Zoning (Z) WORKING GROUP (WG)
Stellwagen Bank National Marine Sanctuary (SBNMS)

Scituate, MA
9:30 am to 5:00 pm
24 August 2006

MEETING SUMMARY

ACTION: **Ben Cowie-Haskell to arrange update from Leslie Ann McGee.**
Leslie Ann McGee of the NEFMC should be requested to give an update to see how the Z WG can dovetail with the EFH Omnibus Amendment process currently underway.

ACTION: **New Ecological Integrity Subgroup member.**
By request from the Z WG, David Pierce should be added to the Ecological Integrity Subgroup.

AGREEMENT: **John Williamson to continue as Z WG Chair.**
The WG agreed that John Williamson should continue to serve as Z WG Chair, pending approval of such action by Sanctuary Headquarters.

AGREEMENT: **Ecological Integrity definition accepted.**
The WG agreed that the latest definition (Appendix A) should be used, but that an 'unpacking document', similar to the one used for the Sanctuary Vision, be developed for all terms referred to in the ecological integrity definition.

AGREEMENT: **Metric list to be revisited by the Ecological Integrity Subgroup.**
The WG agreed that the metrics list should be brought back to the subgroup for further refining and to indicate which metrics would be doable within a one year period. The subgroup should also provide a rationale for why each metric could be done and detail a method for evaluating each metric. It was agreed that most would need to use NOAA Fisheries survey trawl data and use the 1960's as an historical baseline. The subgroup would then report back on the methodology and metrics when their task is complete.

Working Group Attendees (May 31, 2005):

Name	WG Seat / Affiliation	Attendance
John Williamson	SAC Chair / Fishing Community Activist	Not Present
Ben Cowie-Haskell	Team Lead (SBNMS)	Present
Deb Cramer	At Large / Science Writer	Present
Edward Barrett	Mobile Gear / MA Fishermen's Partnerships	Present
David Casoni	Fixed Gear	Present
Tom DePersia	Recreational Fishing/Charter / Stellwagen Bank Charterboat Assoc.	Present
Mary Beth Tooley	Pelagic Gear / East Coast Pelagics	Not Present
Charles Casella	Recreational Fishing	Present
Susan Farady	Conservation / The Ocean Conservancy	Present
Peter Borrelli	Conservation / Center for Coastal Studies	Present
Priscilla Brooks	Conservation / Conservation Law Foundation	Not Present
David Pierce	Government / MA Div. of Marine Fisheries	Present
Kate Killerlain Morrison	Government / MA Office of Coastal Zone Management	Present
Susan Murphy	Government / NOAA Fisheries, Sustainable Fisheries Div.	Not Present
Lewis Incza	Academic / University of Southern Maine	Present
Les Kaufman	Academic / Boston University	Called In
Larry Madin	Academic / Woods Hole Oceanographic Institution	Not Present
David Gouviea	Government / NOAA Fisheries	Present
Jud Crawford	Alternate for Priscilla Brooks	Present
Brian Hooker	Alternate for Susan Murphy	Present
Others Present		
Kent Thornton	Meeting Facilitator / FTN Associates	Present
Timothy Feehan	PSGS	Present
Mike Fogarty	NOAA Fisheries, NEFSC	Present
Tracy Dalton	University of Rhode Island	Present
Andrew Cooper	University of New Hampshire	Present

WELCOME AND REVIEW OF AGENDA

Ben Cowie-Haskell, WG Team Lead, welcomed the WG and opened the meeting. He then reviewed the agenda for the meeting. The WG accepted the agenda with the addition of a discussion on the use of WG member alternates.

GROUND RULES AND CHARGE FOR THE DAY

Review of WG Role and Responsibility

Kent Thornton, FTN Associates and Meeting Facilitator, presented the following summarized review of the role and responsibility of the WG, as found in the Reference Document:

- 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.

After the ground rules and charge for the day were reviewed, Kent Thornton requested that each person introduce themselves. This exercise was used to make all WG members familiar with each other and provide information that would identify each member's point of view.

Z WG MEMBERSHIP CHANGES

Ben Cowie-Haskell and Susan Farady introduced the issue of the resignation of John Williamson from the Sanctuary Advisory Council (SAC) and the effects this would have on the Z WG. A decision would need to be made on who would serve as Chair for the Z WG. It was explained that the SAC had chosen to allow John to serve as Chair, but it was a question of apperance, considering that the Chair is supposed to be a member of the SAC and that two members from the same stakeholder group should not serve on the same WG. Continuing on with John as the chair would provide continuity for the group and keep it moving in the right direction. Craig MacDonald, SBNMS Superintendent, is currently seeking approval from Headquarters to allow John to remain as Chair, should the Z WG choose to keep him on.

Issue 1: **John Williamson to remain as Chair of the Z WG.**

The WG agreed to allow John Williamson to remain the Chair of the Z WG.

> ***Discussion:*** Allowing John Williamson to continue as Z WG Chair could potentially raise appearance issues, considering he now works for the Ocean Conservancy which causes two members from the same constituency group sitting on the same WG. Members of the WG were aware that this issue could cause problems with appearance but were satisfied with John's ability to remain neutral and keep the WG on track. Many WG members were concerned that not having John as Chair would delay the entire process and break down the continuity of the WG. The WG agreed that John should remain the Z WG Chair, pending the final decision by Headquarters.

PRESENTATIONS

Ecological Integrity Definition

Ben Cowie-Haskell presented the definition of 'ecological integrity' as developed during the November Z WG meeting and the subsequent revisions made by the Subgroup.

Current Process

To date, the SAC has created a Sanctuary Vision and the Ecosystem Based Sanctuary Management (EBSM) WG derived a goal statement for EBSM. The definition of 'ecological integrity' and the metrics used to assess integrity must comply with the Sanctuary Vision. The sanctuary vision is stated as follows:

> *"The Stellwagen Bank National Marine Sanctuary is teeming with a great diversity and abundance of marine plants and animals supported by diverse, healthy habitats in clean ocean waters. The ecological integrity of the sanctuary is protected and fully restored for current and future generations. Human uses are diverse and compatible with maintaining natural and cultural resources."*

The Z WG is a by-product of the EBSM Action Plan. The definition of 'ecological integrity' and the metrics used to assess integrity must also comply with the goal statement set by the EBSM WG. The EBSM goal statement reads:

> *"Ecosystem-Based Sanctuary Management (EBSM) integrates knowledge of ecological interrelationships to manage impacts within sanctuary boundaries. The general goal of EBSM is to protect the ecological integrity of the SBNMS while recognizing that the sanctuary is nested within GOM 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."

Based on the above vision and goal statements, the Z WG is charged with defining 'ecological integrity' and developing the methods for assessing the ecological integrity of the sanctuary to base decisions on zoning within the sanctuary.

Process
The Z WG is currently at Step 2 in the process, as defined in the Z WG mission statement:

1. ZWG convenes and assigns a subgroup to come up with 2-3 operational definitions of ecological integrity with measurable parameters.
2. Subgroup makes recommendation on definition of ecological integrity appropriate for the SBNMS.
3. ZWG evaluates existing zoning scheme based on agreed upon criteria associated with the scientific requirements and goals of EBSM.
4. ZWG makes recommendation to SAC on adequacy of existing zoning scheme.
5. SAC makes recommendation to superintendent on adequacy of existing zoning scheme and future of the ZWG.
6. If necessary, the ZWG continues deliberations to develop a modified zoning scheme (including a consideration of fully protected reserves) for the purpose of meeting the scientific requirements and goals of EBSM within 2 years of final management plan implementation.

When the final definition of 'ecological integrity' is agreed upon and a method of assessing integrity within the sanctuary is developed, the Z WG will be able to move to Step 3. The process has been slow, but progress has been made. The Subgroup has refined the definition of 'ecological integrity' and now the Z WG needs to agree upon a final definition.

Definition
The Z WG originally developed a draft definition of 'ecological integrity' that the Subgroup could further expand on. This original definition was worded as follows (also see Appendix B):

"Ecological integrity is defined as the degree to which the system is structurally intact and functionally resilient. Structurally intact means the parts of the system are maintained as well as their interrelationships. Functional resilience is the system's ability to resist changes caused by human or environmental perturbations, or should change occur, to recover over time to its former state without intervention."

The Z WG Subgroup worked on this definition, breaking it down to its essential focus and adding clarifying statements for 'functionally resilient' and 'structurally intact' that could be included as part of an unpacking document for the definition. This new definition, with the two clarifying statements is as follows (also see Appendix C):

"Ecological integrity is a concept that refers to the degree to which an ecological system, including humans, is structurally intact and functionally resilient within the context of historical baselines.

Structurally intact means that all the parts and interactions native to the system are present. In most marine systems, human presence and interactions have become part of the ecosystem and may be part of the historical baseline. System parts thus include, for example: species (including humans), biogenic structures, natural physical structures, and types of human uses.

Functional resilience is the system's ability to resist changes caused by human or other environmental perturbations or, should change occur, to recover to its former state and function. Important functions include nutrient cycling, primary and secondary productivity, food web interactions, reproduction, recruitment, and human interactions (economic, political, cultural, and social)."

Metrics

The Z WG Subgroup also prepared a list of possible metrics to be used for assessing the ecological integrity of the sanctuary. This matrix can be found in Appendix D. With these metrics, the following assumptions must be made:

- Metrics based on a pressure-state-response framework where pressures result from human influences
- Focus on higher trophic levels as integrative metrics
- Need a manageable number of metrics (can't do everything)
- These metrics do not represent everything that's being monitored in the SBNMS (for example: WQ)
- Tried to focus on metrics that could be evaluated with existing data
- Tried to select socioeconomic metrics that had a bearing on both biotic integrity and social integrity

It should also be noted that the metrics list is a 'strawman': perhaps some metrics should be deleted and others added. Also, the idea of the restoration scoring criteria needs fine tuning.

Questions & Answers

Question 1: When the final 'ecological integrity' definition gets to the SAC, how will this fit in with the current Management Plan Review (MPR) process? Will the definition be included?

Answer: The mission for the Z WG is to come up with a recommendation two years after the Management Plan comes out. The WG must first agree on the definition of 'ecological integrity', as this is the key to any WG recommendation or Action Plan. The term is currently contained within the Sanctuary Vision. If the definition is finalized, it can be included in the latest MPR process. Recommendations from the Z WG will not be made until after the MPR process is complete.

Comment: The intent of the two year timeline is to set an outer limit. If work is done sooner, there is no reason not to include it in the Management Plan. A slow pace can produce a momentum issue. There are demands on time, but a slow pace can create issues.

Comment: The current pace should allow this WG to be able to handle what will be coming out of the Habitat Committee with the NEFMC concerning HAPC sites. The committee meets September 16. Leslie Ann McGee should be asked to give an update to see how the Z WG can dovetail with the recommendations coming out of the Habitat Committee.

Examining Historical Baselines: A Case Study of Cod and Potential Applications in SBNMS
Andrew Cooper, UNH, presented on findings from a study on the historic catch of cod on the Grand Banks by the Beverly MA fishing fleet. Andrew also provided some preliminary work on historic catch specific to Stellwagen Bank.

Historical Fishery
Primary fishing grounds of Beverly's cod fleet from 1815 to 1859 was the Grand Banks. These banks were first fished in the 1500s and sustained an intermittent seasonal fishery for over 300 years. The typical type of vessel fishing in this area was a small fishing schooner handlining over the rail.

To collect data on this fishery, historical sources: between 1792 and 1866 were used. During this time, the United States government granted cod fishermen a bounty on individual cod. The purpose of this was twofold:

- To maintain the cod fisheries as a nursery of seamen for the navy.
- To reimburse the fishermen for the import duties they paid on the salt they used to preserve the fish.

Individual vessel log books were discovered. These logs contained detailed information including:

- Location
- Daily catch per man
- Course steered underway
- Vessels spoken
- Weather
- Bottom type
- Natural phenomena
- Few took the time to enter all of this data, but nearly all entered the daily catch per man, and at least occasional lat/longs, and vessels spoken.

Fishing agreements were also used as data sources. These agreements contained:

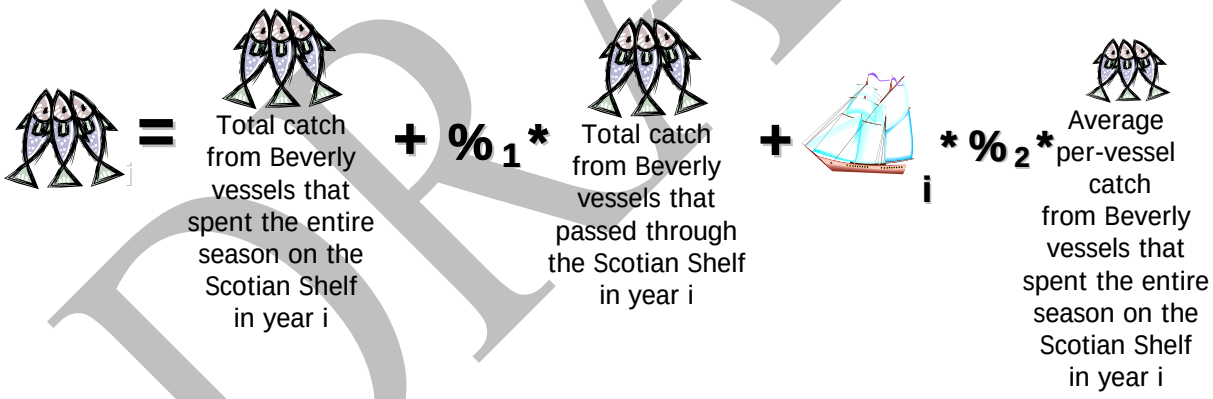
- Vessel name and homeport
- Vessel size (tonnage)
- Weight of cured cod (1 quintal = 112 lbs)
- Number of days at sea
- Number of trips the vessel made that year.

Analysis
Using the data described above, it was possible to chart the distribution of effort in the Grand Banks. This made it possible to compare the catches within what is now Canadian Statistical Area 4X, 4W and 4Vs. Through this comparison, the average size of fish could be compared. The average size cod in the catch 1850s was calculated to be 20 lbs, whereas the average size cod in the 1990s was calculated to be 6.5 lbs. Landings by 43 Beverly schooners on the Scotian Shelf in 1855 was calculated to be 8000t. Landings on the Scotian Shelf and the Bay of Fundy in 1999 by the entire Canadian fleet has been calculated to be 7200t.

It is possible to apply modern stock assessment methods to the landings and effort data to obtain an estimate of biomass. Vessels were put into categories based on information obtained from the vessel logs:

Vessel Classification	Description	Total Number	%
Beverly full time vessels	Fished the *entire season* on the Scotian Shelf	236*	14.4%
Beverly part time vessels	Fished *part of the season* the Scotian Shelf as they crossed towards more distant fishing grounds such as the Grand Banks.	90*	5.5
Non-*Beverly* vessels spoken	Identified their homeports and exchanged catch information with Beverly vessels on the Scotian Shelf. Beverly captains recorded these events in their daily log entries.	1313	80.1

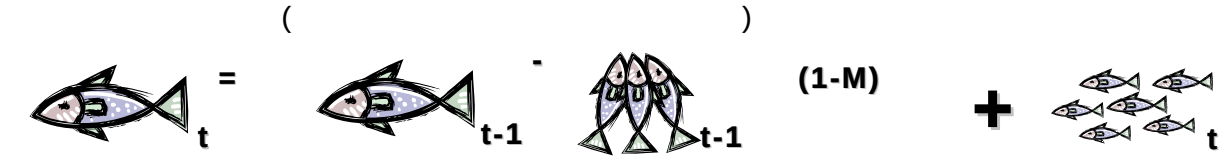
Using this information, estimates could be calculated for total catch in a year using the formula below:

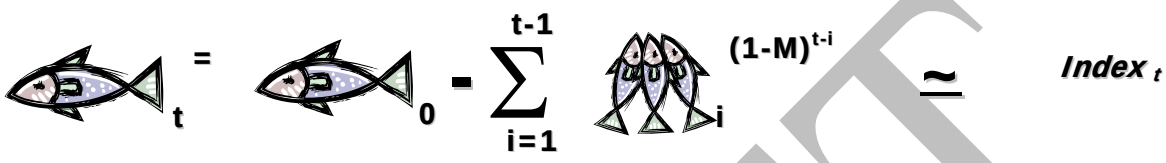


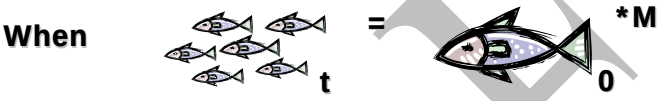
For %1, a range of percentages were used. 25% was used as a conservative guess.
The ship symbol indicated the number of spoken vessels on the Scotian Shelf from ports other than Beverly. Because actual counts were used, it is likely that this is underestimating the true number of vessels on the shelf from ports other than Beverly. This would lead to a underestimation of the total biomass.

For %2, again, a range of percentages were tested. 75% was used as a conservative guess.

The data was also analyzed using the Chapman-Delury Model to determine biomass. The Chapmen-Delury Model is represented below:





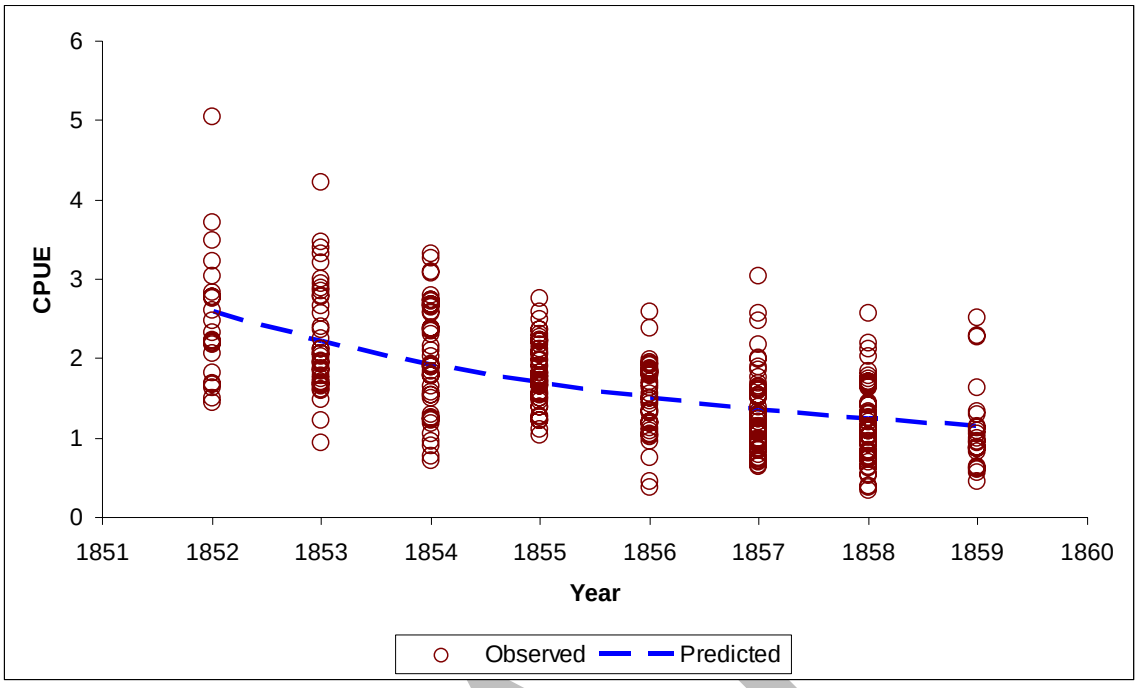


In the top line, the number of cod at time t equals the number of cod at t-1 minus the catch (in numbers) in t-1 all times one minus the natural mortality (e.g. survival) plus recruitment (in numbers).

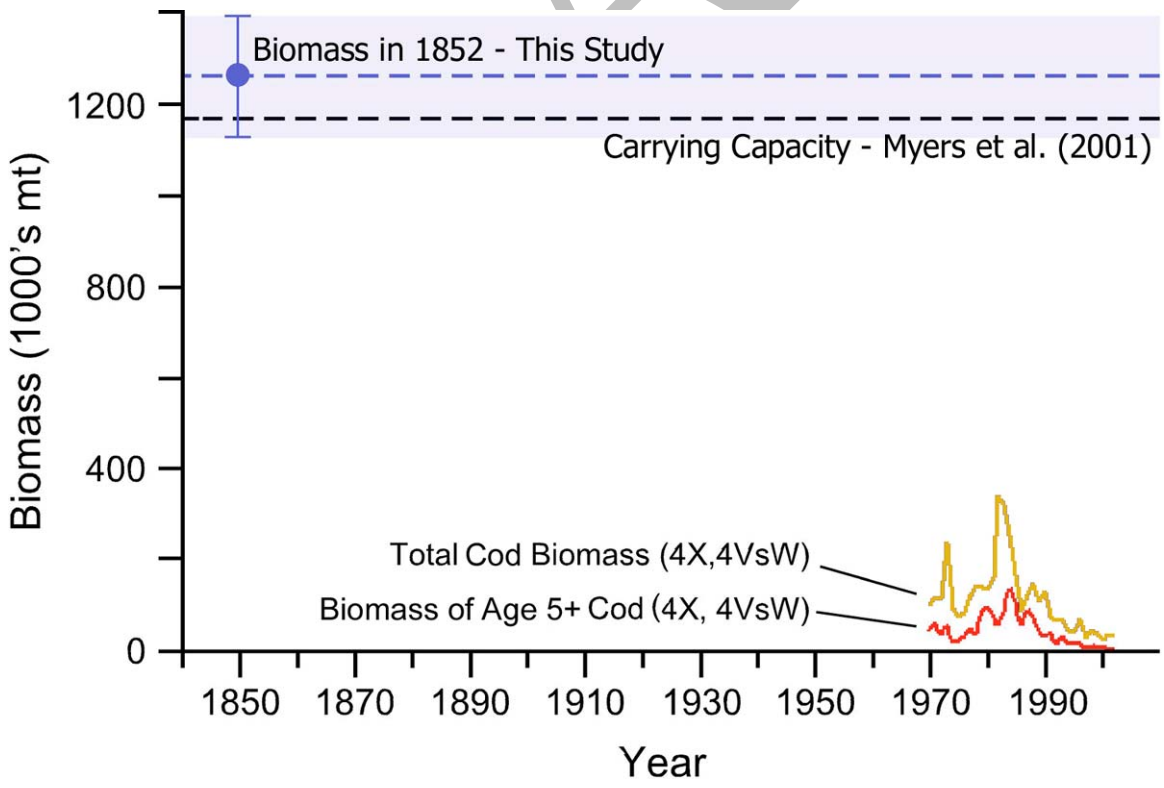
For the middle line, the number of cod at time t equals the number of cod at time zero (baseline) minus the cumulative catch adjusted for mortality. This is proportional to an index of abundance which in our case is CPUE (catch/(tons*days)). The equation of abundance at time t is fit to the index via robust regression.

The above holds when reproduction equals the natural mortality times the baseline abundance (e.g., reproduction offsets natural mortality). The standard Delury model does not make this assumption, and therefore has a slightly more complicated form.

Catch Per Unit of Effort (CPUE)
It is possile to calculate the CPUE from 1852-1859 based on Chapman-Delury model. CPUE equals the total catch in numbers in a season divided by (number of days on the shelf * vessel tonage). For the graphic below, each circle is the CPUE of a Beverly vessel that spent the entire season on the Scotian Shelf that year. The dotted line is the estimated CPUE from the best fit of the Chapman Delury model (which equals abundance times "catchability").



The following estimates can then be made for the historic biomass for cod in the Grand Banks fishing ground:



However, there were three key assumptions to which the results are sensitive:

- Amount of cod caught by the spoken vessels and the pass-through Beverly vessels.
- The mortality rate.
- The relationship between the mortality rate and reproductive rate.

Stellwagen Bank Historical Ecology
Historic datasets have been found that can be used to analyze the historic ecology on Stellwagen bank. Monthly Fishery Statistical Bulletins were developed and used between 1898 and 1935. These monthly bulletins included:

- Total removals.
- Temporal and spatial species composition.
- Fishing effort and behavior.
- Seasonality of fisheries.
- Regional comparative analysis.
- Historical context data.

These bulletins covered numerous fishing grounds throughout the Gulf of Maine (GOM), including Middle Bank, which is also known as Stellwagen Bank. Using data contained in the bulletins, spatial distribution of fish species can be mapped for the entire GOM. It is also possible to calculate the total landings (metric tons) on middle bank from 1901 to 1935. This was calculated to be:

- Haddock 26,238
- Mackerel 10,008
- Hake 9,277
- Cod 7,889
- Pollock 2,535
- Cusk 2,040
- Halibut 50

Data from the bulletins can also be analyzed to show changes in species composition over time. Also, seasonality of fish can be graphed over time. The data also provides information on the number of landings and the number of trips from 1901-1935. This can be further broken down to show catch by gear and to calculate CPUE by different gear.

It should be noted that:

- Existence of data is mostly due to random chance.
- Knowing even where to look for data requires expertise.
- Extracting data from historical sources is incredibly time consuming.
- Properly interpreting data from historical sources can be difficult.
- And then there are all the standard statistical and modeling issues.

Questions & Answers
Question 1: With the Grand Banks Fishery, are these individually owned or corporate vessels?
Answer: Both. Some vessels were individually owned and others were corporate.

Question 2: The numbers don't show that Beverly Grand Banks Fleet could have been catching juveniles. They may not be keeping them as it is easier to cure large cod. Is this accounted for?

Answer: There was no incentive to keep smaller fish. The cod were sold based on size.

Question 3: This data is for the Scotian Shelf only, correct?

Answer: Yes it is. However, the take home message is that given current data, we do a horrible job at estimating biomass.

Question 4: Is there a comparison of the methods of fishing between years on Middle Bank?

Answer: Just landings for now. We are now looking at effort and gear.

Question 5: Does the data for trawl mean otter trawl or beam trawl? The Boston fleet primarily used beam trawls prior to the 1940's.

Answer: The terms may be confused. This will be double-checked.

Question 6: Aren't there assessments on fish stocks going back to the early 1900's? When did they start?

Answer: Haddock assessments go back to the 1930's, but there is a discrepancy in the bycatch and discard.

Question 7: What is the timeline for the rest of the analysis on Middle Bank? Will other fish species be included?

Answer: This project should be completed by Fall 2007. As for other species, everything is being entered but has not been compiled yet.

Question 8: Are historians learning about spawning grounds through this data?

Answer: Yes, for cod. Usually, these grounds are not being fished now, but all data is being recorded. It will all be put on a map at some point.

ECOLOGICAL INTEGRITY DEFINITION

Kent Thornton, WG Facilitator, lead the Z WG discussion on the Ecological Integrity Subcommittee definition of ecological integrity.

Ecological Integrity

After hearing Ben Cowie-Haskell's presentation, members of the Z WG discussed the differences between the old definition and the definition proposed by the subgroup. After discussion, Z WG members agreed with the wording provided in Appendix A. Members agreed that this definition should be used, but that an 'unpacking document', similar to the one used for the Sanctuary Vision be developed for all terms referred to in the ecological integrity definition. During the discussion by the Z WG, a few major issues/topics were discussed in detail. These discussion points are summarized below.

Issue 1: **Historical Baseline**

The Z WG debated the addition of the wording "...within the context of historical baselines" to the definition of ecological integrity.

Discussion: Members discussed the addition of a historical baseline. Some members felt that the WG must define the historical baseline to use. This becomes critical since interrelationships have changed over time. It is possible that the WG may not just belooking at 100's but possibly

1000's of years in the past. Other members stated that is where in the continuum that the baseline is set that is important. It was stated that the subgroup tried to avoid stating a reference that the system should be established to levels prior to human involvement. It was more important to mention the use of a baseline, but that the actual timeframe should not be set here.

Members discussed the difficulty of determining exactly how far back to go in setting a baseline. Over long time periods, climate may fluctuate. A baseline must allow room for understanding how the system will work in the future. An historical baseline also covers concerns over native and introduced species. A baseline would help identify which introduced species are causing problems.

The WG agreed that parameters will eventually be set by the WG through the development of metrics. The historic baseline should be further defined in an 'unpacking document'. Members felt that the addition of the historical baseline to the definition was good since it generates discussion and is important. However, the definition of ecological integrity should move forward and the WG can work on an 'unpacking document' later.

Issue 2: **Humans as Part of the Ecosystem**

Members of the Z WG discussed how humans should be included in the definition of ecological integrity.

Discussion: Members discussed how the new definition shows the interaction between humans and the environment and that humans are not just users of natural resources. Such interaction is quantifiable. Other members suggested that this is where the historical baseline becomes critical. Depending on what decisions are made, an historical baseline may be set that is prior to human interaction. A number of WG members were concerned that the group was really discussion human and non-human resources. When discussing 'ecological integrity', many members focussed more on the biotic community rather than humans. These members were sensitive to task at hand, noting that the Sanctuary Act is clear and that the sanctuary must be managed for multiple uses. However, it is important to understand the impact uses may have on the ecosystem.

Issue 3: **'Structurally Intact' and 'Functionally Resilient'**

Z WG members discussed if the terms 'structurally intact' and 'functionally resilient' should be defined within the ecological integrity definition itself or be defined in the yet to be drafted 'unpacking document'.

Discussion: Members were concerned about the length and complexity that the ecological integrity definition would entail if everything was defined. Some members were sympathetic to the idea of having terms defined in the definition itself, but that terms should really have be defined in a separate 'unpacking document' or appendix. The ecological integrity definition must be clear and brief.

It was noted by other members that the 1st paragraph of the subgroup definition was most important. The subgroup agreed that the further term definitions should be included in some sort of appendix. The intent of the subgroup was to be able to educate readers of the definition, with no scientific background, what the terms meant. The subgroup also wanted to mediate possible argument later on in process. The WG was in agreement that other terms such as 'structurally intact', 'functionally resilient', 'historical baseline', etc., would need to be handled in an 'unpacking document'.

ECOLOGICAL INTEGRITY PERFORMANCE METRICS

Kent Thornton, WG Facilitator, lead the Z WG discussion on the Ecological Integrity Subcommittee's list of metrics (see Appendix D). The metrics were listed and possible data sets for each metric was identified. The subgroup first developed these metrics in March. Baselines and scoring criteria were added after by Ben Cowie-Haskell. New metrics were also included after discussions with Mike Fogarty and Jason Link.

It was stated that metrics need to be a tool used to determine if integrity of the sanctuary has been impacted, and if so, determine if zoning can be a tool reduce the impact. However, some members felt that the SBNMS was zoning in and of itself. The SBNMS is not homogeneous and determinations on zoning could be made without an exhaustive analysis. Other members were unsure how zoning would be able to address an impact should a metric show that such an impact had occurred. As an example, it was stated that if commercial size of demersal species decreased, or very few mature benthic communities are found within the sanctuary, there would be impacts on economics, diversity and sanctuary health. If the concern was for more mature benthic communities, then zones could reduce use of mobile gear in an area. If concern was size structure, zones could be used to limit all human activities in an area. However, such discussion would occur only if it is determined, through the use of metrics, that the integrity of the sanctuary had been impacted. It was noted that the Z WG was a SAC process. It could be possible to jump right into existing zoning schemes, but some measure of performance would be needed to base decisions on.

Many members expressed that they felt they were not qualified to make decisions on metrics. These members acknowledged the need to start somewhere and that the best indicators possible would be needed to determine if integrity of the sanctuary has been impacted. However, these members stated that the subgroup should use its expertise to refine the metrics list and identify what can and can't be done within a reasonable timeframe.

After discussion, WG members agreed that the metrics list should be brought back to the subgroup for further refining and indicate which metrics would be doable within a one to two year period. The subgroup should also provide a rationale for why the metric can be done and detail a method for evaluating each metric. It was noted that most metrics would need to use NOAA Fisheries survey trawl data and use the 1960's as an historical baseline. The subgroup would then report back on the methodology and metrics when their task is complete. The WG also indicated that David Pierce should be added to the subgroup membership. During the discussion by the Z WG, a few major issues/topics were discussed in detail. These discussion points are summarized below.

Issue 1: Biomass Metrics

The WG discussed the biomass metrics listed on the matrix.

> ***Discussion:*** It was agreed that a number of these metrics were needed. Species diversity indices would be a good addition. It was stated that Peter Auster was currently working on changes in diversity on Stellwagen Bank and would eventually be reporting on this analysis in late fall. It could be possible to repeat the analysis and compare it with new data to identify trends.
>
> There was a question by a number of members on whether biomass of fish species should be examined at the level of the entire GOM or just the SBNMS. It was stated that metrics needed to be measurable and that they should be specific to the SBNMS. However, this question persisted for metrics such as zooplankton and humpback whales. These species would need a monitoring program. Phytoplankton would also need monitoring to identify harmful algal blooms that could

impact the sanctuary. Again, this could occur both inside and outside the SBNMS. Members stated that looking only at the confines of sanctuary seems dangerous. There is a need to look at metrics in the context of the greater GOM. Humpbacks could be just outside the sanctuary and get scored low in monitoring within the sanctuary which could trigger some action, but the action may not be needed. Scale would depend on how the information was used. It was acknowledged that the sanctuary couldn't possibly monitor the entire GOM.
Members agreed with the benefits to monitor these metrics, but there was concern over how the information would affect management decisions.

The SBNMS is nested in the GOM, but it is not possible to monitor everything. It was noted, however, that the possibility existed to partner with other research organizations. It is also necessary to identify the most critical metrics, and have a spatial and cost hierarchy on what could possibly be measured. An ocean observing system is currently being built. It may be possible to be proactive and vocalize a need for a monitoring buoy within the SBNMS.

Issue 2: **Size Structure Metrics**
The WG discussed the size structure metrics listed on the matrix.

Discussion: Many members expressed that the inclusion of size structure as important. It would be possible to calculate size structure in relation to mortality. It would also be important to add biomass of species since rebuilding one species may be affected by another species, like dogfish predation on cod juveniles. Some members were concerned with the metrics listed for benthic invertebrates such as lobster. With the indicators for lobster, concern was raised that there is no documentation of lobster historic biomass, just landings and that it is not possible to truly understand the size frequency distribution from trawl data. Other members suggested that port sampling is conducted for length frequency, but not particular to the SBNMS. Also, trawl survey data can indicate trends over time and show change in expansion. Data should be identified specifically for the SBNMS, but data that can be gleaned from other sources should not be dismissed.

Issue 3: **Community Structure Metrics**
The WG discussed the community structure metrics listed on the matrix.

Discussion: It was suggested by some members that with community and food web structure, there was a need to have more discussion with Jason Link. These metrics came from his paper, but his measures relate more to the GOM and Georges Bank.

Issue 4: **Socio-Economic Metrics**
The WG discussed the socio-economic metrics listed on the matrix.

Discussion: Some members were concerned that socio-economic metrics were covered in other action plans. In the EBSM Action Plan, a human-use monitoring program has been recommended. Also, socio-economic metrics seem to be covered within the Compatibility Determination (CD) Action Plan. These members found it difficult to see how socio-economic concerns fit with ecological integrity. It was explained that if some measurable change on benthic communities were to occur that prevented mobile fishing gear use, there would be a need to know how that decision would affect local human communities. It is possible that catch value may show how changes in management are or are not working. With the SBNMS moving toward EBSM, the sanctuary is looking at humans as part of the ecosystem. Because of this, there is a

need to examine interactions between people and how they interact with the rest of the system. The sanctuary would need to examine what could happen to human populations due to a particular policy. Compatibility focuses on use, which is a small subset of how people interact with the sanctuary. It was also suggested by members that socio-economic metrics fit in with the Pressure-State-Response model that was explained at a previous Z WG meeting. Socio-economic metrics would fit both pressure and response. A healthy social system and human community is important. Examining socio-economic metrics can show change, both good or bad, providing needed information. As an example, if whale watching was gone, it would definitely say something about the state the sanctuary was in.

FINAL COMMENTS

Meeting adjourned.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Stellwagen Bank National Marine Sanctuary
175 Edward Foster Road
Scituate, MA 02066

ZONING WORKING GROUP MEETING
Stellwagen Bank National Marine Sanctuary
175 Edward Foster Road
Scituate, MA
Conference Room
24 August 2006
9:00 A.M. – 5:00 P.M.

DRAFT AGENGA

24 August 2006

9:00 **Welcome and Review of Agenda and Charge for the Working Group** (Chair)

9:10 **Ground Rules and Charge for the Day** (Kent Thornton, FTN Associates)

9:20 **Work Group Members – Re-introductions & Affiliation (**All**)**

9:40 **Ecological Integrity Definition – Per November Meeting &**

Proposed Revision (Ben Cowie-Haskell**)**

9:45 **Discussion of Revised Definition (**All**)**

10:15 **Final Ecological Integrity Definition (**All**)**

10:20 ***Break***

10:30 **Presentation: Examining historical baselines: a case study of cod and potential applications in SBNMS – Andrew Cooper, Univ. of New Hampshire**

11:00 **Questions/Discussion**

11:10 **Ecological Integrity SubGroup- Performance Metrics Matrix – Overview (**Ben Cowie-Haskell**)**

11:20 **Work Group Comments and Discussion: Moving Toward Consensus (**All**)**

11:50 **Morning Summary and Afternoon Activities (**Thornton**)**

12:00 ***Working Lunch, Visit the Research Vessel AUK***

1:15 **Ecological Integrity Performance Metrics – Developing a (**Thornton**) Short List and Process for Evaluation**

3:00 ***Break***

3:45 **Firm, Short List of Ecological Integrity Performance Metrics** (Thornton)
Summary

4:15 **Schedule, Next Steps, Action Items (**Thornton**)**

4:40 **Summary of Day** (Thornton)

4:50 **Final Comments, Thoughts —** (Chair, Cowie-Haskell)

5:00 ***Adjourn***

DIRECTIONS
From north or south: Follow Rte 3 to the Hanover (Route 53) Exit, (exit 13). Turn left Route 53 North going away from the Hanover Mall. Continue to the next set of lights at Route 123 (at Assinippi General Store).

Turn right onto Route 123. Follow through Norwell, into Scituate (a few miles). At the intersection of Route 3A, (first light after Assinippi Gen. Store) go straight across at the traffic lights and bear immediately to the right to the Stop sign. Then go straight across, onto The Driftway.

Stay on this road for two miles - follow the double yellow line all the way to the stop sign at the Bank of America.

At the stop sign, you will see a Bank of America ahead of you; on left a Catholic church; diagonally in front on the left the public parking lot. Bear right on to Edward Foster Road, past a salt marsh and over a small bridge. Over the bridge, bear to the left. It is a narrow, winding residential road. Shortly, it takes a sharp left turn at the crest of the first hill, past a boatyard and a seawall. Continue past Roberts Road, to Sunset Road (just at the end of a hedge row on the left). The SBNMS office is marked by a sign and looks like a Coast Guard station.

Turn left onto Sunset Road, to the parking area beyond the Annex. Please pull all the way forward to maximize use of the parking lot- the only one we have. Please do not park in front of anyone's house. If the lot is full you can park at the end of the road near the boathouse.

Appendix A

Final Ecological Integrity Definition

Ecological integrity is defined as the degree to which the system is structurally intact and functionally resilient within the context of historical baselines. Structurally intact means the native parts of the system are maintained as well as their interrelationships. Functional resilience is the system's ability to resist changes caused by human or environmental perturbations, or should change occur, to recover over time.

Appendix B

Original Ecological Integrity Definition Developed by the Z WG

Ecological integrity is defined as the degree to which the system is structurally intact and functionally resilient. Structurally intact means the parts of the system are maintained as well as their interrelationships. Functional resilience is the system's ability to resist changes caused by human or environmental perturbations, or should change occur, to recover over time to its former state without intervention.

Appendix C

Ecological Integrity Definition Developed by the Z WG Subgroup

"Ecological integrity is a concept that refers to the degree to which an ecological system, including humans, is structurally intact and functionally resilient within the context of historical baselines.

Structurally intact means that all the parts and interactions native to the system are present. In most marine systems, human presence and interactions have become part of the ecosystem and may be part of the historical baseline. System parts thus include, for example: species (including humans), biogenic structures, natural physical structures, and types of human uses.

Functional resilience is the system's ability to resist changes caused by human or other environmental perturbations or, should change occur, to recover to its former state and function. Important functions include nutrient cycling, primary and secondary productivity, food web interactions, reproduction, recruitment, and human interactions (economic, political, cultural, and social)."

Appendix D

Matrix for Ecological Integrity Metrics

STRUCTURALLY INTACT (parts)							
Biological							
	Attributes	***Metrics***	***Baseline***	***Restoration scoring criteria[1]***			***Data Source***
	Biomass			5	3	1	
	-fish (cod and other demersal guild species)	Proportion of historic biomass	1900s? 1960s?	>100%	>75%	>50%	NEFSC trawl surveys since 1963; UNH Historical Ecology Study?
	-fish (herring and other pelagic guild species	Proportion of historic biomass	1960s	>100%	>75%	>50%	NEFSC trawl surveys since 1963
	-macro crustaceans: lobster	Proportion of historic biomass	1960s	>100%	>75%	>50%	NEFSC trawl surveys since 1963
	zooplankton	Percent change in absolute abundance and change in community composition (shift to smaller body size?)	1970s	>100%	>75%	>50%	Zooplankton surveys since 1977; continuous plankton recorder surveys
	Humpback whales	Percent deviation from predicted mean abundance in SBNMS based on 25-year time series analysis	1980s	?	?	?	Surveys by Provincetown Center for Coastal Studies and the Whale Center of New England, SBNMS standardized shipboard survey
	Size structure						
	-fish (cod and other guild species)	Percent change in size frequency distribution	1960s	>100%	>75%	>50%	NEFSC trawl surveys since 1963
	-macro crustaceans (lobster)	Percent change in size frequency distribution	1960s	>100%	>75%	>50%	NEFSC trawl surveys since 1963; fishery landings (lbs. and number for area 19)
	Community structure						
	Community type	Percent change in relative abundances	Reference area	>100%	>75%	>50%	Seafloor Habitat Recovery Monitoring Program study, Species- reference area
	Food web structure	Mean number of interactions	1960s	>10%	<10%	<5%	NEFSC trawl surveys since 1963,

		per species (L/S)			below the max. observed across the time series.		sensu Link 2005[2]
	Fish diversity indices	Change in trend of indices	2006	?	?	?	Auster analysis in NCCOS report
	Full complement of native benthic species	Percent change in species richness	1960s	>100%	>75%	>50%	Wigley and Theroux 1998
		Percent change in amount of area impacted by mobile gear: 85 meters and deeper[3]: 85 meters and shallower:	2000	 >100% >100%	 >75% >75%	 >50% >50%	Vessel trip reports, vessel monitoring system
Socioeconomic							
	Diversity of human activities	Percent change in types of human uses	2006	<10%	>20%	>30%	SBNMS standardized shipboard survey
		Percent change in landings by gear type	1990s	?	?	?	Vessel trip reports
		Percent change in landings by port	1990s	?	?	?	Vessel trip reports
FUNCTIONAL RESILIENCE (functions or processes)							
Biological							
	Attributes	***Metrics***	***Baseline***	***Restoration scoring criteria[1]***			***Data Source***
	Productivity	Percent change in ratio of production/biomass	1980s	>100%	>75%	>50%	Primary prod.- chlorophyll a measurements Secondary prod- continuous plankton recorder, NEFSC trawls
	Reproduction	Percent change in spawning condition index	1960s	>100%	>75%	>50%	NEFSC trawl surveys
	Recruitment	Percent change in ratio of recruits to adults	1960s	>100%	>75%	>50%	NEFSC trawl surveys

Socioeconomic						
	Attributes	***Metrics***	***Baseline***	***Restoration scoring criteria[1]***			***Data Source***
	Magnitude of fishing and whalewatching	Percent change in ex-vessel value of commercial catch	1980s?	>100%	>75%	>50%	Vessel trip reports
		Percent change in size of commercial fishing vessels	2000	>100%	>75%	>50%	Vessel trip reports
		Percent change in size of commercial whalewatching vessels	2000	>100%	>75%	>50%	SBNMS data
	Dependency	Percent change in no. of water-side businesses that are dependent on sanctuary resources	1990s?	>100%	>75%	>50%	Mass Marine Trades Assoc. data?
		Percent change in no. of whalewatching vessels.	1980s	>100%	>75%	>50%	SBNMS standardized shipboard survey
	Economic loss	Percent change in lost value due to bycatch and regulatory discards	2000	?	?	?	Fishery observer data

Notes:
1- Ratings of 5, 3, 1 are assigned to each metric according to whether its value approximates, deviates somewhat from, or deviates strongly from (a) the baseline or (b) the value measured at a relatively undisturbed reference site.
2- Link, J.S. 2005. Translating ecosystem indicators into decision criteria. ICES Journal of Marine Science 62: 569-576.
3-85 meters is the depth maxima for storm wave disturbance. 75% of the SBNMS is above 85 meters.