, fishermen, other users

**4d Establish a directed research program.** This program shall complement the monitoring program by ~~addressing specific questions that arise from the~~investigating ecological processes that explain the patterns identified from monitoring ~~such as how the ecosystem functions including how people effect it and are affected by it.~~ The research steering committee should advise on the questions to be answered.

Status: ~~Completed~~Initiated by year ~~32~~.  
Potential partners: ~~US Coast Guard~~research steering committee, consortium, fishermen, other users

**4e Establish collaborative research programs with the recreational and commercial fishermen fishing industries.** ~~Work with~~Examples would include the Northeast Consortium and the Massachusetts Fishermen's Partnership's ~~in institutionalizing the~~Fishermen's Initiative for Scientific Habitat and Ecosystem Research (FISHER Initiative) within the SBNMS.

Status: ~~Completed~~Initiated by year 2.  
Potential partners: MFP, Northeast Consortium, regional NGO's, NEFMC/CRPI, universities

**4f Develop a dynamic~~conceptual~~ ecosystem model linking patterns of diversity with ecological processes.** ~~showing the functional relationships between species and the transfer of energy through the system.~~An initial product of this effort will be a static conceptual model showing functional relationships between species. ~~contract will be let for a systems ecologist to assess existing trophic cascade models currently being used in the Gulf of Maine or elsewhere and determine suitability~~

~~for SBNMS and produce a draft model for the SBNMS.~~ The research steering committee will then review the model and make recommendations to SBNMS.

Status: ~~Completed~~ **Initiated** by year 2.

Potential partners: research steering committee, academia, contractors

**4g Classify and map benthic habitats.** The SBNMS currently has high resolution multibeam imagery of the entire SBNMS. However, benthic habitats have not been classified or mapped based on the multibeam data and groundtruthing data (**e.g. video, sediment sampling and other means**). These data would greatly facilitate planning and resource management efforts.

Status: Completed by year 4.

Potential partners: USGS, academia, consortium, MFP

**4h Understand movements of organisms over landscape features. Understand movements of organisms relative to sanctuary seascapes and movement between the sanctuary and surrounding waters.** Complete ongoing research, including cooperative research, to tag and track Atlantic cod **and expand the research to include other species.**

Status: ~~Completed by year 3~~ **Ongoing.**

Potential partners: contractors, academia, consortium, MFP, **fishermen**

**4i Understand effect of ~~storm and tidal events on benthic habitats~~ natural disturbance (e.g. storm and tidal events, predation) on seafloor habitats. Conduct FISHER Initiative to investigate the impacts of storm and tidal events on sand lance habitat and the physical oceanography of Massachusetts Bay.**

Status: ~~Completed by year 3~~ **Ongoing.**

Potential partners: **contractors, academia, consortium, MFP, fishermen**

**4j Develop predictive larval recruitment, dispersal, and connectivity models.** Models shall include sources, sinks, larval concentrations, and larval behaviors **using data from various sources. This information will be useful in determining the size and location of managed areas.**

Status: ~~Completed~~ **Initiated** by year **32**.

Potential partners: Academia, **state and federal agencies**

**4k Develop an internal oceanographic circulation model ~~for the sanctuary that.~~ This model** will interface with other models and will tie together local, regional, and larger-scale patterns. Development of this model is essential to understand and predict **egg and larval transport, and the fate and effect of nutrients and pollutants.**

Status: Completed by year **43**.

Potential partners: Academia, GoMOOS

**4l Quantify pollutant loadings.** The importance of natural and anthropogenic nutrient and other pollutant loadings to sanctuary waters, **flora, and fauna** from local, subregional (Mass Bay), **and** regional (Gulf of Maine), **and global** sources shall be quantified.

Status: Completed by year 5.

Potential partners: Academia, MWRA, USGS

**4m Establish an integrated ocean observing system.** This system shall collect real-time data at multiple depths on ~~critical~~ oceanographic and biological parameters ~~such as: Temperature (air and water), Atmospheric pressure, Wave height, Conductivity, Irradiance, Chlorophyll, Current velocity and direction, Ambient noise, Suspended sediments, Dissolved nutrients, Fish abundance, Plankton abundance, and Cetacean abundance.~~ **identified to aid in ecosystem based management.** The system could be a subset of the Gulf of Maine Ocean Observing System and would be implemented with a combination of surface buoys and seafloor sensors.

Status: Completed by year 5.

Potential partners: GoMOOS, academia, fishermen, shippers

#### **4n Assess Bycatch**

*Strategy performance measures:*

7. Trend analysis of suite of indicator species shall be analyzed by year 3 and completed thereafter on an annual basis.
8. Nutrient loadings in the sanctuary from local and farfield sources shall be quantified by year 5.
9. The dispersal rate and trajectories of model larvae under various environmental conditions shall be quantified by year 3.
10. The movement rates and distances of cod and redfish over gravel and boulder habitats during all seasons shall be quantified by year 4.
11. Real-time oceanographic and meteorological data shall be provided via the web for at least two locations within the SBNMS by year 5.
12. Benthic habitats in the entire sanctuary shall be mapped at a scale of 1:60,000 or better by year 5.

#### *STRATEGIES RELATED TO PROTECTING ECOLOGICAL INTEGRITY*

##### **STRATEGY EBM.5- PROTECT ECOLOGICAL INTEGRITY**

[descriptive text needed here]

**5a ~~Establish a zoning scheme (including fully protected reserve(s)).~~ Establish a zoning working group to evaluate the adequacy of existing zoning schemes in SBNMS to meet the goals of ecosystem based sanctuary management and if needed, develop a modified zoning scheme (including a consideration of fully protected reserves) to meet those goals. If modifications are needed, the overlap between the sanctuary and the WGOM closure should be evaluated as an option for a protection zone and the potential for a reserve.**

#### **Include text on monitoring plan**

~~In order to protect ecological integrity a zoning scheme shall be established that minimizes fishing gear impacts in 22% of the SBNMS and establishes a permanent, fully protected reference area in some portion of the aforementioned 22% area. The zoning scheme shall be designed to meet the following objectives:~~

- ~~• Conserving and enhancing species diversity~~
- ~~• Conserving and enhancing genetic diversity~~
- ~~• Protecting a range of representative habitat types~~
- ~~• Protecting critical and sensitive habitats (including but not limited to spawning, juvenile, and nursery areas)~~

- ~~Improving understanding of SBNMS marine system such as understanding the structure and function of a minimally disturbed habitat and understanding the effects of human exploitation on ecosystem structure and function.~~

The zoning scheme shall be recommended to the SBNMS by a zoning working group within two years of the implementation of the final management plan as defined by the publication date for the Federal Register Notice notifying the public of the availability of the final management plan. The zoning working group shall be established by the SAC at its November 2004 meeting for the purpose of reviewing and evaluating data and information as it becomes available through various venues (eg. Omnibus Essential Fish Habitat process, sanctuary efforts) and making a recommendation to the SAC and ultimately to the sanctuary superintendent. The membership of the zoning working group shall be of representative stakeholder groups (~~users and non-users~~) similar to the EBMWG. The zoning working group shall begin meeting in January 2005 in order to efficiently utilize the time that the final management plan is in preparation.

Status: Completed by year 2.

Potential partners: **representative** stakeholders (~~users and non-users~~)

**5b (to be integrated into 4c & 5a) Develop zone monitoring plan.** The research steering committee in cooperation with the sanctuary science coordinator shall design a monitoring program that determines the efficacy of the zoning scheme for enhancing and maintaining ecological integrity. The zone monitoring program shall be implemented prior to and for at least 10 years after the implementation of the zoning scheme.

Status: Completed by year 2.

Potential partners: stakeholders (users and non-users)

**5c Implement a permanent ban on the exploitation of sand eels (*Ammodytes* spp.).** Sand eels are an **important forage keystone** species in the sanctuary and are currently unexploited. Sand eels are an **important-critical** forage species for baleen whales, groundfish, and pelagic fish and are an important component of the **food webecological integrity** of the SBNMS. In the past there has been small scale fishery for sand eels in the Massachusetts Bay area for bait and there is currently a sand eel fishery in the North Sea. This activity will be implemented by the NEFMC at the request of the SBNMS **and New England states would be requested to implement the same ban on possession and landings.**

Status: Completed by year 1.

Potential partners: NEFMC

~~**5d Maintain optimum fishery yields at target fishing mortality rate. Through use of closed areas, trip limits, days-at-sea restrictions, and other measures, optimum fishery yields shall be achieved within the SBNMS. This activity will be implemented by the NEFMC.**~~

~~Status: Completed by year 4.~~

~~Potential partners: NEFMC~~

**5e Assess and minimize Reduce bycatch and discard.** Bycatch of target and non-target species shall be **minimizedreduced** in the SBNMS. This activity **couldwill** be implemented by the NEFMC.

Status: Completed by year 3.  
Potential partners: NEFMC

**5f Require vessel monitoring systems (VMS).** VMS shall be required for all recreational for-hire and commercial fishing vessels in the sanctuary. This requirement is necessary in order to fully understand the level of exploitation in the sanctuary, the socioeconomic impacts of regulations, the spatial distribution of effort, and the effort adjacent to closed areas. This activity will be implemented by the NEFMC.

Status: Completed by year 2.  
Potential partners: stakeholders (users and non-users)

**5g Require automated identification systems (AIS).** AIS shall be required for all vessels not involved in commercial fishing or recreational for-hire fishing. This requirement is necessary in order to fully understand the spatial distribution of uses, the socioeconomic impact of regulations, and the activity in and around closed areas. This activity will be implemented by the US Coast Guard.

Status: Completed by year 3.  
Potential partners: US Coast Guard

Strategy performance measures:

8. 22% of SBNMS shall be designated as a Level II closure and some portion of the 22% shall be designated as a fully protected reference area within 4 years.
9. A zone monitoring plan shall be implemented within 2 years of final management plan implementation and zone monitoring results (pre-zoning scheme) shall be available within 4 years.
10. All commercial and recreational vessels using the SBNMS shall have a vessel monitoring system or automatic identification system within 2 years.
11. Fishery yield shall not exceed 16,100 mt for Gulf of Maine cod and other stocks and fishing mortality on these stocks shall not exceed  $F=0.23$  within 4 years. [check with Jon on this]
12. At-sea observers to measure bycatch rates and discards of target and non-target species shall be used on 20% of sanctuary fishing vessels of all types within 2 years.

*STRATEGIES RELATED TO A POSSIBLE BOUNDARY EXPANSION*

**EBM 6- EVALUATE THE NEED AND FEASIBILITY FOR EXPANDING THE SANCTUARY BOUNDARY.**

This strategy is intended to evaluate the need for and feasibility of expanding the SBNMS boundary to include more of Jeffrey's Ledge. The reason for this is that herring on Jeffrey's Ledge may act as a "buffer" prey for predator species in times of low sand eel abundance on Stellwagen Bank. If results indicate that expansion is warranted, action should be taken by the SAC and the SBNMS to expand the sanctuary boundaries to include more of Jeffrey's Ledge.

Status: Completed by year 5.  
Potential partners:

Strategy performance measures:

3. Understand the relationship of herring on Jeffrey's Ledge with humpback whales in the SBNMS by year 5.
4. Characterize the ecology and socioeconomics of Jeffrey's Ledge by year 5.

**EBM 7- IMPLEMENT 10-YEAR MORATORIUM ON TRAWLING AND SEINING FOR ATLANTIC AND RIVER HERRING.** Request that the NEFMC implement a 10-year moratorium on trawling and seining for herring in the SBNMS in order to discern the effects of the herring fishery on sanctuary resources.

Status: Completed by year 3.

Potential partners: NEFMC

Strategy performance measures:

3. Statistical comparison of trend analysis of herring stocks with and without fishing by year 5.
4. Statistical comparison of predator behavior around fished and unfished herring schools by year 5.

*STRATEGIES RELATED TO UNDERSTANDING AND MITIGATING EXTERNAL THREATS*

**EBM 8- EVALUATE AND MITIGATE EXTERNAL INFLUENCES ON THE SBNMS.**

*Activities designated for this strategy include:*

**Assess the extent of invasive species.** The sanctuary is an open system and is vulnerable to invasion by exotic species. The presence or absence and extent of invasive species is currently unknown. If invasive species exist the threats they pose must be evaluated.

Status: Completed by year 5.

Potential partners: EPA, volunteer divers, academia

**Eliminate ballast water exchange.** Discharges of ballast water in the Sanctuary is a source of invasive species and must be curtailed.

Status: Completed by year 2.

Potential partners: EPA, shipping industry

**Enforce existing watershed protection measures.** Fully enforce the Clean Air and Clean Water acts to reduce watershed inputs to the sanctuary. Implement watershed management to minimize turbidity and diminish coastal runoff, including, but not limited to , nutrient plumes from rivers. Such management strategies may include, for example, requiring forested easements along all watersheds.

Status: Completed by year 2.

Potential partners: EPA, state coastal management programs,

**Implement speed restrictions.** Vessels traversing the sanctuary should be limited to 13 knots (the mortality threshold for ship-whale collisions).

Status: Completed by year 4.

Potential partners: NMFS, SAC, shipping industry

**Mitigate impacts from pipelines, cables, and conduits.** Any use or crossing of the sanctuary for cables, pipelines, or conduits must be subject to review and assessed for costs to cover continuing impact monitoring for the lifetime of the easement.

Status: Completed by year 1.

Potential partners: SAC, NMSP

Strategy performance measures:

4. Enumerate invasive species and map their extent by year 5.
5. Eliminate ballast water discharges by year 3.
6. Reduce vessel speed to 13 knots by year 4.