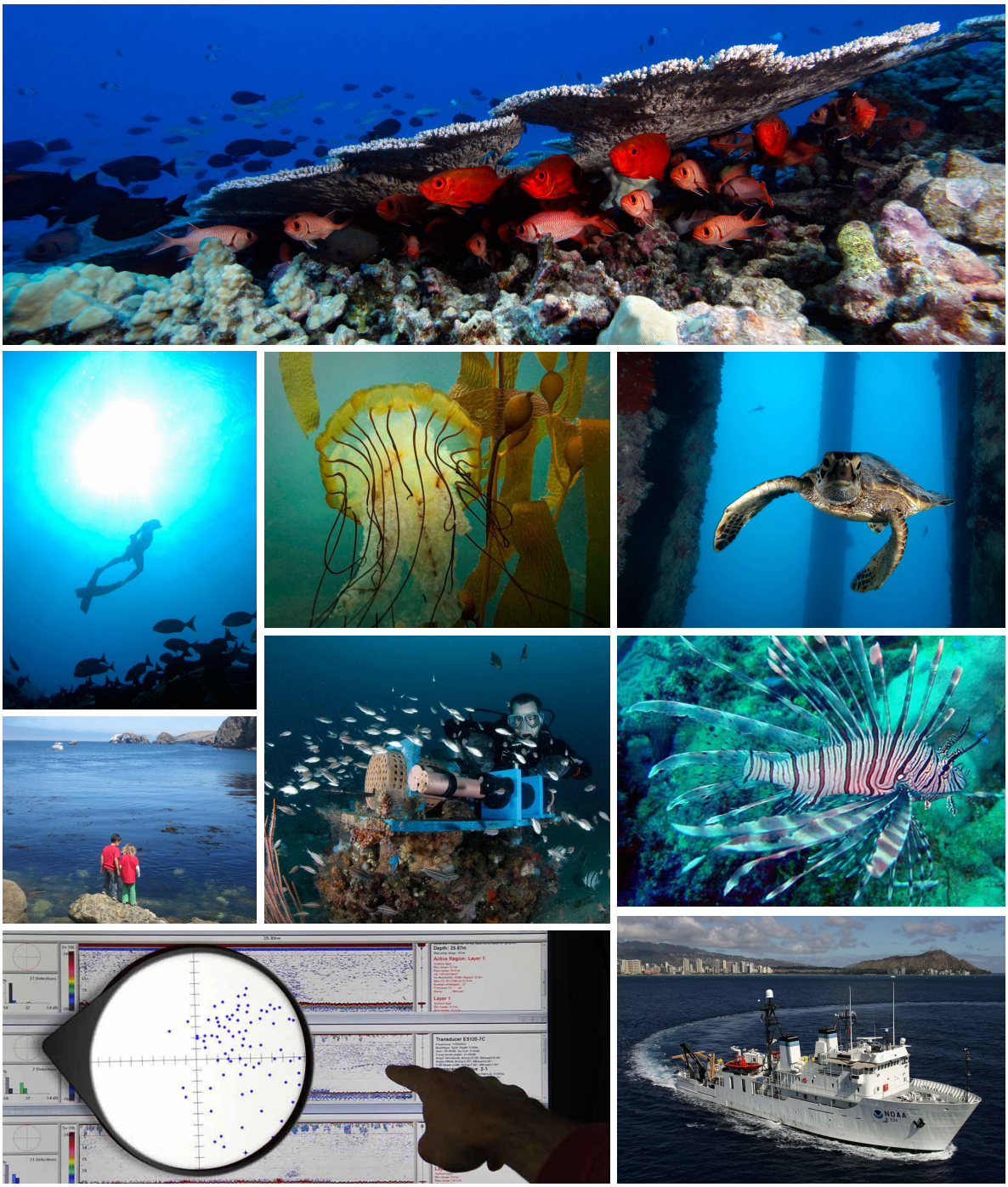
Guide for Developing National Marine Sanctuary Condition Reports



August 2015

NATIONAL MARINE SANCTUARIES

Photos:
Photos (Clockwise from top left): Fish and coral at Rapture Reef in the Papahānaumokuākea Marine National Monument/Greg McFall; Juvenille green sea turtle in the Papahānaumokuākea Marine National Monument/Greg McFall; Lionfish/NOAA NOS; NOAA Ship Hi'ialakai/NOAA NOS; Sonar echogram/NOAA NOS; Children at Scorpions Harbor near the Channel Islands National Marine Sanctuary/Brooke Liston; Diver and seafloor sensors/NOAA; Freediver in the Papahānaumokuākea Marine National Monument/Greg McFall; Jellyfish in kelp forest in Monterey Bay National Marine Sanctuary/Chad King

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Introduction

This Guidance Document is an introduction to sanctuary condition reports, a tool employed by the National Oceanic and Atmospheric Administration (NOAA) to assess the condition and trends of national marine sanctuary resources. Specifically, this Guidance Document describes the content of and the process used to develop a Condition Report.

Sanctuary condition reports provide a standardized summary of resources in NOAA's sanctuaries, drivers and pressures on those resources, current conditions and trends for resources and ecosystem services, and management responses to the pressures that threaten the integrity of the marine environment. Condition reports include information on the status and trends of water quality, habitat, living resources and maritime archaeological resources, and the human activities that affect them. They present responses to a set of questions posed to all sanctuaries. The reports also rate ecosystem services status and trends. Resource and ecosystem service status are rated on a scale from good to poor, and the timelines used for comparison vary from topic to topic. Trends in the status of resources and ecosystem services are also reported, and are generally based on observed changes in status over the past five years, unless otherwise specified.

The reports serve as a tool for resource managers, researchers, policy makers and educators. Condition reports distill large amounts of information, ranging from technical data to traditional, local and personal ecological knowledge into concise, easily understood assessments that can be interpreted for a wide audience. The reports help identify gaps in current monitoring efforts, as well as causal factors that may require monitoring and potential remediation in the years to come. The data discussed in the reports will enable resource managers and stakeholders to not only acknowledge prior changes in resource status, but also provide guidance for future management challenges.

The Office of National Marine Sanctuaries, part of NOAA, serves as the trustee for a system of 14 marine protected areas encompassing more than 170,000 square miles of ocean and Great Lakes waters. The 13 national marine sanctuaries and one marine national monument within the National Marine Sanctuary System represent areas of America's ocean and Great Lakes environment that are of special national significance. Within their waters, giant humpback whales breed and calve their young, coral colonies flourish and shipwrecks tell stories of our maritime history. Habitats include beautiful coral reefs, lush kelp forests, whale migrations corridors, spectacular deep-sea canyons and underwater archaeological sites. These special places also provide homes to thousands of unique or endangered species and are important to America's cultural heritage. Sites range in size from one square mile to almost 140,000 square miles and serve as natural classrooms, cherished recreational spots and are home to valuable commercial industries. The sanctuary condition reports serve as a management tool to assist in the protection and conservation of these special places.

Framework of the Condition Reports

Sanctuary condition reports are structured around two frameworks: (1.) the System-Wide Monitoring Framework (SWiM) and (2.) the Driving forces (Drivers)-Pressures-State-Ecosystem Services-Response Framework (DPSER). The first provides the generic structure of an ecosystem, used as the logic framework for the reports, while the second defines the structure of the condition reports themselves.

System-Wide Monitoring Framework (SWiM)

The SWiM Framework (Figure 1) assumes that, although every marine sanctuary has a unique ecosystem structure and function and thus requirements for monitoring, all have similar fundamental components and processes that interact in comparable ways. For this reason, the SWiM framework compartmentalizes the major aspects of an ecosystem – water, habitat, living resources and anthropogenic influences, and of additional interest to marine sanctuaries, maritime archaeological resources – in a generic way that can be applied to each national marine sanctuary, even in the face of obvious ecosystem differences.

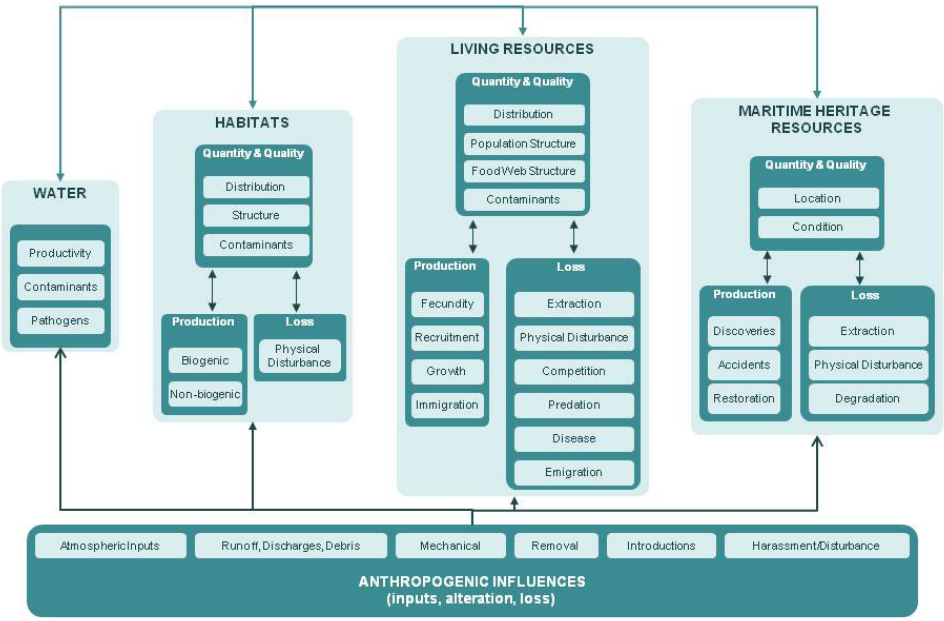


Figure 1. This diagram depicts the connectivity among three key areas of ecosystem structure and function, maritime archaeological resources and the human influences that affect each.

Driving forces (Drivers)-Pressure-State-Ecosystem Services-Response (DPSER) Framework

The first generation of sanctuary condition reports (2007-2013) was structured on a Pressure-State-Response (PSR) framework. The PSR framework assumes that human activities exert pressures on the environment, which can induce change in the condition, or state, of the environment (e.g., the quality and quantity of natural resources). The human responses to these changes (e.g., environmental and economic policies) are aimed at preventing, reducing or mitigating undesirable changes. In addition to containing a site history and resources sections, an overview of the sanctuary that describes the history of the area and common resources to the sanctuary, all first generation condition reports included a section devoted to each portion of the pressure-state-response framework.

For the second generation of condition reports, an expanded framework will be used – the DPSER Model – that will add two concepts that better incorporate humans into the ecosystem framework and the report itself (Figure 2). First, a discussion of Drivers will bring an additional understanding of the forces behind the pressures, based on various soci-

etal values, and how changes in those societal values affect the pressures. Drivers are the ultimate cause of changes in ecosystems, and can be biophysical, human or institutional in nature. Second, is the addition of an Ecosystem Services section. For purposes of this report, we define ecosystem services as "benefits that humans desire from the environment" (e.g., recreation or food). They are what link humans to ecosystems, can be goods or services (e.g., food is a good, and coastal protection is a service), are valued by various types of users and can be regulated directly by the environment, or managed by controlling human activities or ecosystem components (e.g., restoring habitats). Whether or not specific services are rendered can be evaluated based on attributes of the natural ecosystem that people care about. For example, recreational SCUBA divers care about water clarity and visibility in coral reef ecosystems. These are attributes that can be measured and assigned status and trend ratings, which then allows one to track one or more specific ecosystem services to which they pertain.

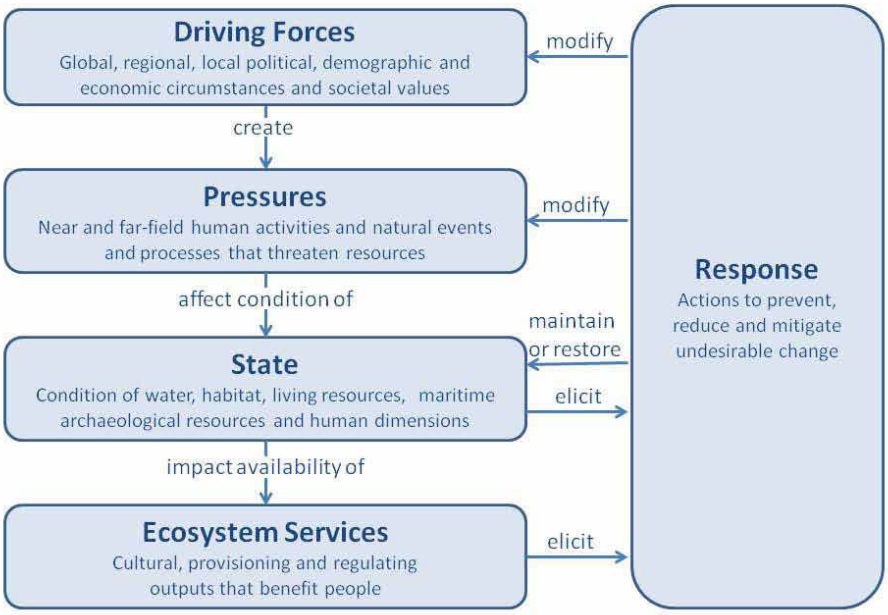


Figure 2. The DPSER Model describes the interactions between the environment and humans. The components of the model are: Driving Forces, Pressures, State, Ecosystem Services and Responses.

Sections of the Condition Reports

Each sanctuary condition report is structured in the same manner to provide a consistent reporting approach. Every report includes the following sections:

I. About This Report and System-Wide Monitoring
II. Summary and Findings
III. Summary Table
IV. Site History and Resources
V. Driving Forces
VI. Pressures on Sanctuary Resources
VII. State of Sanctuary Resources
VIII. Ecosystem Services
IX. Response to Pressures
X. Concluding Remarks
XI. Citations
XII. Appendices

NOTE - *Some sanctuaries may elect to combine sections V and VI in a section titled "Societal Values, Drivers and Pressures."*

I. About This Report and System-Wide Monitoring

All sanctuary condition reports include an About This Report section and a System-Wide Monitoring section. These pieces are identical in all reports as they provide a consistent message regarding the content of the condition reports. Specifically, the About This Report section describes the purpose and goals of the condition report while the System-Wide Monitoring section describes the system-wide monitoring framework that the sanctuary system has instituted, of which the condition reports are a part.

II. Summary and Findings

This section of the report serves as an abstract, or brief review, of the content and major findings of the condition report. Text in this section provides a summary of the conclusions made in the State of Sanctuary Resources section of the document.

III. Summary Table

Reports contain a Summary Table that summarizes the State of Sanctuary Resources section of the report. Ratings for the 17 questions and 12 ecosystem services are presented as colors indicating status and symbols indicating trends; indicators used to rate status and trend; description of findings (a standardized statement that best characterizes resource status); and the sanctuary's response (current or proposed management responses to pressures impacting sanctuary resources).

IV. Site History and Resources

This section is a general description of the marine sanctuary. Topics may include geological origin, the physical oceanographic setting and its dynamics, the cultural setting and history, commerce, protection history and any other topics that orient the reader to the site. This section also contains basic characterization information on water, habitat, living resources and maritime archaeological resources, that set the stage for discussions in the State section of the report.

V. Driving Forces

In previous condition reports, discussion was limited to a description of the pressures human activities exerted on sanctuary resources. In future reports, we will discuss pressures in the context of not only human activities, but drivers that affect those pressures, and changing societal values that in turn affect the drivers.

Drivers describe the effect of societal values on different uses of the ecosystem, resulting in pressures that affect the condition, or state, of the environment. Drivers may include specific changes in the demographics of an area (age structure, population, etc.), demand for ocean products, economic situations, industrial development patterns or business trends. Societal values may include levels of conservation awareness, political leanings or changing opinions about the acceptability of specific behaviors (e.g., littering, fishing). Drivers may be associated with particular pressures; therefore, for each of the pressures described, the states of influential drivers will also be discussed. In addition, an overall rating for the status and trends of drivers will be made in Question 17 (see below).

This section is intended to provide a better understanding of the reasons why pressures are operating and why they may be changing. By understanding the influential drivers and societal values, we can better predict future trends in pressures, even though they may be delayed. In addition, we can more clearly anticipate the nature of the "trade-offs" in different uses of the ecosystem resources. Trade-offs occur when two or more ecosystem services cannot be maximized simultaneously. In some cases, conflicting drivers preclude it, as in cases where demand for low cost goods conflicts with demand for living resource protection. This may happen, for example, when the shortest vessel routes must be changed because they traverse high density areas for endangered species. In other cases, a single driver, like high recreational demand, can lead to conflicts, like when fishing and diving areas overlap. Understanding the potential interactions between drivers can better inform policy and management responses. It can also influence education and outreach efforts designed to change societal values, ultimately altering driver impacts and reducing pressures.

VI. Pressures on Sanctuary Resources

There are numerous human activities and natural events and processes that are the proximal causes of changes in the condition of natural and archaeological resources in marine sanctuaries. The Pressures on Sanctuary Resources section of each condition report, however, identifies and describes the nature and extent of solely anthropogenic pressures that impact the state of the ecosystem. Natural "pressures" are not considered to be negative influences, and are therefore more appropriately discussed in the Site History and Resources section of the report. Because drivers and pressures are sometimes difficult to discuss separately, it might be helpful to combine the Driving Forces and Pressures sections into one section titled Societal Values, Drivers and Pressures.

VII. State of Sanctuary Resources

As a result of pressures, the state of the environment is affected. The State of Sanctuary Resources section of each condition report serves as a summary of the condition and trends of sanctuary resources within five areas: (1.) water, (2.) habitat, (3.) living resources, (4.) maritime archaeological resources and (5.) human dimensions. An ecological scorecard approach is used to assess resource conditions and trends across the sanctuary system.

The approach centers around a fixed set of 17 questions, which are answered using indicators that are relevant to the needs of individual marine sanctuaries. The questions and their indicators address information needs that are common to most or all sanctuaries, thereby accommodating the broad needs of reporting at the site level and nationally.

The reports provide both a narrative and visual tool that summarizes resource condition. All questions receive a rating pertaining to resource condition and are assigned a corresponding color code on a scale from "good" to "poor." These ratings are customized for each question through clarifying statements. In addition, symbols are used to indicate trends: "▲" – conditions appear to be improving; "▬" – conditions do not appear to be changing; "▼" – conditions appear to be declining; and "?" – trend is undetermined.

The State section of each condition report is a written summary of resource condition and trends and provides detailed answers and justifications for the 17 questions. The content for this section is sanctuary-specific and source material typically includes data, literature and personal experience. Evaluations of status and trends are made by subject matter experts who depend on quantitative and, when necessary, non-quantitative assessments and observations of scientists, managers and users.

The 17 questions are as follows (see Appendix A for descriptions and statements that are used to judge the status and assign a corresponding color code):

Water Quality

1. What is the eutrophic condition of sanctuary waters and how is it changing?
2. Do sanctuary waters pose risks to human health and how are they changing?
3. Have recent changes in climate altered water conditions and how are they changing?
4. Are other stressors, individually or in combination, affecting water quality, and how are they changing?

Habitat Resources

5. What is the integrity of major habitat types and how is it changing?
6. What are contaminant concentrations in sanctuary habitats and how are they changing?

Living Resources

7. What is the status of keystone and foundation species and how is it changing?
8. What is the status of other focal species and how is it changing?
9. What is the status of non-indigenous species and how is it changing?
10. What is the status of biodiversity and how is it changing?

Maritime Archaeological Resources

11. What is the archaeological integrity of known maritime archaeological resources and how is it changing?
12. Do known maritime archaeological resources pose an environmental hazard and how is this threat changing?

Human Dimensions

13. What are the levels of human activities that may adversely influence water quality and how are they changing?
14. What are the levels of human activities that may adversely influence habitats and how are they changing?
15. What are the levels of human activities that may adversely influence living resource quality and how are they changing?
16. What are the levels of human activities that may adversely influence maritime archaeological resource quality and how are they changing?
17. What are the states of influential human drivers and how are they changing?

VIII. Ecosystem Services

This section examines how humans benefit or suffer loss with changes in the conditions of resources, as noted in the State Section of the model. Collectively, these benefits are called "ecosystem services." Four categories of ecosystem services were identified in a four-year study by the United Nations in 2005, the "Millennium Ecosystem Assessment".[1] They are: (1.) cultural (non-material benefits), (2.) provisioning (products obtained), (3.) regulating (buffers to change, such as coastal protection) and (4.) supporting (processes like nutrient recycling that control other ecosystem services). For the condition reports, in which the primary focus of pressures and their impacts is on anthropogenic sources, we rate only "final" ecosystem services – defined as outputs that are directly used and valued by people and are consistent with the anthropogenic focus of the reports. Thus, we rate only the services in the cultural, provisioning and regulating categories. And while we recognize the importance of supporting services, which influence critical natural processes that support ecosystem structure and function, they are generally not explicitly valued by people. For instance, clean water that is safe for recreation (which is included in condition reports under the Regulating category) is a final ecosystem service that depends on a number of intermediate (supporting) services, such as dilution, nutrient cycling and decomposition. "Clean water" is therefore rated as an ecosystem service in the reports, while the supporting services are not. Supporting services, may, however, be discussed in the context of status ratings for various resource categories elsewhere in the report.

1 Millennium Ecosystem Assessment (MA). 2005. Ecosystems and Human Well-Being: Synthesis [1]. Island Press, Washington. 155pp.

Twelve specific ecosystem services will be rated in each condition report (Table 1). They are modified from the list in the "Millennium Ecosystem Assessment" and also embrace aspects of the "Goals" rated in the Ocean Health Index.[2] An example for South Florida, including the Florida Keys, can be found in Johns et al. (2013).[3] For a description of each ecosystem service, see Appendix A.

Table 1. The following 12 ecosystem services will be rated in each sanctuary condition report.

Cultural	*Provisioning*	*Regulating*
1. Sense of Place	5. Food	9. Clean Water
2. Tourism and Recreation	6. Ornamentals	10. Biodiversity
3. Science and Education	7. Biotechnology	11. Coastal Protection
4. Heritage	8. Energy	12. Climate Stability

IX. Response to Pressures

Responses are actions that individuals or institutions take to alter driving forces, pressures or resource conditions. The marine sanctuaries use an ecosystem based approach to comprehensively address and manage a variety of impacts, pressures and threats. The Response section of the condition reports describes the approach and goals of each sanctuary to protect, maintain and improve resources while also interpreting the marine environment for the public and facilitating human uses of the sanctuaries that are consistent with the primary objective of sanctuary resource protection.

X. Concluding Remarks

This section of the report serves as a final summary of the content and major findings of the condition report. Notably, this section should include a "looking ahead" piece that discusses any possible emerging threats to the sanctuary that were not discussed in the report, as well as expectations for the direction of sanctuary management and resources in the future.

XI. Citations

All reports should include a Literature Cited section that lists all publications cited in the report.

XII. Appendices

It is recommended that each condition report has at least two appendices. The first is Appendix A: Rating Scheme for Questions and Ecological Services. The purpose of this appendix is to clarify the 17 questions and 12 ecosystem services, and possible responses used to report their condition. Individual staff and partners use this guidance, as well as their own informed and detailed understanding of the site, to make judgments about the status and trends of sanctuary resources. The language in Appendix A is the same in all condition reports.

The second appendix, Appendix B: Consultation with Experts and Document Review, describes the process used to prepare a sanctuary condition report. Content should include the approach the sanctuary used to address the 17 questions and 12 ecosystem services (e.g., workshop, e-mails with experts, etc.), how experts qualified their level of confidence in their ratings and the various review stages the report went through.

2 Ocean Health Index. http://www.oceanhealthindex.org/Goals/.

3 Johns, G., C. Kelble, D. Lee, V.R. Leeworthy, W. Nuttle. 2013. Ecosystem Services Provided by the South Florida Coastal Marine Ecosystem, Version: 20 April 2013. MARES White paper – Ecosystem Services. Miami, Florida. 35pp. http://www.sofla-mares.org/docs/MARES_WhitePaper7_ESprovidedBySFCME_20130420.pdf.

Process for Drafting a Condition Report

The process for preparing condition reports involves a combination of accepted techniques for collecting and interpreting information gathered from subject matter experts. The approach varies somewhat from sanctuary to sanctuary in order to accommodate different work styles. The following outlines an approach that has been successful for many sanctuaries. It is organized by a suggested chronological order for drafting content for each section.

Drafting Initial Content

It is suggested that one person at each sanctuary with expertise in the history of the sanctuary and its resources, assume the role of primary author for the condition report. This person is responsible for drafting the initial content of the report. It is suggested that the following sections be completed first.

Section I. About This Report and System-Wide Monitoring

These two sections are identical in all reports, as they provide a consistent message regarding the content of the condition reports. The language in these sections will be provided by ONMS HQ staff to ensure consistency between sites.

Section IV. Site History and Resources

This section provides a general description of the marine sanctuary. It is the responsibility of the primary author to determine the initial content for this section. Source material may include management plans and associated documents, the sanctuary's website, sanctuary characterization and monitoring reports, institutional knowledge from sanctuary staff, Census Bureau statistics, general scientific literature on the sanctuary and its region and historical references that could be accessed via the sanctuary's online library or the NOAA library, etc.

Section V. Driving Forces

It is reasonable to consider combining this and the following section into one called Societal Values, Drivers and Pressures. This and the section on Ecosystem Services would benefit from a social scientist serving as the primary author. This may be the ONMS Chief Economist if local capacity does not exist and the section should be written before the expert workshop. There will also be a need to integrate concepts from these sections into the Site History and Resources, State, and Response sections. A primary source of socioeconomic information can be found on the ONMS Socioeconomic web site: http://sanctuaries.noaa.gov/science/socioeconomic. Where gaps in information exist, a valuable source of information might be members of the Sanctuary Advisory Council (SAC), particularly regarding drivers and pressures on sanctuary resources. Some members may also be helpful in providing initial input on the 17 questions.

Section VI. Pressures on Sanctuary Resources

The primary author should compile a list of known pressures to sanctuary resources. Content for this section is sanctuary-specific and therefore varies, but general topics may include: anchoring, artificial reefs, chemical and petroleum spills, coastal development, commercial and recreational fishing, coral bleaching events, cruise ships, diseases, dredging, entanglement, harmful algal blooms, marine debris, military use, noise, non-indigenous species, oil and gas industry, pollution and contamination, research activities, ship strikes, swimming advisories, vessel use, visitor use and wildlife disturbance. Source material for this section may include management plans and associated documents, the sanctuary's website, sanctuary characterization and monitoring reports and institutional knowledge from sanctuary staff.

Section VIII. Ecosystem Services

The lead author for this section would, like the Driving Forces section, be the ONMS Chief Economist, unless local capacity is available. Content for this section is sanctuary-specific and therefore varies. Each sanctuary is likely to have a very different mix of ecosystem services. A primary source of information is again the ONMS Socioeconomic web site. Where major gaps in information exist, a valuable source of information might be members of the SAC.

For rating ecosystem services, a two-step approach is used. In step 1, the effort is quantitative, and involves compiling economic indicators for each service and adjusting for other factors not related to natural resource/environmental attributes. Preliminary ratings on a five-point scale are done using only three levels of ratings (e.g., Good, Fair and Poor).[4]

4 Lee, D.J., G.M. Johns, V. R. Leeworthy. 2013. Selecting Human Dimensions Economic Indicators for South Florida Coastal Marine Ecosystems, Version: 19 May 2013. MARES White paper – Economic Indicators. Miami, Florida. 43pp. http://www.sofla-mares.org/docs/MARES_WhitePaper9_SelectingHDSindicators_20130519.pdf.

These ratings are done before the expert workshop. Step 2 is conducted at the workshop, where human dimension non-economic indicators and ecological indicators are used to make final ratings for each service and the certainty ratings for each service. The objective of step 2 is to check to see if economic indicators and human dimension non-economic indicators are telling a consistent story, and most importantly whether the ecological indicators suggest that the economic indicators are yielding an incorrect rating. Ratings based solely on economic indicators could send a false signal about the status of an ecosystem service if short-term economic gain is achieved as a result of sacrificing the stock of natural capital, leading to unsustainable levels of service.

Section IX. Response to Pressures

The author should compile a list of known management responses to the pressures that affect sanctuary resources. Content is sanctuary-specific, but topics generally include programs in place by both NOAA and our partners. Examples include a description of regulations (e.g., zones and spatial closures, gear restrictions, discharge prohibitions, etc.), education and outreach programs, enforcement efforts and monitoring and research program and partnerships. Source material may include management plans and associated documents, the sanctuary's website, sanctuary characterization and monitoring reports and institutional knowledge by sanctuary staff.

Section XII. Appendices

Appendix A: Rating Scheme for System-wide Monitoring Questions is identical in all condition reports as it provides a consistent tool for reporting on resource status and trend. The language in this section will be provided by ONMS HQ staff to ensure consistency between sites.

Addressing the State Section

In order to draft the State section during the first round of condition reports, most sanctuaries hosted a workshop. An approach that is closely related to the Delphi Method, a technique designed to organize group communication among a panel of geographically dispersed experts by using questionnaires, was employed to facilitate the formation of a group judgment. This method can be applied when it is necessary for decision-makers to combine the testimony of a group of experts, whether in the form of facts or informed opinion, or both, into a single useful statement.

The Delphi Method relies on repeated interactions with experts who respond to questions with a limited number of choices to arrive at the best supported answers. Feedback to the experts allows them to refine their views, gradually moving the group toward the most agreeable judgment. For condition reports, the set of 17 questions related to the status and trends of sanctuary resources is addressed, with accompanying descriptions and five possible choices that describe resource conditions.

In order to address the 17 questions and the ratings related to ecosystem services, it is recommend that sanctuary staff select and consult outside experts familiar with water quality, living resources, habitat, maritime archaeological resources and human dimensions. The recommended approach to gather expert input is for a workshop to be convened where experts can participate in facilitated discussions about each of the 17 questions. If logistical constraints prevent this, then phone calls, emails or one-on-one meetings with experts can also be conducted.

Identifying and Inviting Experts

Subject matter experts should be identified and invited to the workshop. A subject matter expert is generally considered someone who holds considerable historic and current information about a given topic and who should be deferred to in its interpretation.[5,6] Experts can represent various affiliations, including sanctuary staff, NOAA, other federal programs, state and territorial agencies and programs, tribes, private organizations and academic institutions. It is the responsibility of sanctuary staff to identify appropriate experts who have familiarity with local resources. It is recommended that the group size for expert workshops be between 10 and 20 individuals. This allows for a well-represented expertise base, without the group size becoming too large, which could impede meaningful discussions. It may also be beneficial to group experts by theme or question.

It is recommended that experts be invited to the workshop one to two months in advance. Experts may be invited to the workshop via a letter of invitation from the sanctuary superintendent. See Appendix B for an example letter. The

5 Barley, S.R. and G. Kunda. 2006. Contracting: a new form of professional practice. Academy of Management Perspectives 20:45–66.

6 Martin, T.G., M.A. Burgman, F. Fidler, P.M. Kuhnert, S. Low-Choy, M.M. McBridge, K. Mengersen. 2011. Eliciting expert knowledge in conservation science. Conservation Biology 26(1)29–38.

letter should highlight how the workshop process will proceed, identify who will prepare the draft condition report and identify who will be responsible for process and results. It is important to inform the experts invited to the workshop that they should be prepared to share evidence on the sanctuary's status and trends at the meeting. It is recommended that background material be provided to each expert so that they can familiarize themselves with the condition report and the set of questions prior to their arrival at the workshop. This will allow for more informed decision making. Background material may include:

1. Workshop Agenda (Appendix C)
2. Guidance Document
3. Sample condition reports so that experts can familiarize themselves with the framework and content of the reports.
4. Latest draft of the site's condition report (e.g., any content that has been drafted for the Site History and Resources; Societal Values, Drivers, and Pressures; and Response sections), which should be reviewed for content, accuracy and potential gaps.
5. Set of 17 Questions and their descriptions. It is highly recommended that each expert familiarize themselves with these, as well as the response options, prior to the workshop so that they can make informed decisions and possibly bring supporting material (e.g., data, publications, etc.).
6. Description of Ecosystem Services and the rating system to be used to assess them.
7. Because many of the questions refer to the term "ecological integrity" it is recommended that invitees familiarize themselves with this term prior to the workshop (see Appendix A for definition).

Hosting the Workshop

A facilitator should be identified in advance to lead workshop discussions. This person should be impartial but have a basic expertise and understanding of marine ecology and ocean health. The facilitator needs to be familiar with the set of questions and the response options, and be capable of moderating lively discussions. The facilitator should not be involved in the scoring and should remain impartial to the experts' judgments. With experience, the facilitator can help interpret questions and inform the experts how other marine sanctuaries have handled similar issues, and can help the group come to agreement on the most appropriate ratings. The role of the facilitator includes: overseeing the workshop activities, clarifying the process, answering experts' questions about the process and the questions themselves, and ensuring that the agenda is followed. A notetaker should also be identified in advance. The primary author of the report must attend the workshop.

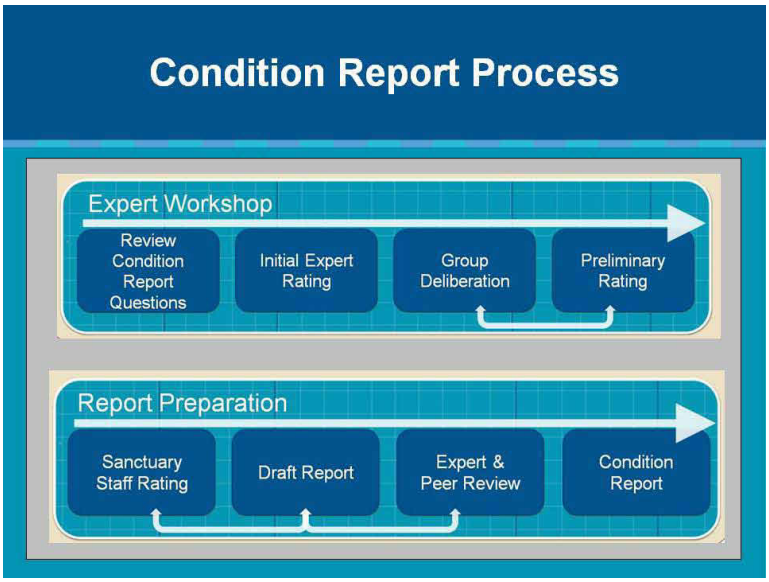


Figure 3. Major steps of expert workshops and subsequent requirements for the preparation of sanctuary condition reports.

Workshops are typically held over four days, though more time may be needed to cover all resource categories and the ecosystem service ratings. The basic steps of the workshop and subsequent activities are shown in Figure 3 and described below:

Relying on Expert Judgment

In developing the status and trend ratings, workshop participants may be faced with the challenge of making determinations in the absence of data. In cases where actual monitoring data and related information are unavailable, it is common to consider expert input, judgment and opinion. For condition reports, it is understood that expert opinion is not a substitute for actual monitoring programs, but it is a viable and valuable resource to support responses to the 17 questions, as long as uncertainty is documented. Appropriately qualified, expert input is an essential link between data collected and the use of that data for management. Experts interpret and translate the data, and provide the power of prediction needed to give decision makers confidence that their actions will have the desired outcome.

1. At the start of the workshop, the facilitator should begin by providing an overview of the purpose and objectives of the condition report. The facilitator should review the workshop agenda and thoroughly describe the process that will be undertaken to answer the questions, including a description of the Delphi Method.
2. The facilitator should review with the group the material that has already been prepared in the report (e.g., Site History, Drivers, Pressures, Ecosystem Services, Response sections, etc.) and confirm that they are accurate and complete.
3. The facilitator should then review each question with the experts. This includes a thoughtful explanation of the descriptive paragraph that accompanies each question and a thorough overview of each statement that accompanies the status ratings. The options for a trend rating should also be reviewed. This review will ensure that everyone has a common understanding of the question's scope.
4. The group, under the direction of the facilitator, should then take on the task of answering each question individually. The process for each question is the same. Based on the expertise of the subject matter experts, the group is asked to provide recommendations on status and trend ratings for each question. When replying to each question, for both status and trend, the experts should focus on the standardized statements, not the colors or symbols. When making a recommendation, experts must provide their basis for judgment (e.g., publications, personal observations, data etc.); discussions and debate will likely ensue. In order to ensure consistency with Delphic methods, a critical role of the facilitator is to minimize dominance of the discussion by a single individual or opinion (which often leads to "follow the leader" tendencies in group meetings) and to encourage the expression of honest differences of opinion.
   As discussions progress, the group will likely converge on a rating that most accurately describes the current resource condition. After an appropriate amount of time, the facilitator should ask whether the group can agree on a rating for the question, as defined by specific language linked to each rating (see Appendix A). If an agreement is reached, the result is recorded and the group can move on to consider the trend in the same manner. If agreement is not reached, the facilitator should instruct sanctuary staff to consider all input and decide on a rating and trend at a future time, and to send their ratings back to workshop participants for individual comment. It is the notetaker's responsibility to accurately capture the salient points of discussion, identify key contributors to the conversation and possibly collect any resources that are mentioned (e.g., data sets, publications, etc.).
5. After status and trend ratings are decided for a question, it is recommended that experts at the workshops are given the opportunity to express and document their level of confidence in their status and trend ratings by characterizing the sources of information they used to make their judgments. A confidence scale should be used (see Appendix D for details) and a ranking of information quality is suggested for three categories: (1.) data, (2.) literature and (3.) personal experience.
6. Steps 2-4 can also be used to get expert ratings of the status and trends for the ecosystem services, with some modification using the two-step process described in section VIII; additional people with socioeconomic expertise will need to assist with this process. The challenge is to identify indicators relevant to the ecosystem services, discuss their status and trends and combine thoughts about several of them to collectively agree on an overall rating for the service.
7. The facilitator should then remind the experts that the information collected during the workshop will be compiled into the next draft of the condition report, which they will be asked to review. Experts should also be reminded to send the facilitator and/or primary author any additional source material, such as publications, data or figures that may be useful when compiling the report.

First Full Draft

The remaining sections of the report are drafted following the workshop.

VII. State of Sanctuary Resources

After the workshop, it is the responsibility of the primary author to compile the notes from the meeting and draft responses to the set of questions for the State section of the report. The author should review the notes taken during the workshop along with any additional information that may have been collected (e.g., publications, data, figures, graphs, etc.). The author may need to contact some of the experts from the workshop to clarify points or to provide additional information. Visuals such as graphs and charts may be useful accompaniments to each question. Appropriate citations should also be included when drafting text. The questions in the State section should summarize the opinions and uncertainty expressed by the experts. Comments and citations received from the experts should be included, as appropriate, in text supporting the ratings.

The response for each question should include the following:

- A statement that defines the status and trend ratings
- A clear statement of the basis for judgment
- Data and/or other information used to determine status and trend
- Time frame used to judge the trend
- Description of the baseline condition used for the rating
- Appropriate text supporting the ratings

In addition, a table should accompany each subsection of the State section of the report (e.g., water, habitat, living resources, maritime archaeological resources, human dimensions) that provides a brief summary of the information found in the State section (see Figure 4 for an example). Each question found in that section of the report should be presented along with its rating (color indicating resource condition and symbol indicating trend), indicators used as a basis for judgment (short statement or list of indicators used to justify the rating) and description of findings (standard statement from Appendix A that best characterizes resource status).

Good	Good/Fair	Fair	Fair/Poor	Poor	Undet.

▲ = Improving — = Not changing ▼ = Declining
? = Undetermined trend **N/A** = Question not applicable

#	Questions/Resources	Rating	Indicators	Description of Findings
WATER				
1	Stressors	▼	Elevated levels of contaminants (e.g., persistent organic pollutants), and ocean temperature and chemistry changes, some of which have been linked to changes in the offshore ecosystem.	Selected conditions may inhibit the development of assemblages and may cause measurable but not severe declines in living resources and habitats.
2	Eurotrophic Condition	▼	Nutrient enrichment in selected areas, increased nutrient loading, and increased frequency and intensity of harmful algal blooms.	Selected conditions may preclude full development of living resource assemblages and habitats, but are not likely to cause substantial or persistent declines.
3	Human Health	?	Measurable levels of biotoxins and contaminants in some locations that have the potential to affect human health; no reports of human impacts.	Selected conditions that have the potential to affect human health may exist but human impacts have not been reported.
4	Human Activities	▲	Inputs of pollutants from agriculture and urban development; reduced risk of impacts from vessels due to regulation of traffic patterns and discharges, removal of oil from sunken ships.	Selected activities have resulted in measurable resource impacts, but evidence suggests effects are localized, not widespread.

Figure 4. Tables should accompany each subsection in the State section of the reports. The table should include the status and trend rating, indicators used to make the rating and a description of findings for each question. This table is an example from the Monterey Bay NMS Condition Report.

VIII. Ecosystem Services

The same approach to summarizing information in the State section of the report should be used to complete the Ecosystem Services section. A similar table should also be included (see Appendix A for example) showing the ratings of status and trends for each service, indicators used as a basis for judgement, the description of findings and other relevant information, such as management considerations or sustainability.

III. Summary Table

All rating tables found in the State section of the report (see Figure 4 for an example) and the Ecosystem Services section of the report (see example at the end of Appendix A) should be compiled into "Summary Tables" that are presented at the beginning of the report. The tables summarize the State of Sanctuary Resources and Ecosystem Services sections of the report. For the State of Sanctuary Resources, each of the 17 questions is presented along with its rating, indicators used to make the ratings, description of findings and the sanctuary's response (current or proposed management responses to pressures impacting sanctuary resources). A similar summary should also be done for each ecosystem service, as described above.

II. Summary and Findings

This section serves as a brief review of the content and major findings of the condition report (similar to an Abstract). Specifically, text in this section should provide a summary of the conclusions made in the State of Sanctuary Resources and Ecosystem Services sections of the document and current management actions directed at the pressures affecting resources. The Summary and Findings section is brief and typically 2-3 paragraphs in length.

X. Concluding Remarks

After all sections of the report are drafted, the Concluding Remarks section should be completed. This section should reflect on the content and major findings of the condition report, particularly on their implications relative to sanctuary resource protection goals. The primary author should consider including a "looking ahead" piece that discusses any possible emerging threats to the sanctuary that were not discussed in the report, as well as expectations for the direction of sanctuary management and resources in the future. The Concluding Remarks section is brief and typically 2-3 paragraphs in length.

XI. Citations

All citations found in the report, including any literature that was compiled during the workshop and ultimately included in the State section, should be included the Citations section.

Review Periods

Once all sections of the condition report are compiled, it must be reviewed. It is recommended that each report undergo a series of reviews by subject matter experts and important partners.

Initial Review

It is recommended that the first draft of the document be sent to the subject matter experts who were invited to the workshop (this could also include those who had been invited to the workshop but could not attend) for what is called an Initial Review. These experts are given 3-4 weeks to review the report in order to ensure that it accurately reflects the input they provided. This review period is also an opportunity for experts to identify information gaps and provide comments and revisions to the ratings and text. Upon receiving comments from the experts, the writing team should edit and revise the text and ratings as it deems appropriate. If changes are extensive or complex, the team should ask the experts who suggested them to confirm the accuracy of the new content.

Invited Review

The next draft of the report is then sent to particularly important partners in research and resource management, as well as local decision makers, for what is called an Invited Review. This may include sanctuary advisory councils, other NOAA offices (e.g., NMFS), other NOS programs (e.g., Marine Debris Program) and state and tribal partners. The writing team should consult with sanctuary leadership to identify appropriate reviewers. These bodies are given 3-4 weeks to review the document and are asked to review the technical merits of resource ratings and accompanying text, as well as to point out any omissions or factual errors. This review period ensures that all interested parties are afforded the opportunity to review and comment on the report. Again, the writing team is responsible for addressing and editing the report as appropriate per the comments received.

External Peer Review

A final draft of the report is then sent out for an External Peer Review. This review is a requirement that started in December 2004, when the White House Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review (OMB Bulletin) establishing peer review standards that would enhance the quality and credibility of the federal government's scientific information. Along with other information, these standards apply to "Influential Scientific Information," which is information that can reasonably be determined to have a "clear and substantial impact on important public policies or private sector decisions." The condition reports are considered Influential Scientific Information. For this reason, these reports are subject to the review requirements of both the Information Quality Act and the OMB Bulletin guidelines. Therefore, following the completion of every final draft of a condition report, they must be reviewed by a minimum of three individuals who are considered experts in their field, were not involved in the development of the report and are not employees of the sanctuary preparing the report. Their review is solicited via a letter that is sent from the Deputy Director of the Office of National Marine Sanctuaries (see Appendix E). Comments from these peer reviews are incorporated into the final text of the report. Furthermore, OMB Bulletin guidelines require that reviewer comments, names and affiliations be posted on the agency website. Reviewer comments, however, are not attributed to specific individuals. Following the External Peer Review the comments and recommendations of the reviewers should be considered by sanctuary staff and incorporated, as appropriate, into a final draft document. In some cases sanctuary staff may reevaluate the status and trend ratings and when appropriate, the accompanying text in the document may be edited to reflect the new ratings.

The final interpretation, ratings and text in the condition report are the responsibility of sanctuary staff, with final approval by the sanctuary superintendent. To emphasize this important point, authorship of the report is attributed to the sanctuary alone. Subject experts are not authors, though their efforts, names and affiliations should be acknowledged in the report.

Finalizing the Report

Once all text and figures are finalized, the report must be copy edited and formatted to meet ONMS standards. A website will also be developed to host the report. These actions are completed at ONMS headquarters. A checklist of "final tasks" is available from headquarters upon request.

Disseminating the Report

Once the report is finalized, it should be released to the public. This may be done through a variety of channels including: posting an electronic version (pdf) on the web, producing hard copy reports that can distributed, informing Congress (see Appendix F for an example letter to Congress) and notifying the media (see Appendix G for an example of a press release). These actions are mainly coordinated through ONMS headquarters.

Appendices

Appendix A: Rating Scheme for System-Wide Monitoring Questions for Sanctuary Resources and Ecosystem Services

This appendix clarifies the questions and responses used to report the condition of sanctuary resources and ecosystem services in condition reports for national marine sanctuaries. Sanctuary staff and subject experts use this guidance, as well as their own understanding of the condition of resources, to make judgments about the status and trends of sanctuary resources.

In 2012, the Office of National Marine Sanctuaries modified some of the 17 questions and the possible responses used in the first round of condition reports; the revised questions are presented here. Although all questions have been edited to some degree, both in their description and status ratings, the nature and intent of most questions have not changed. Four (questions 3, 7, 8 and 17), however, are either new or are significantly altered and therefore, are not directly comparable to the 2004 questions. For these, a new baseline will need to be considered.

During workshops in which status and trends are rated, subject experts discuss each question, and available data, literature (e.g., published scientific studies, reports) and experience associated with the topic. They then discuss the statements provided as options for judgments about status; these statements have been customized for each question. Once a particular statement is agreed upon, a color code and status rating (e.g., good, fair, poor) is assigned. Experts can also decide that the most appropriate rating is "N/A" (the question does not apply) or "Undetermined." (resource status is undetermined due to a paucity of relevant information).

A subsequent discussion is then held about the trend. Conditions are determined to be improving, remaining the same or declining in comparison to the results found in the first round of condition reports. Symbols used to indicate trends are the same for all questions: "▲" – conditions appear to be improving; "▬" – conditions do not appear to be changing; "▼" – conditions appear to be declining; and "?" – trend is undetermined.

Ecological Integrity

Ratings for a number of questions depend on judgments of the "ecological integrity" of marine sanctuary ecosystems because one of the foundational principles behind the establishment of marine sanctuaries is to protect ocean ecosystems. The term ecological integrity is used to imply the presence of naturally occurring species, populations and communities, and ecological processes functioning at appropriate rates, scales and levels of natural variation, as well as the environmental conditions that support these attributes (modified from National Park Service Vital Signs monitoring program).[7] Sanctuaries have ecological integrity when they have their native components intact, including abiotic components (the physical forces, habitats and chemical elements, such as water), biogenic habitats, biodiversity (the composition and abundance of species and communities) and ecological processes (e.g., competition, predation, symbioses) (modified from Parks Canada).[8] For purposes of this report, the level of integrity that is judged to exist is based on the extent to which humans have altered specific components and attributes of the system, and the effect of that change on the ability of an ecosystem to resist continued change and recover from it; the statements for many questions are intended to reflect this judgment. Reference in the rating system is made to "near-pristine" conditions, which for this report would imply a status as near to an unaltered ecosystem as we can reasonably presume to exist, recognizing that there are virtually no ecosystems on Earth completely free from human influence.

Not all questions, however, use ecological integrity as a basis for judgment. One focuses on the impacts of water quality factors on human health. Two questions rate the status of keystone and key species compared with that expected in an unaltered ecosystem. One rates maritime archaeological resources based on their historical, archaeological, scientific and educational value. Another considers the level and persistence of localized threats posed by degrading archaeological resources. Finally, four ask specifically about the levels of on-going human activities that could affect resource condition.

7 National Park Service Vital Signs Monitoring Program. http://science.nature.nps.gov/im/monitor.
8 National Parks of Canada, Ecological Integrity. http://www.pc.gc.ca/progs/np-pn/ie-ei.aspx.

WATER QUALITY

Question 1 (Water/Eutrophic Condition): What is the eutrophic condition of sanctuary waters and how is it changing?

Eutrophication is the accelerated production of organic matter, particularly algae, in a water body. It is usually caused by an increase in the amount of nutrients (largely nitrogen and phosphorus) being discharged to the water body. As a result of accelerated algal production, a variety of interrelated impacts may occur, including nuisance and toxic algal blooms, depleted dissolved oxygen and loss of submerged aquatic vegetation.[9] Indicators commonly used to detect eutrophication and associated problems include nutrient concentrations, chlorophyll content, rates of water column or benthic primary production, benthic algae cover, algae bloom frequency and intensity, oxygen levels and light penetration.

Eutrophication of sanctuary waters can impact the condition of other sanctuary resources. Nutrient enrichment often leads to plankton and/or algae blooms. Blooms of benthic algae can affect benthic communities directly through space competition. Indirect effects of overgrowth and other competitive interactions (e.g., accumulation of algal-sediment mats) often lead to shifts in dominance in the benthic assemblage, oxygen depletion, etc. Disease incidence and frequency can also be affected by algae competition and changes in the chemical environment along competitive boundaries. Blooms can also affect water column conditions, including light penetration and plankton availability, which can alter pelagic food webs. Harmful algal blooms (HABs), some of which are exacerbated by eutrophic conditions, often affect other living resources, as biotoxins are consumed or released into the water and air, or decomposition depletes oxygen concentrations.

Good	Eutrophication has not been documented, or does not appear to have the potential to negatively affect ecological integrity.
Good/Fair	Eutrophication is suspected and may degrade some attributes of ecological integrity, but has not yet caused measurable degradation.
Fair	Eutrophication has caused measurable but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Eutrophication has caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Eutrophication has caused severe degradation in most, if not all attributes of ecological integrity.

9 Bricker, S.B., C.G. Clement, D.E. Pirhalla, S.P. Orlando, D.R.G. Farrow. 1999. National estuarine eutrophication assessment: effects of nutrient enrichment in the nation's estuaries. NOAA, National Ocean Service, Special Projects Office and the National Centers for Coastal Ocean Science. Silver Spring, MD.

Question 2 (Water/Human Health): Do sanctuary waters pose risks to human health and how are they changing?

Human health concerns are generally aroused by evidence of contamination (usually bacterial or chemical) in bathing waters or seafood intended for consumption. They also arise when harmful algal blooms are reported or when cases of respiratory distress or other disorders attributable to harmful algal blooms increase dramatically. Any of these conditions should be considered in the course of judging the risk sanctuary waters pose to humans.

Some sanctuaries may have access to specific information about beach closures and seafood contamination. In particular, beaches may be closed when criteria for water safety are exceeded. Shellfish harvesting and fishing may be prohibited when contaminant or biotoxin loads or infection rates exceed certain levels. Alternatively, seafood advisories may also be issued, recommending that people avoid or limit intake of particular types of seafood from certain areas (e.g., when ciguatera poisoning is reported). Any of these conditions, along with changing frequencies or intensities, can be important indicators of human health problems and can be characterized using the descriptions below.

Good	Water quality does not appear to have the potential to negatively affect human health.
Good/Fair	One or more water quality indicators suggest the potential for human health impacts, but human health impacts have not been reported.
Fair	Water quality problems have caused measurable human impacts, but effects are localized and not widespread or persistent.
Fair/Poor	Water quality problems have caused severe impacts that are either widespread or persistent.
Poor	Water quality problems have caused severe, persistent and widespread human impacts.

Question 3 (Water/Climate Change): Have recent changes in climate altered water conditions and how are they changing?

The purpose of this question is to capture shifts in water quality, and associated impacts on sanctuary resources, due to climate change. Though temporal changes in climate have always occurred on Earth, evidence is strong that changes over the last century have been accelerated by human activities. Indicators of climate change in sanctuary waters include water temperature, acidity, sea level, upwelling intensity and timing, storm intensity and frequency, changes in erosion and sedimentation patterns, and freshwater delivery (e.g., rainfall patterns). Climate-related changes in one or more of these indicators can impact the condition of habitats, living resources, and maritime archaeological resources in marine sanctuaries.

Increasing water temperature has been linked to changing growth rates, reduced disease resistance and disruptions in symbiotic relationships (e.g., bleaching on coral reefs), and changes in water temperature exposure may affect a species' resistance or the capacity to adapt to disturbances. Acidification can affect the survival and growth of organisms throughout the food web, as well as the persistence of skeletal material after death (through changes in rates of dissolution and bioerosion). Recent findings also suggest acidification impacts at sensory and behavioral levels, which can alter vitality and species interactions. Sea level change alters habitats, as well as their use and persistence. Variations in the timing and intensity of upwelling is known to change water quality through factors such as oxygen content and nutrient flow, further disrupting food webs and the natural functioning of ecosystems. Changing patterns and intensities of storms alter community resistance and resilience within ecosystems that have, over long periods of time, adapted to such disturbances. Altered rates and volumes of freshwater delivery to coastal ecosystems affects salinity and turbidity regimes and can disrupt reproduction, recruitment, growth, disease incidence, phenology and other important processes.

Good	Climate-related changes in water conditions have not been documented or do not appear to have the potential to negatively affect ecological integrity.
Good/Fair	Climate-related changes are suspected and may degrade some attributes of ecological integrity, but have not yet caused measurable degradation.
Fair	Climate-related changes have caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Climate-related changes have caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Climate-related changes have caused severe degradation in most, if not all attributes of ecological integrity.

Question 4 (Water/Other Stressors): Are other stressors, individually or in combination, affecting water quality, and how are they changing?

The purpose of this question is to capture shifts in water quality due to anthropogenic stressors not addressed in other questions. For example, localized changes in circulation or sedimentation resulting from coastal construction or dredge spoil disposal can affect light penetration, salinity regimes, oxygen levels, productivity, waste transport and other aspects of water quality that in turn influence the condition of habitats and living resources. Human inputs, generally in the form of contaminants from point or non-point sources, including fertilizers, pesticides, hydrocarbons, heavy metals and sewage, are common causes of environmental degradation. When present in the water column, any of these contaminants can affect marine life by direct contact or ingestion, or through bioaccumulation via the food chain.

[Note: Over time, accumulation in sediments can sequester and concentrate contaminants. The effects of contaminants may manifest only when the sediments are resuspended during storm or other energetic events. In such cases, reports of status should be made under Question 7 – Habitat/Contaminants.]

Good	Other stressors on water quality have not been documented, or do not appear to have the potential to negatively affect ecological integrity.
Good/Fair	Selected stressors are suspected and may degrade some attributes of ecological integrity, but have not yet caused measurable degradation.
Fair	Selected stressors have caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Selected stressors have caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Selected stressors have caused severe degradation in most, if not all attributes of ecological integrity.

HABITAT

Question 5 (Habitat/Integrity): What is the integrity of major habitat types and how are they changing?

Ocean habitats can be categorized in many different ways, including water column characteristics, benthic assemblages, substrate types and structural character. There are intertidal and subtidal habitats. The water column itself is one habitat type.[10] There are habitats composed of substrates formed by rocks or sand that originate from purely physical processes. And, there are certain animals and plants that create, in life or after their death, substrates that attract or support other organisms (e.g., corals, kelp, beach wrack, drift algae). These are commonly called biogenic habitats.

Regardless of the habitat type, change and loss of habitat is of paramount concern when it comes to protecting marine and terrestrial ecosystems. Of greatest concern to sanctuaries are changes to habitats caused, either directly or indirectly, by human activities. Human activities, like coastal construction and armoring, alter the distribution of habitat types along the shoreline. Changes in water conditions in estuaries, bays and nearshore waters can negatively affect biogenic habitat formed by submerged aquatic vegetation. Intertidal habitats can be affected for long periods by oil spills or by chronic pollutant exposure. Marine debris, such trash and lost fishing gear, can degrade the quality of many different marine habitats including beaches, subtidal benthic habitats and the water column. Sandy seafloor and hardbottom habitats, even rocky areas several hundred meters deep, can be disturbed or destroyed by certain types of fishing gear, including bottom trawls, shellfish dredges, bottom longlines and fish traps. Groundings, anchors and irresponsible diving practices damage submerged reefs. Cables and pipelines disturb corridors across numerous habitat types and can be destructive if they become mobile.

The integrity of biogenic habitats depends on the condition of particular living organisms. Coral, sponges and kelp are well known examples of biogenic habitat forming organisms. The diverse assemblages residing within these habitats depend on and interact with each other in tightly linked food webs. They may also depend on each other for the recycling of wastes, hygiene and the maintenance of water quality. Other communities that are dependent on biogenic habitat include intertidal communities structured by mussels, barnacles and algae and subtidal hard-bottom communities structured by bivalves, corals or coralline algae. In numerous open ocean areas, drift algal mats provide food and cover for juvenile fish, turtles and other organisms. The integrity of these communities depends largely on the condition of species that provide structure for them.

This question is intended to address acute or chronic changes in both the extent of habitat available to organisms and the quality of that habitat, whether non-living or biogenic. It asks about the quality of habitats compared to those that would be expected in near-pristine conditions (see definition above).

Good	Habitats are in near-pristine condition.
Good/Fair	Selected habitat loss or alteration is suspected and may degrade some attributes of ecological integrity, but has not yet caused measurable degradation.
Fair	Selected habitat loss or alteration has caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Selected habitat loss or alteration has caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Selected habitat loss or alteration has caused severe degradation in most, if not all attributes of ecological integrity.

10 FGDC (Federal Geographic Data Committee). 2012. Coastal and marine ecological classification standard, version 4.0. 339pp.

Question 6 (Habitat/Contaminants): What are contaminant concentrations in sanctuary habitats and how are they changing?

Habitat contaminants result from the introduction of unnatural levels of chemicals or other harmful material into the environment. Contaminants may be introduced through discrete entry locations, called point-sources (e.g., rivers, pipes, or ships) and those with diffuse origins, called non-point sources (e.g., groundwater and urban runoff). Chemical contaminants themselves can be very specific, as in a spill from a containment facility or vessel grounding, or a complex mix, as with urban runoff. Familiar chemical contaminants include pesticides, hydrocarbons, heavy metals and nutrients. Contaminants may also arrive in the form of materials that alter turbidity or smother plants or animals, therefore affecting metabolism and production.

This question is focused on risks posed primarily by contaminants within benthic formations, such as soft sediments, hard bottoms or structure-forming organisms. Not only are contaminants within benthic formations consumed or absorbed by benthic fauna, but resuspension due to benthic disturbance makes the contaminants available to water column organisms. In both cases contaminants can be passed upwards through the food chain. While the contaminants of most common concern to marine sanctuaries are generally pesticides, hydrocarbons and nutrients, the specific concerns of individual sanctuaries may differ substantially.

Notes: (1.) Contaminants in the water column addressed in the water quality section of this report should be cited, but details need not be repeated here; (2.) Many consider noise a pollutant, but in the interest of focusing here on more traditional forms of habitat degradation caused by contaminants, we recommend addressing the impacts of acoustic pollution within the living resource section, most likely as it impacts key species.

Good	Contaminants have not been documented, or do not appear to have the potential to negatively affect ecological integrity.
Good/Fair	Selected contaminants are suspected and may degrade some attributes of ecological integrity, but have not yet caused measurable degradation.
Fair	Selected contaminants have caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Selected contaminants have caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Selected contaminants have caused severe degradation in most, if not all attributes of ecological integrity.

LIVING RESOURCES

Question 7 (Living Resources/Keystone and Foundation Species): What is the status of keystone and foundation species and how is it changing?

Certain species are defined as "keystone" within ecosystems, meaning they are species on which the persistence of a large number of other species in the ecosystem depends.[11] They are the pillars of community stability (among other things, they strongly affect both resistance and resilience) and their contribution to ecosystem function is disproportionate to their numerical abundance or biomass. Their impact is therefore important at the community or ecosystem level. Keystone species are often called "ecosystem engineers" and can include habitat creators (e.g., corals, kelp), predators that control food web structure (e.g., Humboldt squid, sea otters), herbivores that regulate benthic recruitment (e.g., certain sea urchins) and those involved in critical symbiotic relationships (e.g., cleaning or co-habitating species).

"Foundation" species are single species that define much of the structure of a community by creating locally stable conditions for other species, and by modulating and stabilizing fundamental ecosystem processes.[12] These are typically dominant biomass producers in an ecosystem and strongly influence the abundance and biomass of many other species. Examples include krill and other zooplankton, kelp, forage fish such as rockfish, anchovy, sardine and coral. Foundation species exhibit similar control over ecosystems as keystone species, but their high abundance distinguishes them.

Changes in either keystone or foundation species may transform ecosystem structure through disappearances of or dramatic increases in the abundance of dependent species. Not only do the abundances of keystone and foundation species affect ecosystem integrity, but measures of condition can also be important to determining the likelihood that these species will persist and continue to provide vital ecosystem functions. Measures of condition may include growth rates, fecundity, recruitment, age-specific survival, contaminant loads, pathologies (e.g., disease incidence, tumors, deformities), the presence and abundance of critical symbionts or parasite loads.

Good	The status of keystone and foundation species appears to reflect near-pristine conditions and may promote ecological integrity (full community development and function).
Good/Fair	The status of keystone or foundation species may preclude full community development and function, but has not yet led to measurable degradation.
Fair	The status of keystone or foundation species suggests measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	The status of keystone and foundation species suggests severe degradation in some, but not all attributes of ecological integrity.
Poor	The status of keystone and foundation species suggests severe degradation in most, if not all attributes of ecological integrity.

11 Paine, R.T. 1969. Food web complexity and species diversity. Amer. Natur. 103:91-93.

12 Dayton, P.K. 1972. Toward an understanding of community resilience and the potential effects of enrichments to the benthos at McMurdo Sound, Antarctica. In: B.C. Parker (ed.). Proceedings of the colloquium on conservation problems in Antarctica. Lawrence, KS: Allen Press.

Question 8 (Living Resources/Focal Species): What is the status of other focal species and how is it changing?

This question targets other species of particular interest from the perspective of sanctuary management. Theses "focal species" may not be abundant or provide high value to ecosystem function, but their presence and health is important for the provision of other services, whether conservation, economic or strategic. Examples include species targeted for special protection (e.g., threatened or endangered species), species for which specific regulations exist to minimize perturbations from human disturbance (e.g., touching corals, riding manta rays or whale sharks, disturbing white sharks, or disturbing nesting birds) or indicator species (e.g., Common Murres as indicators of oil pollution). This category could also include so-called "flagship" species, which include charismatic or iconic species associated with specific locations, ecosystems or are in need of specific management actions, are highly popular and attract visitors or business, have marketing appeal or represent rallying points for conservation action (e.g., humpback and blue whales, Dungeness crab).

Status of these other focal species can be assessed through measures of abundance, relative abundance or condition, as described for keystone species in Question 7. In contrast to keystone and foundation species, however, the impact of changes in the abundance or condition of other focal species is more likely to be observed at the population or individual level, and less likely to result in ecosystem or community effects.

Good	Selected focal species appear to reflect near-pristine conditions.
Good/Fair	Reduced abundances in selected focal species are suspected, but have not yet been measured.
Fair	Selected focal species are at reduced levels, but recovery is possible.
Fair/Poor	Selected focal species are at substantially reduced levels, and prospects for recovery are uncertain.
Poor	Selected focal species are at severely reduced levels and recovery is unlikely.

Question 9 (Living Resources/Non-Indigenous Species): What is the status of non-indigenous species and how is it changing?

This question allows sanctuaries to report on the threat posed and impacts caused by non-indigenous species. Also called alien, exotic, non-native or introduced species, these are animals or plants living outside their native distributional range, having usually arrived there by human activity, either deliberate or accidental. Activities that commonly facilitate invasions include vessel ballast water exchange, restaurant waste disposal and trade in exotic species for aquaria. In some cases, climate change has resulted in water temperature fluctuations that have allowed range extensions for certain species.

Non-indigenous species that have damaging effects on ecosystems are called "invasive" species. Some invasive species can be extremely destructive, and because of this potential, non-indigenous species are usually considered problematic and warrant rapid response after invasion. For those that become established, however, their impacts can sometimes be assessed by quantifying changes in affected native species. In some cases, the presence of a species alone constitutes a significant threat (e.g., certain invasive algae and invertebrates). In other cases, impacts have been measured, and may or may not significantly affect ecosystem integrity.

Evaluating the potential impacts of non-indigenous species may require consideration of how climate change may enhance the recruitment, establishment and/or severity of impacts of non-indigenous species. Altered temperature or salinity conditions, for example, may facilitate the range expansion, establishment and survival of non-indigenous species while stressing native species, thus reducing ecosystem resistance. This will also make management response decisions difficult, as changing conditions will make new areas even more hospitable for non-indigenous species targeted for removal.

Good	Non-indigenous species are not suspected to be present or do not appear to affect ecological integrity (full community development and function).
Good/Fair	Non-indigenous species are present and may preclude full community development and function, but have not yet caused measurable degradation.
Fair	Non-indigenous species have caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Non-indigenous species have caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Non-indigenous species have caused severe degradation in most, if not all attributes of ecological integrity.

Question 10 (Living Resources/Biodiversity): What is the status of biodiversity and how is it changing?

Broadly defined, biodiversity refers to the variety of life on Earth, and includes the diversity of ecosystems, species and genes, and the ecological processes that support them.[13] This question is intended as an overall assessment of biodiversity compared to that expected in a near-pristine system (one as near to an unaltered ecosystem as we can reasonably expect, given that there are virtually no ecosystems completely free from human influence). It may include consideration of measures of biodiversity (usually aspects of species richness and evenness) and the status of functional interactions between species (e.g., trophic relationships and symbioses). Intact ecosystems require that all parts not only exist, but that they function together, resulting in natural symbioses, competition, predator-prey relationships and redundancies (e.g., multiple species capable of performing the same ecological role). Intact structural elements, processes and natural spatial and temporal variability are essential characteristics of community integrity and provide a natural adaptive capacity through resistance and resilience.

The response to this question will depend largely on changes in biodiversity that have occurred as a result of human activities that cause depletion, extirpation or extinction, illness, contamination, disturbance and changes in environmental quality. Examples include collection of organisms, excessive visitation (e.g., trampling), industrial activities, coastal development, pollution, activities creating noise in the marine environment and those that promote the spread of non-indigenous species.

Loss of species or changing relative abundances can be mediated through selective mortality or changing fecundity, either of which can influence ecosystem shifts. Human activities of particular interest in this regard are commercial and recreational harvesting. Both can be highly selective and disruptive activities, with a limited number of targeted species, and often result in the removal of high proportions of the populations, as well as large amounts of untargeted species (by-catch). Extraction removes biomass from the ecosystem, reducing its availability to other consumers. When too much extraction occurs, ecosystem stability can be compromised through long-term disruptions to food web structure, as well as changes in species relationships and related functions and services (e.g., cleaning symbioses). This has been defined as "ecologically unsustainable" extraction.[14]

Good	Biodiversity appears to reflect near-pristine conditions and promotes ecological integrity (full community development and function).
Good/Fair	Selected biodiversity loss or change is suspected and may preclude full community development and function, but has not yet caused measurable degradation.
Fair	Selected biodiversity loss or change has caused measurable, but not severe degradation in some attributes of ecological integrity.
Fair/Poor	Selected biodiversity loss or change has caused severe degradation in some, but not all attributes of ecological integrity.
Poor	Selected biodiversity loss or change has caused severe degradation in most, if not all attributes of ecological integrity.

13 United Nations Convention on Biological Diversity. https://www.cbd.int/convention.
14 Zabel, R.W., C.J. Harvey, S.L. Katz, T.P. Good, P.S. Levin. 2003. Ecologically sustainable yield. Am. Sci. 91:150-157.

MARITIME ARCHAEOLOGICAL RESOURCES

Question 11 (Maritime Archaeological Resources/Integrity): What is the archaeological integrity of known maritime archaeological resources and how is it changing?

Archaeological resources are material evidence of past human activities and include vessels, aircraft, structures, habitation sites and objects created or modified by humans. The condition of archaeological resources in a marine sanctuary significantly affects their value for science and education, as well as a resource's eligibility for listing in the National Register of Historic Places. The integrity of an archaeological resource refers to its ability to help scientists answer questions about the past through archaeological research. Historical significance of an archaeological resource depends upon its integrity and/or its representativeness of past events that made a significant contribution to the broad patterns of history, its association with important persons or its embodiment of distinctive type or architecture. Thus, while archaeological integrity is generally linked to condition, historical significance may rely on other factors as well.

Assessments of archaeological resources include evaluation of the apparent levels of integrity, which result from deterioration caused by human and natural forces (unlike questions about water, habitat and living resources, the non-renewable nature of archaeological resources makes any reduction in integrity, even if caused by natural forces, permanent). The archaeological, scientific and educational values of archaeological resources are substantially determined and affected by resource integrity and historical significance.

Good	Known archaeological resources appear to reflect little or no unexpected disturbance.
Good/Fair	Selected archaeological resources exhibit indications of disturbance, but there appears to have been little or no reduction in historical, archaeological, scientific or educational value.
Fair	The diminished condition of selected archaeological resources has reduced, to some extent, their historical, archaeological, scientific or educational value, and may affect the eligibility of some sites for listing in the National Register of Historic Places.
Fair/Poor	The diminished condition of selected archaeological resources has substantially reduced their historical, archaeological, scientific or educational value, and is likely to affect their eligibility for listing in the National Register of Historic Places.
Poor	The degraded condition of known archaeological resources in general makes them ineffective in terms of historical, archaeological, scientific or educational value, and precludes their listing in the National Register of Historic Places.

Question 12 (Maritime Archaeological Resources/Threat to Environment): Do known maritime archaeological resources pose an environmental hazard and how is this threat changing?

Deliberate or accidental sinking of a ship, aircraft or other manufactured goods, sometimes including lost or discarded munitions, potentially introduces hazardous materials into the marine environment. Many historic shipwrecks, particularly those sunk in the early to mid-20th century, still have the potential to retain oil and fuel in tanks and bunkers. As shipwrecks age and deteriorate, the potential for release of these materials into the environment increases.

Typically, the relatively small size of lost crafts and other man-made goods makes them more localized threats and unlikely to exhibit effects at the ecosystem scale. Therefore, the ratings below reflect the different levels of impact within these areas of influence, and the likely persistence of those impacts.

Good	Known maritime archaeological resources pose few or no environmental threats.
Good/Fair	Selected maritime archaeological resources may pose isolated or limited environmental threats, but substantial or persistent impacts are not expected.
Fair	Selected maritime archaeological resources cause or are likely to cause measurable, but not severe, impacts to certain sanctuary resources or areas, but recovery is possible.
Fair/Poor	Selected maritime archaeological resources pose substantial threats to certain sanctuary resources or areas, and prospects for recovery are uncertain.
Poor	Selected maritime archaeological resources pose serious threats to sanctuary resources, and recovery is unlikely.

HUMAN DIMENSIONS

Question 13 (Water/Human Activities): What are the levels of human activities that may adversely influence water quality and how are they changing?

Among the human activities in or near sanctuaries that affect water quality are those involving direct discharges and spills (vessels, onshore and offshore industrial facilities, public wastewater facilities), those that contribute contaminants to groundwater, stream, river, and water control discharges (agriculture, runoff from impermeable surfaces through storm drains, conversion of land use), and those releasing airborne chemicals that subsequently deposit via particulates at sea (vessels, land-based traffic, power plants, manufacturing facilities, refineries). In addition, dredging and trawling can cause resuspension of contaminants in sediments. Many of these activities can be controlled through management actions in order to limit their impact on protected resources.

Good	Few or no activities occur that are likely to negatively affect water quality.
Good/Fair	Some potentially harmful activities exist, but they have not been shown to degrade water quality.
Fair	Selected activities have caused measurable resource impacts, but effects are localized and not widespread or persistent.
Fair/Poor	Selected activities have caused severe impacts that are either widespread or persistent.
Poor	Selected activities have caused severe, persistent and widespread impacts.

Question 14 (Habitat/Human Activities): What are the levels of human activities that may adversely influence habitats and how are they changing?

Human activities that degrade habitat quality do so by affecting structural (physical), biological, oceanographic, acoustic or chemical characteristics of the habitat. Structural impacts, such as removal or mechanical alteration of habitat, can result from various fishing methods (e.g., trawls, traps, dredges, longlines and even hook-and-line in some habitats), dredging of channels and harbors, dumping dredge spoil, grounding of vessels, anchoring, laying pipelines and cables, installing offshore structures, discharging drill cuttings, dragging tow cables and placing artificial reefs. Removal or alteration of critical biological components of habitats can occur due to several of the above activities, most notably trawling, groundings and cable drags. Marine debris, particularly in large quantities (e.g., lost gill nets and other types of fishing gear), can degrade both biological and structural habitat components. Changes in water circulation often occur when channels are dredged, fill is added, coastlines are armored or other construction takes place. Management actions, such as beach wrack removal or sand replenishment on high public-use beaches, may impact the integrity of the natural ecosystem. Alterations in circulations can lead to changes in food delivery, waste removal, water quality (e.g., salinity, clarity and sedimentation), recruitment patterns and a host of other ecological processes. Chemical alterations most commonly occur following spills and can have both acute and chronic impacts. Many of these activities can be controlled through management actions in order to limit their impact on protected resources.

Good	Few or no activities occur that are likely to negatively affect habitat quality.
Good/Fair	Some potentially harmful activities exist, but they have not been shown to degrade habitat quality.
Fair	Selected activities have caused measurable resource impacts, but effects are localized and not widespread or persistent.
Fair/Poor	Selected activities have caused severe impacts that are either widespread or persistent.
Poor	Selected activities have caused severe, persistent and widespread impacts.

Question 15 (Living Resources/Human Activities): What are the levels of human activities that may adversely influence living resources and how are they changing?

Human activities that degrade the condition of living resources do so by causing a loss or reduction of one or more species, by disrupting critical life stages, by impairing various physiological processes or by promoting the introduction of non-indigenous species or pathogens. (Note: Activities that impact habitat and water quality may also affect living resources. These activities are dealt with in Questions 13 and 14, and some may be repeated here as they also directly affect living resources).

For most sanctuaries, recreational or commercial fishing and collecting have direct effects on animal or plant populations, either through removal or injury of organisms. Related to this, lost fishing gear can cause extended periods of loss for some species through entanglement and "ghost fishing." In addition, some fishing techniques are size-selective, resulting in impacts to particular life stages. High levels of visitor use in some places also cause localized depletion, particularly in intertidal areas or on shallow coral reefs, where collecting and trampling can be chronic problems.

Mortality and injury to living resources has also been documented from cable drags (e.g., towed barge operations), dumping spoil or drill cuttings, vessel groundings or repeated anchoring. Contamination caused by acute or chronic spills or increased sedimentation to nearshore ecosystems from road developments in watersheds (including runoff from coastal construction or highly built coastal areas), discharges by vessels or municipal and industrial facilities can make habitats unsuitable for recruitment or other ecosystem services (e.g., as nurseries or spawning grounds). And while coastal armoring and construction can increase the availability of surfaces suitable for hard bottom species, the activity may disrupt recruitment patterns for other species (e.g., intertidal soft bottom animals), and natural habitat may be lost.

Oil spills (and spill response actions), discharges and contaminants released from sediments (e.g., by dredging and dumping) can all cause physiological impairment and tissue contamination. Such activities can affect all life stages by direct mortality, reducing fecundity, reducing disease resistance, loss as prey and disruption of predator-prey relationships and increasing susceptibility to predation. Furthermore, bioaccumulation results in some contaminants moving upward through the food chain, disproportionately affecting certain species.

Activities that promote the introduction of non-indigenous species include bilge discharges and ballast water exchange, commercial shipping and vessel transportation. Intentional or accidental releases of aquarium fish and plants can also lead to introductions of non-indigenous species.

Many activities are controlled through management actions that limit their impact on protected resources.

Good	Few or no activities occur that are likely to negatively affect living resource quality.
Good/Fair	Some potentially harmful activities exist, but they have not been shown to degrade living resource quality.
Fair	Selected activities have caused measurable living resource impacts, but effects are localized and not widespread or persistent.
Fair/Poor	Selected activities have caused severe impacts that are either widespread or persistent.
Poor	Selected activities have caused severe, persistent and widespread impacts.

Question 16 (Maritime Archaeological Resources/Human Activities): What are the levels of human activities that may adversely affect maritime archaeological resources and how are they changing?

Some human maritime activities threaten the archaeological integrity of maritime archaeological resources. Archaeological integrity is compromised when elements are moved, removed or otherwise damaged. Threats come from looting by divers, inadvertent damage by scuba diving visitors, improperly conducted archaeology that does not fully document site disturbance, anchoring, groundings and commercial and recreational fishing activities, among others. Many of these activities can be controlled through management actions in order to limit their impact on archaeological resources.

Good	Few or no activities occur at maritime archaeological resources site that are likely to adversely affect their integrity.
Good/Fair	Some potentially relevant activities exist, but they have not been shown to degrade maritime archaeological resource integrity.
Fair	Selected activities have caused measurable impacts to maritime archaeological resources, but effects are localized and not widespread or persistent.
Fair/Poor	Selected activities have caused severe impacts that are either widespread or persistent.
Poor	Selected activities have caused severe, persistent and widespread impacts.

Question 17 (Human Dimensions/Drivers): What are the states of influential human drivers and how are they changing?

Driving forces are those characteristics of human societies that influence the nature and extent of pressures on resources. They are the underlying cause of change in coastal marine ecosystems, as they determine human use. Drivers are influenced by demographics (age structure, population, etc.), demand, economic circumstances, industrial development patterns, business trends and societal values. They operate at global, regional and local scales. Examples include increasing global demand for agricultural commodities, which increases the use of chemicals that degrade coastal water quality; difficult economic times that reduce fishing efforts for a period of time within certain regions; or local construction booms that alter recreational visitation trends. Other drivers could be the demands that govern trends such as global greenhouse gas generation, regional shipping or offshore industrial development, local recreation and tourism, fishing, port improvement, manufacturing and age-specific services (e.g., retirement). Each of these, in turn, influences certain pressures on natural and cultural resources.

Integrated into this question should be consideration of societal values, which include such matters as levels of conservation awareness, political leanings, opinion about environmental issues relative to other concerns or changing opinions about the acceptability of specific behaviors (e.g., littering, fishing). Understanding these values gives one a better understanding of the likely future trends in drivers and pressures, as well as the nature of the societal tradeoffs in different uses of the ecosystem resources (e.g., the effects of multiple changing drivers on each other and the resources they affect). This can better inform policy and management responses, and education and outreach efforts that are designed to change societal values with the intention to change drivers and reduce pressures.

In rating the status and trends for drivers, experts should consider the following:

- the main driving forces behind each pressure affecting natural resources and the environment
- the best available indicators of each driving force
- the status and trend of each driving force
- societal values behind each driving force
- the best indicators of societal values
- the status and trend of societal values

Good	Few or no drivers occur that have the potential to influence pressures in ways that will negatively affect resource qualities.
Good/Fair	Some drivers exist that may influence pressures in ways that will degrade some attributes of resource quality, but they have not yet caused measurable degradation.
Fair	Selected drivers are influencing pressures in ways that result in measurable resource impacts, but effects are localized and not widespread or persistent.
Fair/Poor	Selected drivers are influencing pressures in ways that result in severe impacts that are either widespread or persistent.
Poor	Selected drivers are influencing pressures in ways that result in severe, persistent and widespread impacts.

ECOSYSTEM SERVICES

The following provides a description of the various ecosystem services that are considered within each sanctuary condition report.

Cultural (non-material benefits)

1. Sense of Place – aesthetic and spiritual attraction, and the level of recognition and appreciation given to efforts to protect a place's iconic elements
2. Tourism and Recreation – experiential opportunities that include recreation and community activities
3. Science and Education – the capacity to provide intellectual enrichment, contributing information and knowledge
4. Heritage – recognition of historical or heritage legacy

Provisioning (products and supplies)

5. Food – the capacity to support market demands for nutrition-related commodities through various fisheries
6. Ornamentals – resources collected for decorative or aesthetic purposes
7. Biotechnology – medicine and other chemicals found in sanctuary animals or plants, or manufactured from them
8. Energy – use of non-renewable or renewable materials or processes to supply energy

Regulating (buffers to change)

9. Clean Water – minimizing pollution, including trash, nutrients, sediments, pathogens and chemicals
10. Biodiversity – preserving species and critical habitats and life cycle events, and controlling invasive species, pests, and diseases
11. Coastal Protection – flow regulation that protects habitats, property, coastlines and other features
12. Climate Stability – the important role of ocean ecosystems in sequestering carbon, regulating temperature and controlling ocean acidity

Sanctuaries vary with regard to the ecosystem services they support, so each sanctuary is likely to have a different mix of services and information to support their assessment. Within this section, for any of the 12 ecosystem services considered relevant to the marine sanctuary in question, a status rating will be selected based on the following scale:

Final Rating Scheme for Ecosystem Services.

Rating	Description of Findings
Good	The capacity to provide the ecosystem service has been either enhanced or remained unaffected.
Good/Fair	Unable to fully provide the ecosystem service due to prior or existing human activity, but performance is acceptable.
Fair	Ability to provide ecosystem service is compromised, and existing management would require enhancement to enable acceptable performance.
Fair/Poor	Ability to provide ecosystem service is compromised, and it is uncertain whether new or enhanced management would restore it.
Poor	Unable to deliver ecosystem service due to the extreme, pervasive or widespread nature of human activities, and it is doubtful that new or enhanced management would restore it.

To rate each ecosystem service, experts consider the following:

- the ecosystem services relevant to the sanctuary
- the best available indicators for each ecosystem service (economic, non-economic human dimensions and ecological)
- the status and direction of change of each ecosystem service
- whether economic and non-economic human dimensions indicators yield the same conclusions about the status and trend for each ecosystem service
- whether economic indicators send a false signal about the status and trend of an ecosystem service (namely, conflicting ecological and economic indicators, suggesting that we are sacrificing natural capital for short-term economic gain)

The steps used to rate ecosystem services were adapted from the multi-year study "Marine and Estuarine Goal Setting for South Florida" (MARES) of three South Florida marine ecosystems, including Florida Keys National Marine Sanctuary. It used Integrated Conceptual Ecosystem Models (ICEMs) for each ecosystem under the DPSER Model[15], and evaluation of three types of indicators: (1.) economic, (2.) human dimension non-economic[16] and (3.) ecological for each ecosystem service.

Rating is a two-step process with economic indicators used to develop a preliminary rating prior to the expert workshop based on a three-tier rating ("High," "Medium" or "Low" economic value). Subsequent discussions during the workshop consider and integrate non-economic and ecological indicators, allowing subject experts to characterize the ecosystem service within the five-tier rating system below. The final rating ("Good," "Fair," etc.) corresponds to the equivalent rating within the table on page 34. The Description of Findings from that table is used to convey the rating in the condition report.

Optional Rating Scheme for Ecosystem Services: How to get to the final ecosystem services ratings using indicators.

Good	Economic indicators are positive and increasing, human dimension non-economic indicators are increasing or stable and ecological indicators do not indicate there is a decline in the natural capital stock.
Good/Fair	Economic indicators are positive and stable, human dimension non-economic indicators are increasing or stable and ecological indicators do not indicate there is a decline in the natural capital stock.
Fair	Mixed results for the economic and non-economic indicators and some ecological indicators indicate a decline in the natural capital stock but not widespread.
Fair/Poor	Economic indicators are negative and declining, while non-economic indicators are negative or stable. Ecological indicators are showing more widespread declines in natural capital stock.
Poor	Economic and non-economic indicators are negative and declining. Ecological indicators are negative showing widespread declines in the natural capital stock.

15 Nuttle, W.K. and P.J. Flethcher (eds.). 2013. Integrated Conceptual Ecological Model for the Florida Keys/Dry Tortugas Coastal Marine Ecosystem, MARine Estuarine goal Setting (MARES) for South Florida, NOAA Technical Memorandum, OAR-AOML-101/NOS-NC-COS-161. Miami, Florida. 91pp. http://www.sofla-mares.org/docs/MARES_FKDT_ICEM_20130913.pdf.

16 Lovelace, S., P. Flethcher, M. Dillard, W. Nuttle, S. Patterson, P. Ortner, D. Loomis and M. Shivlani. 2013. Selecting Human Dimensions Indicators for South Florida's Coastal Marine Ecosystem – Noneconomic Indicators, Version 19 May 2013. MARES White paper, Noneconomic Indicators. Miami, Florida. 39pp. http://www.sofla-mares.org/docs/MARES_WhitePaper5_SelectingHDSindicators_NonEconomic_20130519.pdf.

Discussion of ecosystem services ratings within the written report should focus on the influence of drivers and societal values considered responsible for the ratings. Also discussed may be whether economic and non-economic indicators yield the same conclusions. This will enable consideration of the sometimes conflicting relationship between economic gain and the preservation of natural capital. For example, economic indicators (e.g., dive operator income) may suggest improving recreational services while biological indicators (e.g., anchor damage) suggest that natural resource qualities are being sacrificed for short-term gain, making the activity unsustainable.

Below is an example of a report table presenting ratings for ecosystem services for Hypothetical NMS:

Ecosystem Services	Status & Trend	Indicators	Description of Findings	Other
Cultural Services				
Sense of Place	—	Consistently ranked as one of the healthiest and most photogenic places on Earth; clear water, large animals	The capacity to provide the ecosystem service has been either enhanced or remained unchanged.	An invasive species and climate change threaten to change resources and affect reputation
Tourism and Recreation	—	Distance and conditions can limit access; buoys put limits on distribution of diving activity; whale watching guidelines enforced	Unable to fully provide the ecosystem service due to prior or existing human activity, but performance is acceptable.	Probably sustainable
Science and Education	▲	Active and growing scientific and education programs	The capacity to provide the ecosystem service has been either enhanced or remained unchanged.	Part of National Coral Reef Monitoring Program
Heritage	—	Prior looting has diminished resources; interpretive materials are needed to reduce future impacts	Ability to provide ecosystem service is compromised, and existing management would require enhancement to enable acceptable performance	
Provisioning Services				
Food	▼	Reduced landings; acidification threats; ciguatera alerts; invasives threaten future capacity	Ability to provide ecosystem service is compromised, and it is uncertain whether new or enhanced management would restore it.	Fishing closures being considered
Ornamentals	—	Targeted spp. have been extirpated; market has collapsed	Unable to deliver ecosystem service due to the extreme, pervasive or widespread nature of human activities, and it is doubtful that new or enhanced management would restore it.	Collecting ornamentals is banned
Biotechnology	—	No current activity, but no suspected diminishment of capacity	The capacity to provide the ecosystem service has been either enhanced or remained unchanged.	
Energy	**n/a**			No current research or extraction facilities
Regulating Services				
Clean Water	▼	Beach closures; HABs; undocumented discharges; inadequate and degrading storm water handing infrastructure	Ability to provide ecosystem service is compromised, and it is uncertain whether new or enhanced management would restore it.	
Biodiversity	▼	Loss of cleaning stations suggests changing species interactions; commercial fish responding to new restrictions; invasives threaten native spp.	Ability to provide ecosystem service is compromised, and existing management would require enhancement to enable acceptable performance.	
Coastal Protection	—	Armoring actions coordinated through consultation; nearshore biogenic and natural habitats intact	Unable to fully provide the ecosystem service due to prior or existing human activity, but performance is acceptable.	
Climate Stability	**n/a**			

Appendix B: Example Workshop Invitation Letter

Dear Dr. _____,

We would like to invite you to participate in an upcoming scientific meeting at _____ National Marine Sanctuary. The purpose of this meeting is to develop the __NMS Condition Report. This report will provide a summary of resources in __NMS, driving forces, pressures on resources, the current condition and trends, ecosystem service status and trends and management responses to the pressures that threaten the integrity of the marine environment. Specifically, this document will include information on the status and trends of water quality, habitat, living resources and maritime archaeological resources and the human activities that affect them. The report will include responses to a set of questions that will rate resource status on a scale from good to poor and assign a trend to those resources based on observed changes in status over the past five years, unless otherwise specified. It will also include ratings for various ecosystem services based on indicators and the factors affecting them. This meeting will allow us to address all these areas.

Similar reports summarizing resource status and trends will be prepared for each marine sanctuary approximately every five years and updated as new information allows. This information is intended to help set the stage for management plan reviews at each site and to help sanctuary staff identify monitoring, characterization and research priorities to address gaps, day-to-day information needs and new threats.

The __NMS Condition Report meeting will be held on _____ at the _____ National Marine Sanctuary office. However, participants are not being asked to attend all sections of the meeting. Instead, we have split the meeting into __ workshops by topic. **Your participation is requested for the _____ section of the workshop scheduled for _____ from __ - __ pm. If you are interested and able to attend the workshop, please RSVP to me no later than _____.**

We ask that prior to the meeting you review two documents. The first is the __NMS Condition Report. It can be accessed by visiting http://sanctuaries.noaa.gov/science/condition. This report was the first condition report produced at the sanctuary and can serve as an excellent model for future condition reports. The second document, which is attached, is the latest draft of the _____ Condition Report. We will spend the meeting improving this document and working on the incomplete sections of the report.

Also, please spend some time reviewing the attached "Guide for Developing National Marine Sanctuary Condition Reports," particularly Appendix A: Rating Scheme for System-Wide Monitoring Questions for Sanctuary Resources and Ecosystem Services. The purpose of this appendix is to clarify the 17 questions and 12 ecosystem services, and the possible responses used in determining the current condition of the sanctuary. We ask that during the meeting you use this guidance to make judgments about the status and trends of sanctuary resources. The questions are used to promote consistency in the approach by staff and partners at each of the 14 sites to develop condition reports. They are meant to set the limits of judgments so that responses can be confined to certain reporting categories that can be compared among sites. Thank you in advance for your time and efforts.

Sincerely,

_____

Appendix C: Example Agenda for a Four-Day Workshop

Day One

8:00 – 9:00	Introduction
9:00 – 12:00	Rate Living Resource Questions
12:00 – 1:00	*Lunch*
1:00 – 2:00	Complete Living Resource Questions
2:00 – 5:00	Rate Habitat Questions

Day Two

8:30 – 12:00	Rate Water Quality Questions
12:00 – 1:00	*Lunch*
1:00 – 4:00	Rate Maritime Archaeological Resource Questions

Day Three

8:00 – 8:30	Introduction to Ecosystem Service Ratings
8:30 – 12:00	Rate Provisioning Services
12:00 – 1:00	*Lunch*
1:00 – 5:00	Rate Regulating Services

Day Four

8:00 – 12:00	Rate Cultural Services

Appendix D: Documenting Confidence

Experts at the workshops are given the opportunity to document their confidence in status and trend ratings for ecosystem, archaeological and economic indicators, as well as recommend appropriate language for report content that characterizes this confidence. We draw on aspects of work by Halpern et al. (2007)[17] and the Intergovernmental Panel on Climate Change (2010)[18] to standardize language in the reports based on criteria that are either qualitative or quantitative in nature; workshop facilitators should ensure consistent use of this language. By doing so, we communicate degrees of uncertainty and likelihood in ways that are consistent within and among sanctuary condition reports, and with other assessments.

After deciding on each rating during workshops, experts are asked to characterize their level of confidence, first by considering three categories of evidence typically used to make status or trend ratings: (1.) data, (2.) published information and (3.) personal experience. For each status and trend rating, the group should rate the overall quality of evidence as "limited," "medium" or "robust," depending on the type, amount, quality and consistency of evidence available. Ratings will be recorded in the table at the end of this section.

Evidence Scores		
Limited	*Medium*	*Robust*
Limited data or published information, and little or no substantive personal experience	Data available, some peer reviewed published information or direct personal experience	Considerable data, extensive record of publication or extensive personal experience

Workshop participants should then use the table below to combine ratings for both evidence (from Evidence Scores table) and the level of agreement, either among participants, or if possible, within the broader scientific community. Levels of agreement can be characterized as "low," "medium" or "high." Clearly, the highest levels of confidence are associated with ratings for which there is robust evidence and high agreement.

Medium High agreement Limited evidence	*High* High agreement Medium evidence	*Very High* High agreement Robust evidence
Low Medium agreement Limited evidence	*Medium* Medium agreement Medium evidence	*High* Medium agreement Robust evidence
Very Low Low agreement Limited evidence	*Low* Low agreement Medium evidence	*Medium* Low agreement Robust evidence

Considering all the above, a level of confidence for each question can then be expressed using one of the five italicized qualifiers in the table: (1.) very low, (2.) low, (3.) medium, (4.) high and (5.) very high.

17 Halpern, B.S., K.A. Selkoe, F. Micheli and C.V. Kappel. 2007. Evaluating and ranking the vulnerability of global marine ecosystems to anthropogenic threats. Conservation Biology 21(5):1301-1315.

18 Mastrandrea, M.D., C.B. Field, T.F. Stoker, O. Edenhofer, K..L. Ebi, D.J. Frame, H. Held, E. Kriegler, K.J. Mach, P.R. Matschoss, G.K. Plattner, G.W. Yohe and F.W. Zwiers. 2010. Guidance note for lead authors of the IPCC fifth assessment report on consistent treatment of uncertainties. Intergovernmenal Panel on Climate Change (IPCC). Available at http://www.ipcc.ch.

The final table, presented as an appendix in the condition report, will appear as follows:

Question		**Evidence Quality** ***(limited, medium, robust)***	**Agreement** ***(low, medium, high)***	**Confidence** ***(very low, low, medium, high, very high)***
1	Status			
	Trend			
2	Status			
	Trend			
3	Status			
	Trend			
...				

Where probabilistic information is available and uncertainty can be quantified, authors may choose to use standard terms to characterize their findings in terms of likelihood rather than confidence. This may be possible when spatial and/or temporal variables have been analyzed to compare attributes and measure trends. For these cases, Mastrandrea et al. (2010) recommend the following standard nomenclature:

- "virtually certain" >99-100%
- "very likely" >90-99%
- "likely" >66-90%
- "about as likely as not" 33-66%
- "unlikely <10-33%
- "very unlikely" <1-10%
- "exceptionally unlikely" <1%

Authors should consistently apply these terms when describing confidence and *likelihood* in the condition report. Where appropriate, particularly in cases of disagreement, authors should also present the range of views expressed by experts.

Appendix E: Example Letter to Peer Reviewers

Dear _____,

The Office of National Marine Sanctuaries (ONMS) respectfully requests your review of the attached report, titled "Condition Report for _____ National Marine Sanctuary." Sanctuary staff has identified you as a particularly suitable expert who could provide substantive comments that would improve the document prior to dissemination. **We request your written comments by _____, or within four (4) weeks of receiving this message.**

In December 2004, the White House Office of Management and Budget (OMB) issued a Final Information Quality Bulletin for Peer Review (OMB Bulletin) establishing peer review standards that would enhance the quality and credibility of the federal government's scientific information. Among other information, these standards apply to Influential Scientific Information (ISI), which is information that can reasonably be determined to have a "clear and substantial impact on important public policies or private sector decisions."

ONMS is in the process of developing reports on the status and trends of natural and archaeological resources within the marine sanctuaries as part of its System-Wide Monitoring (SWiM) Program. These "condition reports," which will be produced periodically for each marine sanctuary, are considered Influential Scientific Information. For this reason, these reports are subject to the review requirements of both the Information Quality Act and the OMB Bulletin guidelines.

Charge

This condition report provides a summary of marine sanctuary resources, pressures (e.g., human impacts), the current state of the sanctuary and responses to the pressures that threaten the integrity of the marine environment. The primary purpose of the condition reports is to report in a standardized way across all marine sanctuaries on the status and trends of water quality, habitat, living resources, maritime archaeological resources, ecosystem services and the human activities that affect them. Resource status is rated on a scale from good to poor, and the timelines used for comparison vary from topic to topic. Trends in the status of resources are also reported, and are generally based on observed changes in status over the past five years, unless otherwise specified. Evaluations of status and trends were made by sanctuary staff, based on interpretation of quantitative and, when necessary, non-quantitative assessments and observations of scientists, managers and users. Therefore, ratings reflect the collective level of concern among participants based on their knowledge and perceptions of local problems. Reports summarizing resource status and trends will be prepared for each marine sanctuary approximately every five years. This information is intended to help set the stage for management plan reviews.

As you review the document, please do so recognizing that the report is much like an executive summary that is based on site specific data that may not be presented in detail within the report. To the extent possible, references and links to existing data are given, and appropriate summary graphics or data are shown, but original sources are likely to contain much more information than the condition report. The report will also be graphically improved in the final draft. Please focus your comments on the substance of the report text and ratings, rather than on the graphical layout.

The 17 questions and 12 ecosystem services rated in the report are the same in all sanctuaries. The interpretation of the questions and services by sanctuary staff, and their responses are standardized according to the descriptions and explanations provided in Appendix A. We are not requesting your review of this portion of the report, as these standards were established by the original panel of experts who designed SWiM, and in subsequent design modifications. Your review should be limited to the major sections of the report – Site History and Resources, Driving Forces, Pressures on the Sanctuary, State of Sanctuary Resources, Ecosystem Services, and Responses to Pressures - based on your relevant experience and knowledge of the resources of _____ National Marine Sanctuary. We are particularly interested in your expert opinion of our judgments of resource status and trends, the bases for indicators used to rate conditions and whether you feel that other data could or should have been incorporated into the ratings of status and trends. We welcome any recommendations you may have regarding additional data or information sources that may improve assessments of resource conditions. Please note that once all reviewer comments have been addressed, the final report will be appropriately formatted to meet the National Marine Sanctuary System's publication requirements.

Posting of Review Comments

Current OMB Bulletin guidelines require that reviewer comments, identities and affiliations be posted on the Department of Commerce (DOC) website: http://www.cio.noaa.gov/services_programs/prplans/PRsummaries.html.

Reviewer comments, however, will not be attributed to specific individuals. As you know, this is not consistent with traditional scientific peer review standards, which generally call for anonymity. This issue has been raised with OMB, and guidance may change in the future. Until then, we will comply with the published guidelines.

Therefore, by agreeing to be a reviewer for this report, you must agree to allow your comments to be posted on the web, along with those of other reviewers, and have your name and affiliation posted, though the names will not be linked to specific comments.

Conflict of Interest

For this review process, the National Oceanic and Atmospheric Administration (NOAA) adapted the National Academy of Sciences's (NAS) policy for committee selection with respect to evaluating conflicts of interest when selecting peer reviewers who are not federal government employees. Please read the attached conflict of interest policy and complete and return the attached Conflict of Interest form by mail or fax (301-713-4306).

Specific Instructions

Please send your comments directly to _____ who is serving as the point of contact for this project. Attached to this email is a pdf of the report. A Word version of the report will be sent to you separately. Comments and suggested edits may be made directly to the report using the "track changes" and "comment bubble" functions. If you would like a hard copy of the report, please contact us directly. Please note that this a draft report and should not be distributed.

On behalf of the staff of __NMS and ONMS, I thank you for taking the time to review this report. I am confident that your assistance will improve the quality of the document and ensure that management decisions can rely on the best available science and dependable judgments of knowledgeable experts.

Sincerely,

_____

Appendix F: Example Letter to Congress

The Honorable Sandy Adams
United States House of Representatives
Washington, D.C. 20515

October 20, 2011

Dear Representative Adams:

Enclosed, please find the National Oceanic and Atmospheric Administration's (NOAA) Condition Report 2011 for Florida Keys National Marine Sanctuary. Condition reports are one in a series of publications by NOAA's Office of National Marine Sanctuaries to inform the public periodically about the general condition of each sanctuary. Condition reports provide a synthesis of the health of each sanctuary and are meant to set the stage for reviewing management plans.

Since its designation in 1990, Florida Keys National Marine Sanctuary has worked to address human influences to resource health. Sanctuary management actions, including the prohibition of pollution discharges and the designation of highly protected zones, have helped improve water quality, increase the size and abundance of certain fish species and spiny lobster in the sanctuary's Ecological Reserves and document the return of some historic fish spawning aggregations. Human actions, such as poaching, development, vessel groundings and marine debris, continue to negatively affect the habitat and living resources of the sanctuary, but they may be improved with long term management efforts, regulatory compliance and community involvement.

The Florida Keys National Marine Sanctuary Condition Report, the first of its kind for this sanctuary, provides an important baseline on the status of sanctuary resources. The condition report will also guide the comprehensive review of both the sanctuary's regulations and its management plan; this review is anticipated to begin in 2012.

This condition report can be downloaded at: http://sanctuaries.noaa.gov/science/condition/fknms. Please contact _____ in NOAA's Office of Legislative and Intergovernmental Affairs at phone or email if you have questions or require additional information. Thank you for your continued support of NOAA's programs.

Sincerely,

_____

NOAA's Office of Legislative and
Intergovernmental Affairs

Appendix G: Example Press Release (example from Florida Keys National Marine Sanctuary)

DRAFT — NOT FOR DISTRIBUTION — DRAFT

Contact: Karrie Carnes
305-809-4700 x236

FOR IMMEDIATE RELEASE
October 21, 2011

NOAA releases report on the status of marine resources in Florida Keys National Marine Sanctuary
Report highlights local, regional, global stressors to Keys marine ecosystem

NOAA scientists have found that increasing pressure from coastal populations, vessel groundings, marine debris, climate change and poaching are critical environmental threats to the health of the Florida Keys ecosystem. Many historically abundant marine resources, such as green sea turtles and coral habitat, continue to be at risk with low rates of recovery.

The findings were released in the "Condition Report" 2011 for Florida Keys National Marine Sanctuary describing the sanctuary's water quality, habitats, living resources and cultural resources – and the human activities that affect them. This report is one of an ongoing series of condition reports for all national marine sanctuaries. Providing an important baseline on the status of sanctuary marine resources, it will guide a comprehensive review of sanctuary regulations and management plan, beginning in 2012.

Documenting improvements in water quality and an increase in the size and abundance of some fish species and spiny lobster in large reserves within the sanctuary, the report also notes that challenges remain. It further suggests additional means are necessary to support sustained management efforts, and increase regulatory compliance and community engagement to address those challenges.

"This report provides us with a great benchmark that can be used to protect our sanctuary's extraordinarily valuable and productive marine ecosystem," said Sean Morton, superintendent, Florida Keys National Marine Sanctuary. "Additionally, the report helps identify gaps in current monitoring efforts and highlights areas where additional information is needed."

"Our long-term monitoring indicates management actions are contributing to some positive results, however, recovery of ecosystem health takes time," Morton said. "This report will help steer future efforts and highlights the value of ongoing monitoring to support adaptive management."

The Florida Keys have a long history of environmental exploitation dating back to the late 1800s. However, since its designation in 1990, the sanctuary has worked with a wide array of local, state and federal partners to address human-related impacts throughout the Keys, including activities such as public education and research programs, the implementation of regulations prohibiting the discharge of pollution in sanctuary waters and the designation of highly protected no-take marine zones. These efforts have been critical tools in the Florida Keys region where ocean recreation and tourism supports more than 33,000 jobs, accounting for 58 percent of the local economy and $2.3 billion in annual sales.

NOAA prepared the condition report in consultation with outside experts from the scientific community. The full report is available online here: http://sanctuaries.noaa.gov/science/condition/fknms.

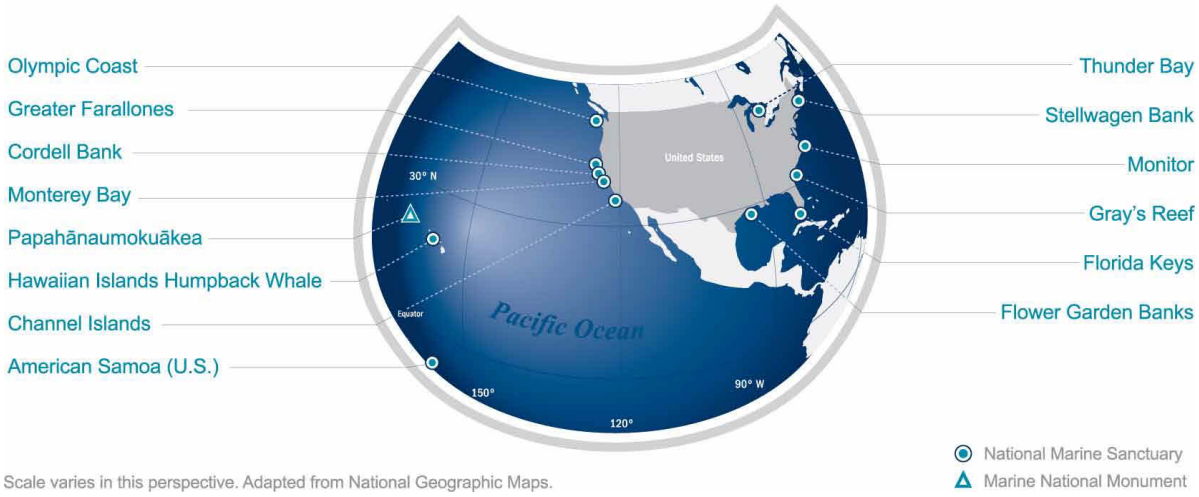
Florida Keys National Marine Sanctuary protects 2,900 square nautical miles of critical marine habitat, including coral reef, hard bottom, sea grass meadow, mangrove communities and sand flats. NOAA and the State of Florida manage the sanctuary. Visit us at http://floridakeys.noaa.gov or on Facebook at http://www.facebook.com/floridakeysnoaagov.

NOAA's mission is to understand and predict changes in the Earth's environment, from the depths of the ocean to the surface of the sun, and to conserve and manage our coastal and marine resources. Join us on Facebook, Twitter and our other social media channels.

The National Marine Sanctuary System

The Office of National Marine Sanctuaries, part of NOAA, serves as the trustee for a system of 14 marine protected areas encompassing more than 170,000 square miles of ocean and Great Lakes waters. The 13 national marine sanctuaries and one marine national monument within the National Marine Sanctuary System represent areas of America's ocean and Great Lakes environment that are of special national significance. Within their waters, giant humpback whales breed and calve their young, coral colonies flourish and shipwrecks tell stories of our maritime history. Habitats include beautiful coral reefs, lush kelp forests, whale migrations corridors, spectacular deep-sea canyons and underwater archaeological sites. These special places also provide homes to thousands of unique or endangered species and are important to America's cultural heritage. Sites range in size from one square mile to almost 140,000 square miles and serve as natural classrooms, cherished recreational spots and are home to valuable commercial industries. The sanctuary condition reports serve as a management tool to assist in the protection and conservation of these special places.

National Marine Sanctuary System



Scale varies in this perspective. Adapted from National Geographic Maps.

The Office of National Marine Sanctuaries is part of NOAA's National Ocean Service.

Vision – People value marine sanctuaries as treasured places protected for future generations.

Mission – To serve as the trustee for the nation's system of marine protected areas to conserve, protect and ehance their biodiversity, ecological integrity and cultural legacy.

National Marine Sanctuaries