



Workshop Report: Developing a Management Effectiveness Framework for the National Marine Sanctuary System



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U.S. Department of Commerce
Gina Raimondo, Secretary

National Oceanic and Atmospheric Administration
Richard W. Spinrad, Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and
NOAA Administrator

National Ocean Service
Nicole LeBoeuf, Assistant Administrator

Office of National Marine Sanctuaries
John Armor, Director



**NATIONAL
MARINE
SANCTUARIES**

Cover photo: Coral outplanting in the Florida Keys. (Credit: Rachel Hancock Davis)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of National Marine Sanctuaries
1305 East-West Highway
Silver Spring, Maryland 20910

Dear Reader:

Analyzing and communicating how marine protected areas are contributing to biodiversity conservation, resource protection, and associated social and economic benefits is a global challenge, and one that is shared by NOAA's Office of National Marine Sanctuaries (ONMS). As an office that works in partnership with a wide range of governments, communities, and organizations, it is critical to communicate about management effectiveness to recognize the key role that national marine sanctuaries play in conservation and sustainable use of our oceans.

In November 2022, inspired by the 50th anniversary of the National Marine Sanctuary System, ONMS convened an internal workshop to spark a candid and creative discussion of the challenges in measuring management effectiveness and identify steps to improve our capability to measure our effectiveness in meeting our management goals. Over 80 people from across the sanctuary system participated, as well as colleagues from other NOAA line and program offices, such as the Office for Coastal Management. In addition, we provided case studies from four sanctuaries – Channel Islands, Florida Keys, Hawaiian Islands Humpback Whale, and Stellwagen Bank – taking a deeper dive into how management, science, and education activities are contributing to conservation outcomes.

The workshop is summarized in this report, including recommendations developed from those discussions. The recommendations in this report are ambitious for ONMS, many requiring additional resources and new staff or structures to fully implement. They are shared here to continue the dialogue on management effectiveness as ONMS explores short-term steps to enhance our capacity, and looks toward the longer term needs and opportunities to fully realize our mission and deliver conservation benefits in a rapidly changing ocean over the next 50 years.

Sincerely,

John Armor
Director

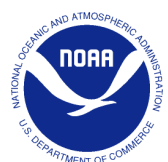




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Acknowledgements

Report authors: Kayla Williams, Lauren Wenzel, Sarah Stein,

Workshop contributors: Kayla Williams, Lauren Wenzel, Sarah Stein, Zac Cannizzo, Gonzalo Cid, Julia Snouck-Hurgronje, Kim Hum, Mike Murray, Erica Seiden, Susie Holst, Michael Lameier, Dana Wusinich-Mendez, Kelly Montenero, and many workshop participants.

Case Study contributors: Julie Bursek, Jennifer Brown, Ryan Freedman, Shauna Fry, Sean Hastings, Chris Mobley, Mike Murray (Channel Islands); Andy Bruckner, Joanne Delaney, Beth Dieveney, Sarah Fangman, Sarah Stein (Florida Keys); Kim Hum, Marc Lammers, Ed Lyman (Hawaiian Island Humpback Whale); Pete DeCola, Ben Haskell, Alice Stratton, David Wiley (Stellwagen Bank).



Executive Summary

Management effectiveness for national marine sanctuaries (sanctuaries) can be described broadly as “the degree to which the sanctuary system or a component site is meeting its ecosystem health and/or cultural resource integrity goals.” The national marine sanctuary system includes 15 national marine sanctuaries and Papahānaumokuākea and Rose Atoll marine national monuments, encompassing more than 620,000 square miles of marine and Great Lakes waters from Washington state to the Florida Keys, and from Lake Huron to American Samoa. The system is managed by NOAA’s Office of National Marine Sanctuaries (ONMS) under the authority of the National Marine Sanctuaries Act, which outlines its primary goal of resource protection, together with other goals such as public awareness and scientific research.

In this report, ecosystem health, cultural resource, and resource protection goals are referred to broadly as “conservation goals.” National marine sanctuaries work through resource protection, research, education and community engagement to accomplish these conservation goals, recognizing the compatible human uses of these areas. As the U.S. works toward new national and global area-based conservation targets, including effective conservation of 30% of the nation’s marine waters by 2030, it is crucial that marine protected area (MPA) performance, including national marine sanctuaries, be periodically examined.

In addition to determining progress toward sanctuary goals, evaluating and communicating management effectiveness promotes adaptive management, justifies resource allocation, and encourages public and partner support for national marine sanctuaries. ONMS develops management plans that describe goals and management objectives, and thereafter publishes periodic Condition Reports that describe the status and trends of sanctuary resources, but there is a need for more internal and external information on the degree to which management actions are achieving conservation goals.

This document summarizes how ONMS has been and can better address management effectiveness across the system and better communicate such effectiveness to a variety of audiences. It is informed by an internal system-wide workshop held in November 2022, detailed case studies of selected national marine sanctuaries, and published international guidance and other protected area work that has focused on protected area management effectiveness and can be applied to sanctuaries.

Workshop Report



NOAA staff disentangling a humpback whale in Humpback Whale National Marine Sanctuary. Photo: NOAA.

Background on Management Effectiveness within the U.S. National Marine Sanctuary System

The national marine sanctuary system includes 15 national marine sanctuaries and Papahānaumokuākea and Rose Atoll marine national monuments, encompassing more than 620,000 square miles of marine and Great Lakes waters from Washington state to the Florida Keys, and from Lake Huron to American Samoa. The system is managed by NOAA's Office of National Marine Sanctuaries (ONMS) under the authority of the National Marine Sanctuaries Act (NMSA), which outlines its primary goal of resource protection, together with other goals such as public awareness and scientific research.

The NMSA, states that one of the goals behind the establishment of the national marine sanctuary system (NMSS) is to "improve the conservation, understanding, management, and wise and sustainable use of marine resources" (NMSA, 2000). For this reason, the topic of management effectiveness has been important to ONMS for decades, and is receiving additional attention in light of the recent 50th anniversary of the NMSS, celebrated in 2022. The NMSA

also states that the Secretary of Commerce should “conduct, support, or coordinate research, monitoring, evaluation, and education programs” to fulfill its mandate. The case studies that informed this document aim to highlight specific sanctuaries’ science, management, and education actions that contribute to reaching conservation goals as mandated by the NMSA.

When a marine sanctuary is established, the NMSA requires the development of a management plan, a site-specific document that lists sanctuary goals, objectives, and strategies for resource protection, and guides decision-making and future project planning. Management plans typically include thematic action plans with indicators or milestones that show how NOAA plans to measure progress toward the desired outcomes of the action plan. After management plans are in place, sites conduct periodic management plan reviews, as required by the NMSA. These updates are informed by condition reports (described below). Management plan reviews assess progress toward the site’s goals and objectives and, when needed, reassess and update the goals, objectives and strategies given resource conditions and trends.

Approximately every ten years, each sanctuary develops a condition report, an assessment of the status and trends of sanctuary resources. Condition reports are developed through a collaborative process, with input from diverse federal and non-federal subject-matter experts, to provide the scientific foundation for management plan review.

The current condition report to management plan review cycle helps individual sanctuaries regularly assess their progress towards conservation goals and make adjustments if necessary. However, a system-wide management effectiveness framework is needed to more explicitly evaluate progress toward achieving conservation goals both at individual sites and across the system by describing how site actions are currently progressing toward improving ecosystem health and cultural resource conservation while accounting for external factors (Figure 1). While some actions needed to sustain healthy resources may be outside the scope of sanctuaries’ management, a stronger focus on outcomes may also facilitate stronger interagency and private sector partnerships needed to achieve them.

ONMS’ approach to performance measurement has evolved over time. In 2007, the ONMS Performance Evaluation Manual contained a series of performance measures listed with associated time-conditional targets for their implementation. Such measures addressed multiple aspects of performance such as habitat and water quality, living marine resources, permitting, partnerships, education, and more. System-wide progress reports provided an internal assessment of the System’s progress toward reaching the performance measure targets, and were created in part to provide internal governmental audiences (i.e., National Ocean Service (NOS) and NOAA budget offices, the Department of Commerce (DOC), and the Office of Management and Budget (OMB)) with up-to-date performance data. The last progress report was conducted in 2009.

Since then, information on the status of national marine sanctuary resources has been published in site-specific condition reports. However, condition reports focus on the status and trends of sanctuary resources and often do not explicitly link this condition to management actions being taken by the sanctuary or other management agencies. Condition reports, and the more concise products that usually accompany them, additionally serve as outreach products to communities and partners.

Management Effectiveness Framework

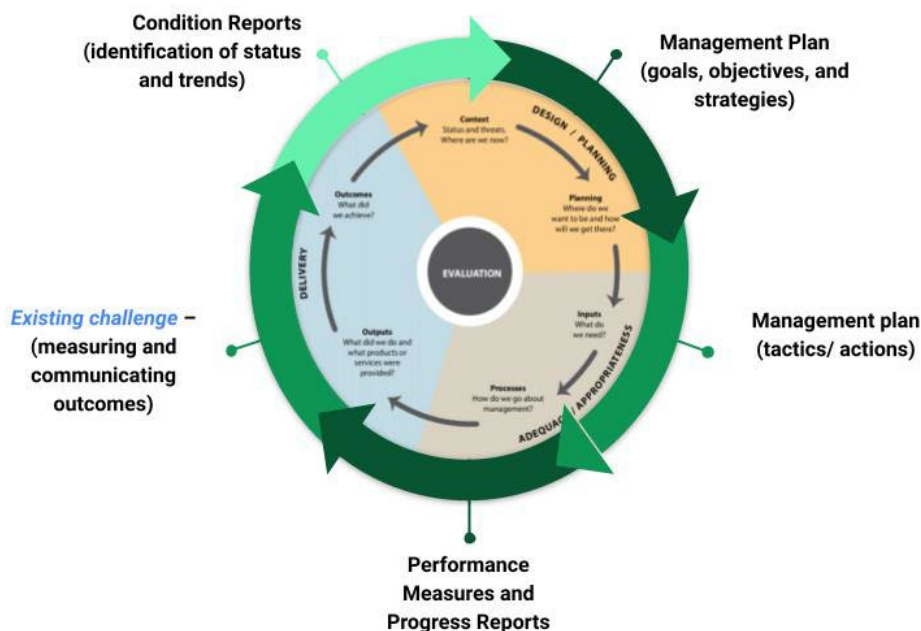


Figure 1. Adapted from the WCPA Management Effectiveness Framework.

Methods

To inform this document, ONMS prepared case studies for four national marine sanctuaries -- Channel Islands, Stellwagen Bank, Florida Keys, and Hawaiian Islands Humpback Whale. Each case study included an in-depth review of the site management plan and condition report, as well as interviews with sanctuary staff, and other representatives. During each of the interviews, information was gathered on:

- The most effective management, science, and education or outreach actions the sanctuary has taken since designation that serve its conservation goals
- How the outcomes of these actions are measured
- Challenges to being effective or achieving conservation outcomes
- Best practices developed to address these challenges

Case study sites were selected based on geographic representation; diversity of ecosystems, species and cultural resources; diverse human uses; previous work on management effectiveness; and recent completion (or work in progress) on a management plan revision or condition report.

The case studies were complemented by an internal sanctuary system-wide virtual workshop held on November 9-10, 2022, to discuss how the system can enhance management effectiveness and its communication at the site and system levels. The system-wide workshop allowed for in-depth conversation with sanctuary staff to provide context, as well as fill in any

information gaps. The information gathered from document analysis, interviews, and the workshop informed this report that describes how ONMS can better address management effectiveness across the NMSS.

Approximately 50 people attended the virtual workshop and attendees represented broad categories of research (ecologists, marine scientists, research coordinators, etc.), management and policy (superintendents, resource protection coordinators, policy and program analysts, etc.), and education (communication and outreach coordinators, education and outreach coordinators, etc.). The workshop agenda for both days included opening presentations that addressed the background of management effectiveness in ONMS, management effectiveness case studies from sanctuaries, NOAA's Coral Reef Conservation Program, and the National Estuarine Research and Reserves (NERR) System. After presentations and group discussion, workshop attendees split into virtual breakout groups.

During the workshop, breakout groups discussed an initial proposed management effectiveness definition: the degree to which protected areas are achieving their conservation goals and objectives. Participants discussed the word "conservation" and how to define it. Workshop attendees also highlighted that sanctuaries have other purposes in addition to conservation (i.e. education, research, and human use).

The NMSA states that the purpose of the Act is "(2): to provide authority for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities," and "(6) to facilitate to the extent compatible with the primary objective of resource protection, all public and private uses of the resources of these marine areas not prohibited pursuant to other authorities" (emphasis added). The purpose section also notes several other purposes of the act, including public outreach and research.

Based on this context, the management effectiveness definition used in this report is: the degree to which the sanctuary system or a component site is meeting its goals for ecosystem health and cultural resource integrity.

The breakout groups also discussed answers to the key questions below:

- What are the main challenges to achieving our conservation goals, and how are we addressing these?
- Some of the key tools we use to assess the effectiveness of our management actions are condition reports, management plans, performance measures (indicators), and socio-economic assessments. How can we improve our use of these and other tools?
- How can we measure the conservation impacts of our partnerships (e.g. when we don't directly control outcomes) at the site level?
- How can we improve our partnerships in order to achieve sanctuary conservation goals?
- Should we establish management effectiveness indicators for the system as a whole? What would this look like?
- How well do we communicate our management effectiveness to the public and our partners? How can we improve?

- How can we update our goals, objectives and management strategies based on what we learn through evaluation?

Finally, groups came together to report out and go over the main findings, which are incorporated into this framework and found below.

What Does the National Marine Sanctuary System Do Well?

Multiple functions in support of overarching conservation goals

National marine sanctuaries have an overarching mission of resource protection, and conduct science and education to support it. Sanctuaries lead research, and support the research of outside organizations and partners, promulgate regulations and work with state and federal partners to enforce them, and educate and engage the public on the importance of marine resources and conservation. This broad range of activities allows the NMSS to play a key role within communities as conveners and partners. For example, sanctuary science teams connect to the larger local scientific community, sanctuary staff influence management decisions of authorities such as NOAA Fisheries and Regional Fisheries Management Councils. Further, sanctuaries bring communities together through education to show the value of marine and Great Lakes areas and promote stewardship.

Catalyzing new conservation efforts

Sanctuaries are effective in catalyzing new conservation efforts. For example, Stellwagen Bank, recognizing that sand lance are a foundational species of the marine food web of the Gulf of Maine, used research and science contained in their condition report to scientifically justify the need for restrictions on landings of sand lance that were then incorporated into state regulations in Massachusetts and Rhode Island. Sanctuaries use research conducted by staff, or in partnership with external organizations, to inform management actions.

What are the Major System-wide Challenges?

Addressing External factors

Sanctuaries often face challenges resulting from the influence of external, regional, and global factors beyond their control that hinder or reverse conservation efforts. These can include both global drivers like rising ocean temperatures and regional or local factors such as water quality issues. For example, Florida Keys National Marine Sanctuary is facing the global threat of climate change compounded with regional water quality issues (see case study in Appendix A). The sanctuary works with various state and federal partners to address the impacts of these stressors. Sanctuary management actions can also address local stressors that can help build resilience to regional and global stressors. Sanctuaries also face challenges in assessing management effectiveness across multiple scales. Condition reports currently assess status and trends for water quality that are representative of the entire sanctuary (e.g., “What is the eutrophic condition of sanctuary waters and how is it changing?”). Due to the size and geography of the sanctuary, some areas of the Florida Keys, for example, are more impacted by water quality than others. These localized differences may not be as thoroughly reflected in the

condition reports as would be useful for monitoring resource conditions across multiple spatial scales.

Including Management Effectiveness in Management Plans

Most management plans do not explicitly highlight how past and current management actions have influenced resource conditions. Management plans should reference the previously published condition report and, where possible, explain how past management actions have influenced the condition of resources in the sanctuary. An example of this is Stellwagen Bank National Marine Sanctuary's final management plan, which includes a "Management Actions and Outcomes" section that tracks management outcomes since the previous plan was published. Currently, there is no consistent approach to evaluating management effectiveness across the system. Management plans should be more standardized across the system, and should include a section titled "Evaluating Management Effectiveness" that describes the performance measures that will be used to evaluate effectiveness, and how and when they will do so (see Recommendation 3).

Developing collaborative relationships with federal, state, and tribal partners

Federal, state, and tribal partnerships are essential to effective management, and can be strengthened. Overlapping and adjacent boundaries with other area-based management tools such as fishery management areas, state parks and reserves, national wildlife refuges, municipalities, and others can make it difficult to communicate and find common ground.

Many sanctuaries and marine national monuments have geographic boundaries that overlap with state jurisdictions, and have partnerships with the state as co-managers. For example, the Florida Keys National Marine Sanctuary (FKNMS) works with a primary state partner, the Florida Department of Environmental Protection, but also has to consider around over 20 other agencies, including specific programs (e.g. enforcement, science). FKNMS also works with regional efforts, such as the Comprehensive Everglades Restoration Plan, a federal-state partnership between the U.S. Army Corps of Engineers and South Florida Water Management District responsible for implementing planning, construction, and operation of numerous restoration projects that aim to "protect, preserve, and restore the south Florida ecosystem" (National Park Service, n.d.). Sanctuaries should continue to participate in interagency programs with goals that benefit the sanctuary.

Sanctuaries have worked for many years with Tribal governments and Indigenous communities, and there is a growing interest within those communities for a greater role in sanctuary and monument management. Sites in the process of sanctuary designation, such as the proposed Chumash Heritage National Marine Sanctuary, Hudson Canyon National Marine Sanctuary, and Papahānaumokuākea Marine National Monument, or in pre-designation discussions, such as those with the Aleut Community of St. Paul Island for Alagum Kanuux, are exploring new models for collaborative management (other terms used include co-management or co-

stewardship). Current challenges include developing relationships of trust with Tribes and Indigenous communities, the degree to which NOAA is permitted by law to delegate management authority, and identifying mechanisms for sharing management responsibilities, such as through partner organizations and MOUs. As these relationships and new models evolve, NOAA will need to evaluate the effectiveness of these governance models.

Administrative Challenges

ONMS faces both external and internal administrative challenges resulting from NOAA and the Department of Commerce processes. Processes for establishing Memoranda of Agreements and execute funds take months to complete and this can impact projects and partnerships. Other administrative hurdles exist for timely federal hiring and allocation of budgets to implement priority projects. ONMS should work with relevant NOAA offices to advocate for more streamlined and effective administrative processes.

Additional Challenges

Additional challenges highlighted during interviews and in the workshop included measuring sanctuary effectiveness, defining what effectiveness means for multiple-use MPAs, quantifying program effectiveness when working with partners, and challenges with standardizing information across the NMSS.

Diverse Site Authorities and Capabilities

ONMS should consider how to address the diverse authorities and capabilities across the sanctuary system, including the legal authority, staff capacity, or other resources to achieve our conservation goals. Sanctuaries vary in their conservation focus (ecosystem, focal species, cultural resources) as do the regulatory tools available to implement conservation actions. For example, the Hawaiian Island Humpback Whale National Marine Sanctuary lacks regulatory authority and cannot take the lead on traditional resource protection (i.e. permitting, etc.). However, the sanctuary plays a critical role in developing the science that influences federal and state policy and in performing stranding responses to directly protect humpback whales, the focal resource of the sanctuary. The National Marine Sanctuaries Act has not been reauthorized since 2000. Since that time, the program has undergone several comprehensive external evaluations that have identified opportunities to strengthen NOAA's authority under the Act. NOAA should continue to work with Congress to promote the passage of a reauthorization that addresses these gaps and opportunities.

Recommendations

As a result of the management effectiveness workshop and other activities and research described above, this document provides the following recommendations to improve the ability of ONMS to track the management effectiveness of both individual sanctuaries and the broader NMSS:

1. Adopt a system-wide definition of management effectiveness and how it is implemented throughout the NMSS.

In order for the NMSS to assess and communicate its effectiveness to its governmental partners, rightsholders, stakeholders, and the public, it must first develop a common understanding of what management effectiveness means with respect to national marine sanctuaries. The working definition developed, based on discussion at the system-wide workshop and NMSA mandates highlighted in the Methods section, is: the degree to which the sanctuary system or a component site is meeting its goals for ecosystem health and cultural resource integrity.

This definition will provide a common framework for sanctuary staff to consider how well our collective management measures are working, providing the basis for the identifying monitoring parameters and indicators. As the U.S. works toward new national and global area-based conservation targets, including effective conservation of 30% of the nation's marine waters by 2030, it is critical that MPA performance, including national marine sanctuaries, be periodically examined.

The goals of a sanctuary can be interpreted broadly or narrowly (e.g., the goals within the terms of designation, goals of regulations, or goals and objectives in the management plan or ONMS Strategic Plan). Sanctuary-specific and system-wide goals should be implemented through supporting SMART objectives (i.e., specific, measurable, achievable, relevant, and time-based).

During the workshop, there was a lively discussion about the term “conservation,” including the role of science and education in supporting conservation goals, the role of compatible uses, and the recognition of different worldviews and cultural aspects of conservation. These issues can be clarified through SMART objectives that identify what is meant by the term within a specific context and how it will be measured.

Finally, ONMS' approach should emphasize that management effectiveness involves a flexible and adaptive process for evaluating the outcomes of our management actions against pre-defined objectives and targets as well as ongoing changes to stressors and resource conditions both in and outside of our direct influence.

2. Clearly state management goals and objectives in management plans.

In order for sanctuary staff, partners, rightsholders, stakeholders, and the public to assess management effectiveness of sanctuaries, a clear connection is needed between the purpose and goals of the sanctuary and the management actions put in place to progress toward achieving those goals. For example, management plans should state the overarching management objectives for the sanctuary, not only the objectives of individual action plans. An example of this is the Channel Islands National Marine Sanctuary's 2009 Management Plan, which states the sanctuary objectives in its Executive Summary.

3. Create a section in revised management plans that explicitly highlights management actions, and the degree to which they were successful in conserving sanctuary resources.

A section within sanctuary management plans highlighting management effectiveness at the site is beneficial as these are public-facing documents that provide the most comprehensive summary of planned management activities within a site and communicate the site's intentions, objectives, goals, and plans. For example, the Stellwagen Bank National Marine Sanctuary's final management plan includes a "Management Actions and Outcomes" section that tracks management outcomes since the previous plan was published. This section should include the performance measures that will be used to evaluate effectiveness. A management effectiveness section in management plans would keep managers, partners, and stakeholders informed about whether previous management measures were successful (not just whether they were implemented), and how management of the site is changing in response. This adaptive management approach is particularly important in light of climate change.

4. Develop system-wide and site based management effectiveness indicators to account for conservation progress at different spatial scales.

There was broad agreement among workshop participants that a set of system-wide management effectiveness indicators is needed, as are site-based indicators to account for the differences in goals, approaches, and spatial scales among sites. As mentioned above, FKNMS is an example of where improvements in site-based indicators would be beneficial for monitoring conditions of sanctuary resources, such as water, across multiple spatial scales. Many management actions in sanctuaries are focused on specific locations (such as particular zones), rather than sanctuary-wide, and monitoring is needed to evaluate the effectiveness of these targeted management actions. In addition, ONMS staff should work to develop management outcomes for the system that are linked to both sites performance indicators and the ONMS Strategic Plan.

5. Continue to strengthen partnerships with States, Tribes and Indigenous Communities, and coastal communities, and engage them in a dialogue about management effectiveness

Given that sanctuaries rely on a wide range of partnerships to achieve our collective conservation goals, partners should be actively engaged in discussions about management effectiveness. Sanctuaries should establish diverse partnerships, collaborations, co-stewardship, and co-production of knowledge to develop management effectiveness indicators, and the research and monitoring to track them over time.

Recognizing that there are different approaches, partnerships, and knowledge systems needed to inform management, special attention needs to be given to our collaboration with Tribal governments and Indigenous communities. This includes working to co-develop indicators through bringing together Indigenous Knowledge and science; working with communities to identify Indigenous community-driven research questions; and equitable involvement of Indigenous partners in collaborative and co-stewardship approaches.

Building effective partnerships also requires administrative tools and capacity to support this work within ONMS and NOAA. Examples include streamlined business procedures and added staff support to navigate processes such as interagency agreements, memoranda of understanding, and cooperative agreements.

6. Improve the use of the existing management and assessment tools

Workshop participants and case study interviewees identified a variety of ways that the NMSS can improve the use of existing management and assessment tools. This includes:

- **Make management plans shorter and more standardized.** Many sanctuary management plans are hundreds of pages long, reducing their utility as management documents that are easily accessible to staff, partners, and the public. Ideally, management plans should be based on standard templates that can be rolled up more easily across regions and nationally to make programmatic decisions such as resource shortfalls and to showcase results. Brief, public-facing management plans could operate at a strategic level, with implementation details in a separate (perhaps internal) implementation plan.
- **Implement a core set of monitoring indicators.** The NMSS is exploring a core set of indicators to better understand the status and trends of resources and environmental conditions across the system. A standardized set of indicators would allow the NMSS to leverage its geographic and ecological diversity in a manner that would allow for the robust monitoring of conditions and trends at local, regional, and national scales. Such a system-wide approach would also allow sanctuaries to more effectively track their management effectiveness within broader regional and national contexts as well as within the context of broader environmental changes and stressors.

- **Continue efforts to make data and information available in near real-time for decision making.** Condition reports are updated approximately every 10 years. Recent efforts to provide current or recent data on conditions and trends (“webinized” data) are an important step in ensuring that decisions are informed by the best available science.
- **Improve linkages between condition reports and updated management plans.** Condition reports describe the status and trends of sanctuary resources. These conditions should be addressed explicitly in the management plan, noting how resource quality will be maintained or approved through proposed management actions and partnerships.
- **Evaluate and report on specific management actions undertaken to address resource protection.** Just as the link between condition reports and management plans lay out the conceptual framework for management effectiveness, undertaking evaluation activities and sharing them internally and externally documents the successes (and failures) of particular management actions.

7. Request that Congress Reauthorize the National Marine Sanctuaries Act

The National Marine Sanctuaries Act has not been reauthorized since 2000. Since that time, the program has undergone several comprehensive external evaluations that have identified opportunities to strengthen NOAA’s authority under the Act. NOAA should continue to work with Congress to promote the passage of a reauthorization that addresses these gaps and opportunities.

8. Manage effectively in a changing climate

Climate change is a persistent, accelerating, and expansive challenge to sanctuaries that directly threatens the ecosystems and cultural resources under their stewardship while undermining the effectiveness of existing and responsive management actions. Effective management in the context of a changing climate and ocean requires directly, adaptively addressing the impacts of climate change while using climate-informed management to more effectively address non-climate threats to the sanctuary.

The NMSS should continue to utilize tools such as Climate Impact Profiles and Climate Vulnerability Assessments to evaluate sanctuaries’ ongoing and expected vulnerability to climate change. The system should also build on this understanding of climate change impacts and vulnerability to identify and implement adaptation strategies, which can include a range of actions that both respond to climate impacts directly and reduce the non-climate stressors that compound, or are compounded by, climate change impacts. Adaptation strategies include, but are not exclusive to: managing dynamic conditions, protecting and restoring habitats including those habitats and processes that draw down and/or store carbon (e.g. blue carbon), working with relevant authorities to manage invasive species and water quality, reducing human disturbance, and educating communities about the role of MPAs in mitigating and adapting to

climate change. As the climate continues to change on a global scale, the NMSS should build the flexibility and adaptability required to address complex climate change challenges into management at the beginning of planning processes.

9. Broadly share the story of ONMS' management effectiveness

ONMS has extensive resources at its disposal to share the successes, accomplishments, and challenges of the sanctuary system, including our websites, social media channels, videos including the Stories from the Blue Series, the annual Earth is Blue Magazine, educational resources, webinars, educational resources, and an extensive network of media partners and contacts to help expand our reach. Planning specifically for what we want to achieve with our communications efforts, who we are trying to reach, the best way to reach those audiences, and the effectiveness of our communication approaches should be an early and integral part of the management effectiveness process.

Conclusion

National marine sanctuaries are areas of the marine environment of national significance, which are designated to manage human activities in and conserve these marine areas. They support research to increase the understanding of ecosystems and maritime heritage resources; protect and restore natural habitats, populations, ecosystem processes and maritime heritage resources; and enhance public awareness and sustainable use of the environment (NMSA, 2000). The NMSS has a variety of tools, such as management plans and condition reports, that can inform management effectiveness, but there is a need to better define management effectiveness and create a management effectiveness program that bridges the gap between the status and trends reported in condition reports and planned activities in management plans, and shows the impact of our management over time. This is especially important in the context of climate change. As climate change continues to accelerate, the NMSS should be flexible in how it measures and communicates effectiveness, and in whose knowledge and science it uses to do this.

Appendix A: Channel Islands National Marine Sanctuary Case Study



Students from a nearby Ocean Guardian school participate in beach cleanup with Channel Islands National Marine Sanctuary staff. Photo: NOAA.

Site Background

The Channel Islands National Marine Sanctuary (CINMS) was designated on October 2, 1980 to protect diverse habitats, exceptional biodiversity, and rich maritime heritage from the impacts of human activity. Located off of the coast of Santa Barbara, California and encompassing 1,470 square miles of water offshore, CINMS is a site known for its diversity of important species and habitats such as kelp forests, eelgrass, deep seafloor habitats, fish, marine mammals, and others. The area is also a focus of commercial activities such as fishing, shipping, and tourism as well as for recreation and cultural activities. It is the ancestral home of the Chumash people, with important cultural, spiritual, and subsistence values. The sanctuary is located both in state and federal waters, and is jointly managed by NOAA, the National Park Service, and the State of California, who coordinate with CINMS to create and implement its programs and regulations. The sanctuary has established methods to assess the status and trends of sanctuary resources, including using an analytical and science-based framework to develop a Condition Report (last updated in 2016).

Natural and cultural resources in and around the sanctuary continue to be affected by human activities, including commercial shipping and recreational boating, commercial and recreational fishing, pollution, and climate change. Based on information gathered through interviews with sanctuary staff and partners, this case study begins to fill a gap by making the connection between sanctuary management actions and resource conditions. The case study describes some of the most effective strategies the sanctuary has employed to address some of these main

pressures, as well as some of the challenges of effective management that remain and best practices developed.

Commercial shipping

Management

One of the of the most effective management efforts CINMS has implemented to address commercial shipping impacts on sanctuary resources is the Protecting Blue Whales and Blue Skies program, a voluntary incentive-based vessel speed reduction (VSR) program that encourages ships to slow down to a speed of 10 knots or less in seasonal slow speed zones. The program focuses on areas along the coast of California that have experienced high levels of shipping traffic, air pollution, and presence of endangered whales. Slowing ships down to 10 knots reduced air pollution and greenhouse gas emissions, risk of fatal vessel strikes of whales, and ocean noise. The program runs apogmnually from May 1 to mid-December, coinciding with peak ozone, whale feeding, and whale migration along the California coast. In return for reduced speeds, shipping companies receive public recognition; financial incentives used to be offered, but due to budget constraints and companies declining the awards, financial incentives are no longer offered. The program has been considerably successful, with the 2021 season seeing the highest cooperation rate since the program's inception in 2014. In 2021, emissions in the area were reduced by 650 tons of smog-forming NOx and 22,201 metric tons of regional greenhouse gasses (GHGs); ocean noise was reduced by 5 db/transit and risk of ship strikes with whales reduced by 50%.

Modeling is used to assess the effectiveness of the vessel speed reduction program by estimating the resulting reduction of whale mortality, ocean noise, and air quality improvements.

Unfortunately, it is difficult to measure the reduction in actual strikes due to factors such as sinking whale carcasses after strike and lack of adequate ship strike reporting. Automatic Identification System (AIS) data is used to track vessel speed for cooperation. AIS allows for real-time tracking of a ship's location, speed, course, and identification.

Science

To address shipping and boating impacts through science, the sanctuary conducts monthly aerial surveys of whales to track their movements in the Santa Barbara Channel region. These surveys inform the dates that trigger the VSR Protecting Blue Whales and Blue Skies program.

Citizen-science that is conducted through whale sightings and photo identification, collected by Channel Islands Naturalist Corps¹ volunteers on participating whale watch vessels, and reported on a publicly available app - Whale Alert - informs whale biologists and the sanctuary to track whales .

The sanctuary supports noise monitoring and research by NOAA,² universities, and other organizations. This monitoring has three purposes: to measure ambient noise levels and

¹ <https://www.nps.gov/chis/getinvolved/supportyourpark/channel-islands-naturalist-corps.htm>

² <https://sanctuaries.noaa.gov/science/sentinel-site-program/channel-islands/noise.html>

document how they change over time, to develop the use of acoustics for monitoring marine ecosystems and species (this is new and developing science), and to gauge the effect of the VSR program on the soundscape.

Commercial Shipping Challenges/ Best practices

One of the challenges the sanctuary faces in effectively addressing impacts from commercial shipping is managing threats to whales and other animals from commercial shipping and recreational boating. Partnerships with the National Marine Fisheries Service (NOAA Fisheries), U.S. Coast Guard, National Park Service, and California Department of Fish and Wildlife are key in addressing these problems. Working directly with multiple stakeholder groups, especially members of the shipping industry, through the Sanctuary Advisory Council and its working groups, will continue to be essential for effectively managing shipping impacts within and outside of sanctuary boundaries.

Another significant challenge is the difficulty in measuring whale mortality resulting from shipping or the number of whales saved due to VSR zones and other vessel routing measures established through the International Maritime Organization (IMO) including modifications to shipping lanes and expansion of the Area to be Avoided. While NOAA lacks definitive data on how many whales are hit by ships, managers must rely on scientific modeling, opinions and projections to inform management actions. The projections likely underreport the number of strikes. For shipping, similarly to other pressures, much of the sanctuary's management measures are precautionary, which can be challenging to justify to ocean users.

Lastly, there is no long term commitment of funding for the Protecting Blue Whales and Blue Skies program. Annually, the program costs about \$500,000 to fund the positive public relations campaign and analysis of the co-environmental benefits; this does not include substantial in-kind staff support provided by the partner agencies.

Commercial & recreational fishing

Management

Sanctuaries work with agencies and organizations with primary responsibility for fisheries management -- Regional Fisheries Management Councils, NOAA Fisheries and states -- to address fisheries issues. National marine sanctuaries have the authority to take an ecosystem approach to fisheries management, such as establishing no-take marine reserves within sanctuary boundaries.

Consultation with federal agencies under section 304(a)(5) of the National Marine Sanctuaries Act and bringing requests to the Pacific Fisheries Management Council have historically proven effective for the sanctuary to indirectly manage impacts of fishing on sanctuary resources. Monterey Bay, Channel Islands, and other west coast sanctuaries and partners worked with the Pacific Fishery Management Council to close krill harvest along the entire west coast. This was a preventative measure to ban the harvest of krill, an important foundational food web resource,

before a commercial fishery was established.³ This work strategically addressed potential impacts from pressures, such as fishing, not limited to sanctuary boundaries but influencing sanctuary resources.

One of the most effective management actions was the establishment of 13 no-take marine reserves and limited-take marine conservation areas,^{4,5} which were initially designated in state waters in 2003 and expanded to federal waters in 2007. CINMS worked with the Pacific FMC and the State of California Fish and Game Commission to create these marine reserves, which cover 21% (240 square nautical miles) of the sanctuary. This marine protected area network prohibits the “*harvesting, removing, taking, injuring, destroying, collecting, moving, or causing the loss of any sanctuary resource, or attempting any of these activities.*” Marine conservation areas prohibit the same, with exceptions for recreational fishing for pelagic finfish or commercial and recreational fishing for lobster. The Channel Islands Marine Protected Area network has been credited with resulting in spillover of commercially important species, such as spiny lobster. The impact is validated through extensive monitoring of these zones, which will be discussed in more detail in the *Science* section below.

Science

Monitoring of marine reserves and marine conservation areas in the Channel Islands is conducted by partners such as the Channel Islands National Park’s Kelp Forest Monitoring Program (KFMP) and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) at the University of California, Santa Barbara. Most marine reserve monitoring and tracking of effectiveness is focused on kelp forests, although the reserves were created to address other habitats such as soft bottom and deep water habitats. Most of the monitoring is focused on kelp forests due to limited monitoring capacity within the sanctuary and because many of the fisheries that are operating in Channel Islands marine reserves are targeting kelp habitats for fish species. Deep sea coral research and monitoring is also an important scientific component at CINMS.

Additionally, through technology tools such as multibeam arrays and remotely operated vehicles (ROVs), deeper water habitats have been mapped and characterized offering opportunities for monitoring and understanding deep sea coral habitats.

To address another key impact of commercial and recreational fishing, entanglement, CINMS has been supporting the work of engineering teams at UCSB on fishing gear that would be less prone to entangling species, with a focus on whales.⁶

³ <https://montereybay.noaa.gov/resourcepro/resmanissues/krill.html>

⁴ <https://channelislands.noaa.gov/marineres/>

⁵ <https://www.nps.gov/chis/learn/nature/marine-protected-areas.htm>

⁶ <https://capstone.engineering.ucsb.edu/projects/noaa-tightlines>

Commercial & recreational fishing Challenges/ Best practices

The sanctuary faces a number of challenges in effectively addressing impacts of commercial and recreational fishing on sanctuary resources. As is the case with many sanctuaries and pressures, the impacts to resources from fishing are also felt outside of the sanctuary. There is also a challenge in measuring effectiveness for precautionary actions (e.g. prohibiting the development of a commercial krill fishery). However, because krill are a nearly exclusive food source for blue whales and other whale species, modeling could project and illustrate the conservation impact of preventing commercial krill harvest across various trophic levels.

Oil and Gas Activities

Management

Establishment of the sanctuary helped to discontinue new oil and gas extraction practices within the sanctuary boundaries. California is a top-10 oil-producing state, and the 1969 Santa Barbara Oil Spill, one of the largest environmental catastrophes in U.S. history,⁷ spurred the modern environmental movement during which time Congress passed environmental legislation such as the National Environmental Policy Act, the Clean Water Act, the Coastal Zone Management Act, and the Marine Protection, Research and Sanctuaries Act (now National Marine Sanctuaries Act).⁸ Channel Islands National Marine Sanctuary was designated to permanently protect waters out to six nautical miles around the islands from offshore drilling. The sanctuary, like others in the sanctuary system, prohibited oil and gas exploration, drilling, and extraction (with the exception of leases pre-dating the sanctuary). California has not allowed new leases for offshore oil and gas drilling and extraction in state waters since 1994. Designating the sanctuary was effective in being the catalyst for effectively stopping new leases for oil and gas drilling in waters surrounding the Channel Islands.

Climate Change

Management

In addition to Protecting Blue Whales and Blue Skies, which is contributing to the reduction in regional greenhouse gasses, the marine reserves in the CINMS are likely having some climate benefit. CINMS will also be conducting a climate vulnerability assessment (CVA), which evaluates the impacts of climate and non-climate stressors on the climate vulnerability (exposure, sensitivity, and adaptive capacity) of a species, habitat, or area. Conducting a CVA will help inform climate planning.

Science

CINMS partners with (PISCO), the University of California-Davis, Bodega Marine Laboratory, and other west coast sanctuaries and partners as part of the West Coast Observation Project (WCOS). WCOS deals with observation data collected at the five sanctuary sites located on the

⁷ <https://www.latimes.com/local/lanow/la-me-oil-spill-santa-barbara-retrospective-20190131-story.html>

⁸ <https://response.restoration.noaa.gov/about/media/how-disaster-changed-face-ocean-conservation.html>

west coast (Olympic Coast, Cordell Bank, Greater Farallones, Monterey Bay, and Channel Islands).⁹ Various climate-related data streams are collected, including ocean temperature, current speed and direction, oxygen, salinity, wind speed and direction, turbidity, and fluorescence at numerous instrument moorings located within each of the five sanctuaries. These moorings are operated in collaboration with PISCO and the University of California-Davis, Bodega Marine Laboratory as part of the Pacific Coast Ocean Observing System (PCOOS).

A peer-reviewed paper on the utility of no-take MPAs in the Channel Islands for boosting climate resilience and resistance is in prep by Ryan Freedman, and other members of the CINMS research team.

Climate Change Challenges/ Best practices

According to the CINMS Climate Change Science Needs Assessment,¹⁰ there are still a number of climate change science and conservation needs. These include predicted shifts in abiotic conditions and impacts to sanctuary resources, climate thresholds relevant to CINMs biological communities, species range shifts, human capacity to respond to climate impacts, changes in ecosystem services, and conservation tools (i.e blue carbon) that can be used to mitigate climate change drivers and impacts. Formal partnerships are needed to conduct research that addresses these information needs.

Education

Citizen Science and Public Outreach Programs

CINMS is involved in a variety of education programs, including the Long-term Monitoring Program and Experiential Training for Students (LiMPETS) and the Channel Islands Naturalist Corps Program. LiMPETS is a long-term citizen science monitoring program, and a collaboration between the Greater Farallones Association, the Pacific Grove Museum of Natural History, and California's National Marine Sanctuaries, that works with students and teachers to demonstrate the scientific method and field survey methods to conduct sandy beach and rocky intertidal monitoring. Monitoring establishes a baseline from which changes in intertidal habitats and organisms are measured. This is especially relevant in light of climate impacts such as species range shifts and sea level rise leading to loss of sandy beach habitat. The Channel Islands Naturalist Corps is a multifaceted educational program coordinated jointly with the Channel Islands National Park that conducts citizen science and public outreach on various sanctuary issues such as vessel strikes to whales (entering photo identification data into the Whale Alert app), commercial and recreational fishing impacts, and others.

Collecting long-term citizen science data through educational programs such as LiMPETS and the Channel Islands Naturalist Corps program are effective in both increasing public awareness and informing management actions. For example, naturalists collect visual whale sighting

⁹<https://sanctuariesimon.org/regional-nms/ocean-observatories/>

¹⁰<https://sanctuaries.noaa.gov/science/assessment/channel-islands/climate.html>

citizen science data which is combined with hydrophone acoustic data to inform the dates of, and promote mariner compliance with, vessel routing and speed reduction measures such as the successful Protecting Blue Whales and Blue Skies¹¹ VSR program.

¹¹ <https://www.bluewhalesblueskies.org/>

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Appendix B. Florida Keys National Marine Sanctuary Case Study



Restoring corals in Florida Keys National Marine Sanctuary as part of the Mission: Iconic Reefs initiative. Photo: NOAA.

Site Background

Environmental degradation caused by human activity such as oil drilling, and declining water quality and coral reef health spurred the initial designation of the Key Largo National Marine Sanctuary in 1975 and Looe Key National Marine Sanctuary in 1981, which were incorporated into FKNMS when President George H. Bush signed into law the bill establishing Florida Keys National Marine Sanctuary in 1990. With the incorporation of Key Largo and Looe Key, FKNMS now protects 2,900 square nautical miles of Florida Keys waters.¹²

The sanctuary is cooperatively managed with the State of Florida with the purpose of protecting the resources of the area, educating and interpreting the Florida Keys marine environment to the public, and managing human uses of the Sanctuary (FKNMS, 1990). The sanctuary is home to a variety of habitats and living resources such as mangroves and seagrasses, coral reefs and hard-bottom habitats, macroalgae, marine invertebrates, fish, birds, turtles, and marine mammals. Monroe County is also a hotspot for tourism, commercial fishing, military activity, and residential areas, all of which are major contributors to the Florida Keys economy. Overuse and human activities have led to resource degradation, in addition to other impacts on water quality and from climate change.

¹² <https://floridakeys.noaa.gov/history.html>

The sanctuary has established methods to measure and report on the status and trends of sanctuary resources. Resource status and trends over time indicate that resources in and around the sanctuary continue to be impacted by the main pressures mentioned above. Based on information gathered through interviews with sanctuary staff and partners, this case study aims to describe how sanctuary management actions are helping to protect and restore resource conditions. The case study describes the most effective strategies the sanctuary has employed to address some of these main pressures, as well as the best practices developed and remaining challenges.

Water Quality

Management

Two related programs with which the sanctuary closely coordinates are the Water Quality Protection Program (WQPP) and the Water Quality Monitoring Program (WQMP). The WQPP, a large, collaborative program involving federal, state, and local governments, non-governmental organizations, academic institutions, and local citizens, was established by the U.S. Congress through the Florida Keys National Marine Sanctuary and Protection Act of 1990¹³ to “identify and implement priority corrective actions within a compliance schedule to address point and nonpoint sources of pollution to maintain the chemical, physical, and biological integrity of the Sanctuary.” The program also includes the restoration and maintenance of a balanced, indigenous population of corals, shellfish, fish and wildlife, and recreational activities in and on the water. It was created to coordinate implementation of water quality protection measures, including adopting or revising applicable water quality standards for the Sanctuary, pollution control measures, and establishing a comprehensive WQMP to “determine the sources of pollution causing or contributing to existing or anticipated pollution problems in the Sanctuary, evaluate the effectiveness of efforts to reduce or eliminate those sources of pollution, and evaluate progress toward achieving and maintaining water quality standards and toward protecting and restoring the coral reefs and other living marine resources of the Sanctuary.” The State of Florida and Administrator of the Environmental Protection Agency (EPA) are charged with implementing and ensuring compliance with the program. In their 2013 Report to Congress, the WQPP Steering Committee recognized the WQMP as the “glue” holding the WQPP together and recognized the need for continued long-term monitoring and research (U.S. EPA, 2013).

Science

FKNMS will continue to support the WQPP by contributing to ongoing efforts such as identifying additional water quality parameters that could be used to better understand water quality factors and stressors impacting sanctuary resources, recommending changes to the existing water quality monitoring program including new or cost-effective monitoring

¹³ https://floridakeys.noaa.gov/about/fknmsp_act.html

technologies, mapping short and long-term water quality data sets, and identifying non-regulatory actions (such as education or habitat restoration) to improve water quality (FKNMS Revised Draft Management Plan, n.d.).

Water quality for several parameters has improved in the Keys over the past quarter century of monitoring. In their 2020 Annual Report, scientists from Florida International University (FIU) stated that, in the 26-year period that WQMP data has been collected (since Sanctuary designation and establishment of the WQPP), they've seen increases in dissolved oxygen, reduced water column turbidity, and increased surface light reaching the bottom (Briceno and Boyer, 2021). In general, these trends are beneficial for wildlife, especially the corals, seagrass, and algae the FKNMS is known for. However, trends are different in different areas of the Keys; for example, bottom light has been increasing at most of the reef/offshore sites throughout the Keys, but decreased in the backcountry, inshore sites and in the Upper Keys. The complications of measuring effectiveness across multiple scales, especially as it relates to large sanctuaries such as the FKNMS, are discussed below.

In addition, water quality monitoring has been used to inform policy. In 2002, EPA designated all state waters in FKNMS as “no discharge zones” prohibiting the dumping of treated or untreated boat sewage into state waters. Subsequently, in 2010, NOAA eliminated discharge exemptions and adopted no discharge regulations throughout the sanctuary by requiring vessels to use marine sanitation devices.¹⁴ Nonetheless, water quality monitoring has continued to detect increased fecal coliform and dissolved oxygen (indicators of algal blooms and nutrient loading) in Boot Key Harbor due to poorly treated vessel wastewater (U.S. EPA, 2013). EPA has also developed water quality targets for indicators such as dissolved nutrients and total unfiltered concentrations of compounds such as nitrogen, organic carbon, phosphorus, silicate, and chlorophyll *a* (Briceno and Boyer, 2021).

Challenges/ Best Practices

One of the main difficulties in addressing management effectiveness is doing so across multiple scales. The Condition Reports generalize the status and trends of resources in the sanctuary as a whole. Having one measure for the entire sanctuary makes it difficult to account for localized differences, especially as it concerns water quality in the Florida Keys. Because the Keys are part of a complex hydrological system that is influenced by waters such as the Greater Everglades ecosystem and mainland South Florida, water quality is not uniform throughout the sanctuary and some areas of the Keys are more affected by water quality issues than others. For these reasons, a best practice would be continued long-term water quality monitoring and increased capacity for research and monitoring to better understand spatial differences (e.g., regional versus local, Upper versus Middle versus Lower Keys) in water quality issues.

Because water quality is both a regional and local issue for the Florida Keys, and the Sanctuary is supporting and working through a number of different forums to help manage it, FKNMS should continue working through forums such as the Comprehensive Everglades Restoration

¹⁴ <https://www.federalregister.gov/d/2010-29416>

Plan (CERP), enacted by the U.S. Congress in 2000. CERP is a federal-state partnership between the U.S. Army Corps of Engineers (USACE) and South Florida Water Management District who are responsible for implementing “planning, construction, and operation of numerous restoration projects that aim to “protect, preserve, and restore the south Florida ecosystem” (National Park Service, n.d.).

Climate Change

Management

While many climate stressors are outside of the sanctuary’s control, such as the intensified storms, increasing temperatures, and ocean acidification associated with climate change, sanctuary staff are working to build resilience more broadly.¹⁵ Through the Restoration Blueprint, the sanctuary management plan update launched in (2012), the sanctuary is aiming to help reduce impacts on corals and actively engage in restoration efforts. Through the sanctuary’s revised management plan, staff plan to support efforts led by the Florida Reef Resilience Program, a collaborative partnership led by The Nature Conservancy and NOAA, to address coral bleaching, disease, ocean acidification, and other climate-related stressors. Additionally, through the Water Quality Protection Program, the sanctuary is working to improve water quality and reduce stressors such as impacts from vessels and divers, runoff from land, and other inputs that decrease coral health and resilience. Sanctuary staff are also aiming to apply the Resist-Accept-Direct climate adaptation framework into sanctuary restoration approaches, which will be explored further through the revised management plan.

Science

Sanctuary science staff along with partners are researching how corals respond to climate stressors. Specifically, understanding different coral genotypes and their assembly of microorganisms can help us to identify which genotypes within a species may be more resilient to warmer water temperatures and/or more resistant to bleaching or disease. The sanctuary is also partnering with staff at NOAA’s Atlantic Oceanographic and Meteorological Laboratory (AOML) to monitor water quality variables including data collection using buoys with temperature and pH sensors.

Additionally, researchers are trying to understand currents and connectivity for effective larval dispersal and to select areas with suitable water quality to encourage restoration in places that may benefit other places via currents and dispersal. Sanctuary scientists also recognize that currents may change, so it is important to predict how they might change and to ensure that there are sources both upstream and downstream.

¹⁵ <https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/docs/20200512-fknms-climate-change-impacts-profile.pdf>

Challenges/ Best Practices

Many challenges and opportunities remain to effectively manage the sanctuary in a changing climate. The sanctuary needs more site-specific (within-sanctuary) data and information to guide climate adaptation efforts. Planning tools and capacity to build a coordinated approach, as well as communication tools to demonstrate to the public the effectiveness of climate adaptation and restoration approaches are also needed.

The sanctuary is taking active steps to address climate impacts, where possible. For instance, staff are rescuing corals after hurricanes to help them recover in situ and, despite the uncertainty, in some cases they are undertaking restoration approaches that manipulate the natural coral species assemblages. Making decisions about whether to actively intervene to restore the ecosystem, or to leave habitats as is, can be challenging, and it requires making difficult, quick decisions, often with limited information. Some next steps for FKNMS could include pursuing climate adaptation projects in mangrove and seagrass habitats. There is still much uncertainty in addition to ongoing and emerging threats; nonetheless, the sanctuary can learn from past successes and apply new, effective approaches going forward.

Marine Zoning

Management

One of the largest management measures that FKNMS has implemented to address issues, such as commercial and recreational fishing pressure in the Sanctuary, is the establishment of marine zones. First established in 1997, marine zones are areas of the sanctuary that are actively managed to protect sensitive natural or cultural resources from overuse or conflicting uses or to preserve the diversity of marine life in the area. Research (see below) has demonstrated the effectiveness of these protection measures in conserving marine biodiversity and sensitive habitats. There are five different types of marine zones in FKNMS and, depending on the type, marine zones limit various human activities, such as fishing. FKNMS is in the process of modifying and increasing protections for sanctuary resources through a proposed rule to expand sanctuary boundaries to protect ecologically connected and nationally significant habitats, propose new or modified sanctuary-wide regulations, and propose new and modified existing marine zones to protect additional sensitive and threatened coral reef, seagrass, and hard-bottom habitats and the species dependent on these habitats (NOAA, 2022). This regulatory review, led by FKNMS, includes significant community and partner engagement.

Some of the proposed modifications to marine zones, including adding new and combining existing no-take Sanctuary Preservation Areas (SPAs), combining no-take Special Use Areas and Ecological Reserves, adding new no-take Habitat Restoration Areas and Nursery Restoration Areas, and maintenance of Key Largo and Looe Key Management Areas and the Florida Key National Wildlife Refuge Complex, aim to protect key and sensitive species (e.g., corals, marine invertebrates, and marine plants) and habitats (e.g., transplanting and restoration areas, nursery areas, etc.) from commercial and recreational fishing impacts (Fonesca et al. 2006).

Science

One of the most effective scientific outcomes has been the monitoring of the FKNMS marine zones. Monitoring of marine zones is used to study and compare habitats and marine life within certain zones to those outside of the zones. In one initial investigation, following establishment of the marine zones, the U.S. EPA, NOAA, the State of Florida, and other partners monitored protected zones through the Marine Zone Monitoring Program for four years and published their results in a 2002-2003 Sanctuary Science Report (Keller and Donahue, 2006). In the report, measures of effectiveness for marine zones included benthic community composition and coral population dynamics, abundance and size of fish and invertebrates, and economic and aesthetic values of the Sanctuary to its users and their compliance with regulations. Their results showed that fully protected marine zones have been beneficial in helping to preserve benthic cover, species richness, and density of marine life such as corals, urchin, and invertebrates (Keller and Donahue, 2006). Continued monitoring is needed to better understand the efficacy of each marine zone type and potential benefits for its associated habitats and the sanctuary as a whole.

Scientific research has further demonstrated the utility of these zones for marine living resource conservation. For example, in a study by the Florida Fish and Wildlife Conservation Commission, Western Sambo Ecological Reserve (WSER) was shown to function similarly to fishery reserve (Cox and Hunt 2005). Improvement in the fisheries stock statuses of some grouper species in the area of FKNMS has also been attributed, in part, to marine zone protections (NOAA, 2011). Furthermore, research has informed proposed updates to marine zoning, including the proposal to create two new Sanctuary Preservation Areas (Turtle Rocks and Turtle Shoal) that would protect coral patch reef habitat which has been demonstrated to be healthy and resilient. Proposed new Wildlife Management Areas are also based on scientific information from the U.S. Fish and Wildlife Service and State of Florida partners. This evidence strongly suggests that additional protection in these areas would “manage, protect, preserve, and minimize disturbance” for sanctuary wildlife resources, including endangered or threatened species, and their habitats (NOAA, 2022).

Challenges/ Best Practices

Although the marine zones have been effective, there is a need for larger zones to promote connectivity among vulnerable habitats and species. However, given the many commercial and recreational human uses of FKNMS, and the multiple different management agencies needed to support regulatory actions, it is difficult to build consensus to expand the marine zones. The 2019 draft management plan initially considered a recommendation to use temporal zoning (e.g., short-term restrictions), but FKNMS staff highlighted the lack of enforcement capacity and monitoring capacity to implement and evaluate such an approach. We recommend continued long-term monitoring of marine zones, with partners such as the EPA and State of Florida, as well as leveraging partnerships to expand the communication of monitoring results, and education on both the conservation and economic benefits of maintaining and expanding marine zones, to the public.

Coral Reefs

Management

Ongoing management activities in the sanctuary aim to protect and restore sensitive, nationally-significant coral reefs and their associated habitats. Mission: Iconic Reefs¹⁶ is a collaborative effort between FKNMS, NOAA Fisheries Office of Habitat Conservation, and others to restore seven iconic reef sites, which comprise nearly three million square feet of the Florida Keys; one of the largest coral restoration projects ever proposed. Through Mission: Iconic Reefs, sanctuary managers and scientists are partnering to apply a multi-phase coral restoration effort involving growing and transplanting corals with the goals of restoring diversity and ecological function increasing self-sustaining coral cover. As of early 2023, this project has outplanted more than 23 thousand corals (Bruckner, personal comm.). Throughout the Mission: Iconic Reefs project there is ongoing monitoring of disease and methods to improve resistance to disease. For ongoing management of corals throughout the sanctuary, FKNMS also partners with NOAA's Coral Reef Conservation Program, which uses a multidisciplinary approach to protect, conserve, and restore the nation's coral reefs by maintaining healthy ecosystem function.

Additionally, one component of the FKNMS Restoration Blueprint is a proposed update to the sanctuary's Temporary Regulation for Emergency and Adaptive Management, which would allow for more rapid management responses to address emerging threats and support resilience and/or recovery of corals and habitats. Such an emergency regulation would help address impacts from many stressors, including invasive species, human uses, and other impacts. Under this proposed regulatory update, an emergency regulation could remain in place for the same duration as those of NOAA Fisheries while ensuring coordination with the State of Florida.

Additional marine zone-specific regulations, currently in place within the sanctuary, and some of which are proposed to be strengthened through the Restoration Blueprint, provide further protection of coral habitats. Specifically, through the Restoration Blueprint, there are several proposed restoration areas including four habitat restoration areas to protect existing, permitted, active coral reef restoration sites and nine nursery restoration areas, with regulations that would prohibit discharge, fishing, and anchoring, and would require that vessels remain in transit through the area.

Science

Many efforts are underway to increase our understanding of coral reefs and their surrounding ecosystems through monitoring and research and to apply the best available science to conservation-based management of coral reefs in the sanctuary. Sanctuary staff are partnering with academic researchers at Mote Marine Lab and elsewhere to propagate disease resistant corals and outplant them in the sanctuary. Monitoring efforts are also aimed at understanding the spatial extent of Stony Coral Tissue Loss Disease and the effectiveness of control measures. Scientific research, conducted by sanctuary staff and partnering organizations, continues to

¹⁶ <https://marinesanctuary.org/mission-iconic-reefs/>

study the vulnerability of coral reefs to disease and bleaching, develop new coral subspecies that are more resistant to disease, and advance technologies for antibiotic treatments that slow and/or prevent the spread of disease.

Challenges/ Best Practices

Several challenges remain to effectively manage and restore the sanctuary's imperiled and sustaining coral reefs. Similar to the other resource areas, coral reefs are subject to many stressors outside of the FKNMS boundaries, and therefore, external to our control, notably climate change and most water quality impacts. However, the sanctuary is striving to better manage elements within ONMS' jurisdiction through the Restoration Blueprint's proposed regulations and revised management plan to increase resilience of coral reefs to other stressors and facilitate more successful restoration efforts. Through regulatory and management plan activities, FKNMS is developing actions that would reduce impacts of certain stressors from human use. For instance, requiring vessels to use mooring buoys in certain zone types and providing larger buoys for larger vessels would help to protect sensitive coral habitat in highly visited areas of the sanctuary. Furthermore, by linking results of the condition report and other ecosystem assessments to subsequent regulatory and management plan updates, the sanctuary can be more responsive to threats and apply effective adaptive management to restore and conserve coral reefs.

Outreach and Education

The Sanctuary employs a wide range of education programs. The FKNMS Boater Education Course is a free course that educates students on the natural and historical resources in the sanctuary, sanctuary rules and regulations, and responsible boating strategies (FKNMS, n.d.). The Sanctuary's Ocean Conservation Education Action Network, or Team OCEAN,¹⁷ trains individuals as on-the-water interpreters and educators alongside sanctuary staff and volunteers. Blue Star is another FKNMS program that highlights the efforts made by fishing and diving tour guides to educate visitors and promote sustainable practices that reduce impacts to sanctuary resources. The sanctuary faces the challenge of educating the public about its complex regulations - mainly, where you can and cannot fish. Although increased public education on sanctuary regulations is needed, there is also a need for educating enforcement officers so that they know the regulations that apply in each marine zone; this will be critical as the sanctuary pursues regulatory review and marine zone expansion through Restoration Blueprint.

¹⁷ https://floridakeys.noaa.gov/volunteer_opportunities/teamocean.html?s=involved

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Appendix C. Hawaiian Island Humpback Whale National Marine Sanctuary Case Study



Breaching Humpback in Hawaiian Island Humpback Whale National Marine Sanctuary. Photo: NOAA.

Site Background

Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) was designated by Congress on November 4, 1992. The primary purposes of the sanctuary are to “(1) protect humpback whales and their habitat, (2) educate and interpret for the public the relationship of humpback whales to the Hawaiian Islands’ marine environment, (3) manage human uses of the sanctuary consistent with the National Marine Sanctuary Act, and (4) identify marine resources and ecosystems of national significance for possible inclusion in the sanctuary.” The sanctuary is co-managed by NOAA and the State of Hawai’i through a cooperative partnership (HIHWNMS Management Plan, 2020).

The Hawaiian Islands are the most isolated land mass on earth. Located in the middle of the Pacific Ocean, they are home to large numbers of endemic species of plants and animals on land and sea, as well as migratory species such as humpback whales, or koholā. Hawaiian waters also experience heavy human use by residents, tourists, and businesses for recreation, research, military activities, commercial fishing, energy projects, aquaculture, and much more. For this

reason, koholā, which are the focal living marine resource of HIHWNMS, are facing pressure from entanglement, vessel strikes, climate change, harassment, and noise pollution.

Based on information gathered through interviews with sanctuary staff and partners, this case study aims to describe the connection between sanctuary actions and resource conditions. HIHWNMS is non-regulatory and does not issue permits, though the State of Hawai'i does issue permits and can formulate regulations that apply to the sanctuary as long as they are consistent with the Marine Mammal Protection Act (MMPA). HIHWNMS prioritizes entanglement response, science to inform management and guide decision makers, and education and outreach to build understanding of the importance of koholā and compliance with rules and regulations. This case study describes the most effective strategies the sanctuary has employed to address some of the main pressures on koholā, best practices, and remaining challenges.

Entanglement

Science

HIHWNMS is the primary on-water response agency for humpback whale entanglement in Hawai'i, working with and under a permit from NOAA Fisheries (HIHWNMS, n.d.). The program responds to confirmed reports of entangled whales across the state, and determines the origin of gear and impact when possible.¹⁸ In addition to entanglement response, sanctuary staff conduct health and risk assessments to better understand and manage threats to humpback whales and “keep a finger on the pulse of the animals” that are using sanctuary waters. The sanctuary also played a leading role in the Structure of Populations, Levels of Abundance, and Status of Humpback Whales (SPLASH) project,¹⁹ a large collaboration that examined human impacts of entanglement and ship strikes to the North Pacific stock of humpback whales. SPLASH provided a baseline on entanglement incidents and compared entanglement rates for North Pacific humpback whales across different regions (NOAA, n.d.). SPLASH informed policy decisions on how to manage whales in the North Pacific, and is just one example of the role HIHWNMS staff play by conducting and supporting science within the sanctuary to inform management decisions by NOAA and the State of Hawai'i.

Vessel strike

Management

Staff from HIHWNMS, Pacific Whale Foundation, the State of Hawai'i, and other partners developed vessel speed guidelines in Hawai'i, including a 15 knot speed limit in whale habitat during whale season and a six knot limit for directed approach within 400 yards of humpback whales. HIHWNM continues to assess changes in the numbers, severity, and types of vessel collisions over time in order to understand whether the proposed guidelines are sufficient to

¹⁸ https://sanctuaries.noaa.gov/science/monitoring/mi_hihwnms.html

¹⁹ <https://nmshawaiiumpbackwhale.blob.core.windows.net/hawaiiumpbackwhale-prod/media/docs/20200403-splash-information-sheets.pdf>

reduce the risk of vessel-whale collisions that endanger the lives of humpback whales and humans.

Challenges/ Best Practices

While the sanctuary lacks regulatory authority, sanctuary staff work with the State of Hawai'i and the on-water community to build understanding of the problem and causes of vessel strikes, and promote compliance with the recommended speed guidelines of 15/6 knots during whale season.

Climate change

Science

HIHWNMS studies the effects of climate change on humpback whales through monitoring long term changes in population trends. These include efforts to quantify changes in whale abundance through visual surveys and acoustic monitoring. The sanctuary also performs long-term monitoring of humpback whale health, which is in-part driven by climate change factors.

Challenges/ Best Practices

Climate change is an impending threat to marine life and oceans globally, and a major, long-term factor influencing whale population health and migration. A changing climate may impact food resources for whales, which in turn can influence whether and to where they migrate. There is an opportunity to talk about this issue with the public, and a need for more research to understand changing feeding habits and migration patterns over time. The sanctuary has plans to conduct a climate vulnerability assessment to better understand climate impacts to humpback whales and their habitat.

Ocean Noise

Science

HIHWNMS is exploring how whales use sanctuary waters through tagging and acoustic monitoring initiated through SanctSound.²⁰ The SanctSound project was a collaboration between NOAA and the U.S. Navy to better understand sound in the National Marine Sanctuary System (IOOS, n.d.). Acoustic sensors were placed in different parts of HIHWNMS, as well as six other sanctuaries and one marine national monument, to assess sounds made by marine animals, physical processes, and humans. For HIHWNMS, acoustic monitoring is helping us learn more about Hawaii's humpback whale population, distribution, and behavior. Acoustic monitoring can also be used to better understand noise levels in different parts of the sanctuary and the source of these sounds, so that we can better inform adaptive management over time.

Challenges/ Best Practices

Noise is one of the main anthropogenic threats to humpback whales and acoustic monitoring is a powerful tool that can help inform management. Therefore, the Office of National Marine

²⁰ <https://sanctsound.ioos.us/>

Sanctuaries has developed a plan to continue sound monitoring beyond the end of funding from the U.S. Navy. However, resources are more limited, so the scope of the effort has been reduced accordingly. Because of its in-house acoustics expertise, HIIHWNMS serves as the technical and analytical hub for acoustic monitoring across the Pacific Islands Region, including in PMNM and NMSAS.

Education

Education is one of the sanctuary's core strategies and strengths. The sanctuary implements a variety of educational programs, such as the Sanctuary Ocean Count,²¹ a citizen science and engagement program that takes place once a month for three months during whale season. Participants take part in shore-based whale watching across the Hawaiian Islands to feed into a long-term population data set. Those data are compiled and shared publicly. To track volunteer experience and program effectiveness post-count, a survey is sent to participants that asks for input on what participants learned from the whale watching training and how training can be improved. Support is needed to analyze the data and assess trends over the past two decades.

The sanctuary also hosts boater workshops, trainings, and outreach on wildlife viewing to educate the public about harassment, entanglement, ship strikes, and boating guidelines to enhance responsible ocean use and promote stewardship. We also run a visitor center, conduct weekly talks that are open to the public, and work with students and teachers to provide information about the biological, cultural, economic, and local importance of koholā.

Challenges/Best Practices

While we measure the number of people reached, it is difficult to measure the impact of education and outreach efforts - at HIIHWNMS and across sanctuaries and disciplines. Yet, it is important that HIIHW and all sanctuaries understand whether our efforts are reaching our intended audiences and positively changing behavior.

²¹ <https://oceancount.org/resources/>

Appendix C References

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<https://nmshawaiihumpbackwhale.blob.core.windows.net/hawaiihumpbackwhale-prod/media/docs/2020-hihwnms-management-plan.pdf>

Appendix D. Stellwagen Bank National Marine Sanctuary Case Study



Tagging team at Stellwagen Bank National Marine Sanctuary gets a close up view of a humpback. Photo: NOAA.

Site Background

The Stellwagen Bank National Marine Sanctuary (SBNMS) was designated on November 4, 1992 to protect one of the most productive marine habitats in the United States. Located in the southwestern Gulf of Maine, stretching between Cape Ann and Cape Cod, and spanning 842 square miles, SBNMS is a site known for its nutrient-rich waters which support numerous invertebrates, fish, sea birds, sea turtles, and marine mammals. The presence of these living marine resources, and its proximity to Boston and other New England ports, make SBNMS a hub for human activities and pressures such as commercial and recreational fishing, commercial shipping and recreational boating, whale watching, climate change, and ocean noise. The sanctuary is located entirely in federal waters. NOAA's Office of National Marine Sanctuaries (ONMS) works with other NOAA offices, such as NOAA Fisheries, to create and implement sanctuary programs and regulations.

The sanctuary has established methods to measure and report on conditions and trends of sanctuary resources. The Condition Report, published in 2020, documents these pressures and

resulting impacts on sanctuary resources. Based on information gathered through interviews with sanctuary staff and partners, this case study aims to describe the connection between sanctuary management actions and resource conditions. The case study describes the most effective strategies the sanctuary has employed to address some of these main pressures and remaining challenges.

Commercial shipping

Management

To address commercial shipping impacts on sanctuary resources, SBNMS employs a variety of non-regulatory programs in support of NOAA vessel speed reduction regulation implemented by NOAA Fisheries, such as the Right Whale Speed Rule. SBNMS implements a Report Card Program to assess and “grade” the compliance of vessels with 10 knot speed restrictions, aimed at protecting endangered North Atlantic right whales and other large whale species from vessel collisions, in the Cape Cod Bay and Off Race Point Seasonal Management Areas (SMAs) that run through the sanctuary. Grades range from A+ and A, which are 100% and 90-99% compliance respectively, to F, which is below 60% compliance. The Report Card model is used in combination with a Corporate Responsibility Program to provide recognition to maritime companies that comply with SMAs and voluntary dynamic management areas (DMAs) to protect right whales. Companies or vessels with Report Card compliance scores of greater than 90% receive a Certificate of Corporate Responsibility, demonstrating their commitment to Right Whale Conservation. There has been an increase in mariner compliance with speed restrictions (72% of participating vessels with an A+ or A grade in 2015; 85% of participating vessels with an A+ or A in 2019 and 90% in 2022) and a reduction in the likelihood of vessel strike incidents reported within SMAs covered by the Corporate Responsibility Program. Of all the SMAs on the East Coast, the two that overlap SBNMS have the best compliance rate which is due to the non-regulatory Corporate Responsibility Program. Much of the sanctuary’s effectiveness in mitigating vessel strikes of whales involves working with and supporting agencies such as NOAA Fisheries or the International Maritime Organization (IMO) that regulate vessel activities and traffic separation schemes.

Science

SBNMS uses diverse partnerships with the U.S. Coast Guard (USCG), Bureau of Ocean Energy Management (BOEM), and the New England Fishery Management Council to collect Automatic Identification System (AIS) and Vessel Monitoring System (VMS) data to map and model vessel transits through the sanctuary. This type of monitoring is effectively used to inform compliance with vessel traffic management efforts such as the NOAA Right Whale Speed Rule. Additionally, sanctuary staff developed the Whale Alert app in 2012, which provides near real time information on whale sighting locations to mariners and the general public. The app is regarded as an effective monitoring and outreach tool that aids in compliance with vessel speed regulations. It is also the only product NOAA has for a mariner to obtain near real time information on the presence of right whales.

Challenges/ Best Practices

Many collisions with whales go unnoticed or unreported, making it difficult to know how many ship strikes occur in the sanctuary before and after management measures are put into place. However, these mitigation measures described above reduce the likelihood of vessel strike incidents. Sanctuaries should continue to use modeling approaches, as SBNMS and many other sanctuaries do, to forecast the reduction in risk of vessel strike resulting from sanctuary management actions. Sanctuaries should also continue to cooperate with NOAA Fisheries to track the number and location of ship strike incidents to inform future management actions and provide more real time location information about whales to mariners.

Commercial & recreational fishing

Management

SBNMS staff work with NOAA Fisheries' Greater Atlantic Regional Fisheries Office (GARFO) and the New England Fishery Management Council (NEFMC) to address fishing concerns in the sanctuary. In 2015, SBNMS submitted a proposal to the NEFMC to create a small (55 square nautical mile) fully protected reference area to allow better understanding of ecosystem structure and function in an area closed to fishing. The Council voted against establishing the reference area. However, they followed that with a vote to create the Stellwagen Dedicated Habitat Research Area (SDHRA) that is overlaid on top of the Western Gulf of Maine Closure Area (WGOMA, established in 1998), which is closed to groundfishing. The SDHRA included no new restrictions on fishing. A portion of the SDHRA overlaps 22% of SBNMS, and is known as "the Sliver". In this area, no bottom tending commercial fishing gear, such as trawls, dredges, and gillnets, is allowed. Although the Sliver is not a fully no-take area, it represents an area closed to bottom tending mobile and fixed fishing gear since 1998 and therefore serves as a de facto reference area. From 1998-2010, SBNMS monitored the recovery of habitats inside vs. outside the Sliver to understand the effects of human versus natural disturbance to seafloor habitats and their associated biological community and in 2021 resumed monitoring at four sites inside the Sliver to study the effects of natural disturbance on habitats and associated biota.

The SDHRA, including the Sliver, provides significant conservation, economic, and research benefits to the region. A study published in 2010 found that the Sliver harbors higher abundances and biomass of commercial groundfish species than in other areas of the sanctuary (Brown et al. 2010). Another study in 2020 found that 14% of the \$19.4 million average annual value for commercial fishing was derived from the "edge" of the Sliver (Schwarzmann et al. 2020). For-hire recreational charter boats landed 37% of their total catch from the Sliver. Sanctuary staff continue to work with colleagues at the NEFMC and GARFO to actively manage and understand the management impacts of the SDHRA/ Sliver and any beneficial "spillover" effects.

In addition to NOAA Fisheries and NEFMC, the sanctuary also partners with state governments to protect marine resources from fishing impacts. For example, sand lance, a forage fish for

predators such as humpback whales, seabirds, and others, is not part of a commercial fishery in the U.S. However, as a result of sanctuary research and recognizing the significance of sand lance to the marine food web and the ecosystem in the Gulf of Maine, in 2020 the sanctuary proactively coordinated with the State of Massachusetts to ban the landing of more than 200 pounds of sand lance per day in Massachusetts ports and Rhode Island took the same action in 2021. Connecticut followed suit in 2022. These rules were designed to discourage the development of a commercial fishery for the species, such as those that exist in other areas of the world including Europe's North Sea. NOAA Fisheries (GARFO) declined to take action to better protect sand lance claiming that regulated mesh sizes were sufficient to prevent the targeting of sand lance. According to the Stellwagen Bank 2020 Condition Report, sand lance, which are "tightly linked to isolated shallow sand habitat on top of Stellwagen Bank" are exhibiting variable and unpredictable local abundance within the sanctuary. The Condition Report states that sand lance is being monitored, but "data are currently insufficient to offer a definitive sense of state and multi-year trends."

Science

At SBNMS, science is driving resource protection as well. From 2018 - 2020, SBNMS conducted a Bureau of Ocean Energy Management (BOEM) funded investigation into the ecosystem and economic value of sand habitats. Sand lance are a major component of sand habitat productivity, so much of the habitat research in Stellwagen focuses on investigating the ecology northern sand lance. Research has led to an increased understanding of the value of sand habitat for northern sand lance as well as other species, and the identification of northern sand lance as a key driver of sanctuary and sand habitat productivity. Research is informing SBNMS staff engagement with NEFMC and GARFO staff to identify measures to better protect sand lance habitat.

Challenges/ Best Practices

The sanctuary continues to face challenges balancing commercial and recreational fishing and the conservation of marine biodiversity. SBNMS should continue to strengthen the relationship with NOAA Fisheries and the NEFMC to advance management measures that protect marine ecosystems and biodiversity from fishing impacts. The Sanctuary recently hired a resource protection specialist to address this challenge. There is also a need for long-term and continuous monitoring of forage fish (including sand lance) trends to monitor conservation benefits of sanctuary partnerships for fisheries management.

Climate Change

Management

The sanctuary will conduct a climate vulnerability assessment in 2023 that will identify primary climate stressors and resources vulnerable to those stressors. This assessment will serve as the foundation for future adaptation planning.

Science

The sanctuary is conducting research into the foraging ecology, abundance, and distribution of forage fish, marine mammals, and seabirds in SBNMS and the Gulf of Maine. Specifically, the sanctuary is working with partners to actively study the abundance and distribution of baleen whales, shearwaters, and sand lance. Sanctuary researchers employ novel techniques such as using the chemical dimethyl sulfide (DMS) to track changes in marine predator distribution and foraging success in response to climate change. Furthermore, this research could be used to inform the creation of management actions, such as dynamic management areas, to mitigate risk of vessel strike or entanglement when whales move into less protected waters, following shifting prey distributions resulting from climate change.

The sanctuary is also working with the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) to establish the sanctuary as a “Sentinel Site” for climate change in the Gulf of Maine. This would involve expansion of existing observing systems into the sanctuary to track the effects of climate change and other stressors. Monitoring would further aid in detecting climate-driven shifts in distribution of fish, sea birds, and marine mammals, production and dissemination of data on ocean acidification, temperature, and stratification, and incorporation of climate change into management decisions.

Challenges/ Best Practices

SBNMS will continue to evaluate climate change impacts on sanctuary resources and incorporate changing conditions in management decisions. The sanctuary should inventory the climate change indicators that are currently being monitored, and need to be monitored, within the sanctuary. ONMS held system-wide climate monitoring focus groups in 2022 to gather this information, and is incorporating it into an ONMS Climate Monitoring Framework.

Ocean noise

Management

As part of the interagency consultation process required under the NMSA, and as a result of a project to install liquefied natural gas (LNG) ports in a small area next to the sanctuary, SBNMS worked with NOAA Fisheries to require LNG port license holders to install 10 real-time acoustic listening devices in the Boston Traffic Separation Scheme (TSS), the shipping lanes approaching Boston Harbor. Monitoring provides real-time whale detection, which when detected, mandates LNG tankers to reduce their speed in the TSS. This acoustic information is made publicly available through the Whale Alert app. For the past decade this acoustic monitoring in the TSS has highlighted the predictable presence of right whales in the sanctuary in December, January and February, as well as the early spring months. NOAA is also examining acoustic data to measure the magnitude of vessel quieting that is achievable through speed reduction mandates in SMAs, such as the Offshore Race Point area which overlaps the sanctuary and requires vessels 65 feet and larger to slow to 10 knots annually from March 1- April 30. Finally, Sanctuary staff have requested that the Coast Guard establish new fairways or traffic separation schemes in SBNMS to concentrate vessel traffic and minimize acoustic impacts on sanctuary resources.

This recommendation was adopted in the draft report of the Coast Guard Port Access Route Study for offshore areas of Maine, New Hampshire and Massachusetts.

Science

In addition to acoustic monitoring in the Boston TSS, the sanctuary uses acoustic gliders to provide real-time data on presence and behavior of marine mammals, and commercially important Atlantic cod and Atlantic haddock fish species, in the sanctuary, filling a critical data gap during winter months. Furthermore, locations with known high cod spawning activity, such as Massachusetts Bay, have been nearly continuously acoustically monitored since 2016. This work will continue to better identify locations and timing of spawning cod aggregations to prevent overexploitation of these vulnerable aggregations.

The sanctuary collects continuous, long-term acoustic data through a partnership with the Northeast Fisheries Science Center (NEFSC) to install and maintain three acoustic monitoring stations in the sanctuary. Nationwide, sanctuary staff worked with the National Park Service to install a national network of hydrophones to collect consistent and comparable long-term underwater acoustic data from all major regions of U.S. waters. SBNMS staff will continue to implement research strategies to maintain the sanctuary's position as a sentinel site for passive acoustic monitoring in the Gulf of Maine, and as a testing site for the design of methods to reduce impacts from human activities.

Education

In 2016 the sanctuary initiated the Boater Outreach for Whale Watching (BOWW) program to provide on-water outreach to recreational boaters about appropriate stewardship practices around whales, and to establish a visible SBNMS staff on-water presence within the sanctuary. In six years, the program has expanded from a pilot program to a successful summer program, making trips into the sanctuary each summer and reaching recreational boaters. The goal of BOWW is to reduce small recreational vessel interactions with whales, increase awareness of safe boating practices around whales, and promote and create positive interactions with recreational boaters and commercial whale watchers.

The sanctuary conducts training for whale watching naturalists, providing information about climate change so that naturalists can engage with the public about ways to reduce greenhouse gas emissions, including using alternative energy sources and reducing energy use. Staff also address current and expected impacts of climate change on the sanctuary and resources such as sand lance, a foundational food web fish species in Stellwagen.

Challenges/ Best Practices

There is a need for stronger evaluation of education programs. Currently, tools such as interviews and written evaluations from the audience post-event are used to evaluate effectiveness, but there is a need to track changed human behavior as a result of the sanctuary's education efforts. For example, the SBNMS sanctuary staff work with the Whale and Dolphin

Conservation (WDC) and NOAA Fisheries to conduct unannounced observation of whale watching companies that participate in Sea a Spout and Whale SENSE programs to ensure they are following responsible ecotourism practices.

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Appendix E. ONMS Workshop on Management Effectiveness

November 9 and 10, 2022

**2-5 PM EST; 1-4 PM CST; 11 AM-2 PM Pacific;
9-12 AM Hawaii; 8-11 AM American Samoa**

Objectives:

- Share experiences and knowledge about management effectiveness based on results of sanctuary case studies
- Provide a forum for internal discussion about management effectiveness challenges and solutions
- Discuss topics for program-wide guidance on management effectiveness to be developed by early 2023

Draft Definition:

Management Effectiveness is an assessment of how an MPA is achieving the conservation goals and objectives of the protected area.

Draft Agenda (all times are in Eastern Time Zone)

Day 1 (Nov 9):

Time	Activity
5 min 2:00-2:05 PM	Welcome/Introductions - Kayla Williams, MPA Center
15 min 2:05-2:20 PM	Background on Management Effectiveness - Kayla Williams, MPA Center <ul style="list-style-type: none"> ● Introduction to workshop ● What is management effectiveness? (draft definition) ● Why should we address it? ● Current approaches to management effectiveness; development of best practices guidance for management effectiveness (reason for holding the workshop/ getting feedback).

Time	Activity
45 min 2:20-3:05 PM	<p>Case Studies - Part 1</p> <ul style="list-style-type: none"> ● Channel Islands NMS - Michael Murray (2:20-2:35) ● Florida Keys NMS - Kelly Montenero (2:35-2:50) <p>Presentations followed by 15 minutes for discussion and questions for any of the speakers so far. (2:50-3:05)</p>
15 min 3:05-3:20 PM	<p>Management Effectiveness in the Context of Climate Change - Zac Cannizzo</p> <p>10 min presentation + 5 min Q&A</p>
5 min 3:20-3:25 PM	<p>Orientation to Jamboard</p>
10 min 3:25-3:35 PM	<p>Break</p>
60 min 3:35-4:35 PM	<p>Breakout Groups</p> <ul style="list-style-type: none"> ● What comments do you have on the proposed definition of “management effectiveness”? What would it mean for sanctuaries to be effective? ● What are the main challenges to achieving our conservation goals, and how are we addressing these? ● Some of the key tools we use to assess the effectiveness of our management actions are condition reports, management plans, performance measures (indicators), and socio-economic assessments. <p>How can we improve our use of these and other tools?</p>
15 min 4:35-4:50 PM	<p>Plenary: Breakout groups report out on discussion topics</p>
10 min 4:50-5:00 PM	<p>Wrap Up / Tee Up Day 2 - Lauren Wenzel, MPA Center</p>

Day 2 (Nov 10):

Time	Activity
5 min 2:00-2:05 PM	Welcome Back/Review Agenda - Kayla Williams, MPA Center
1 hour 2:05-3:05 PM	Case Studies - Part 2 <ul style="list-style-type: none"> ● Hawaiian Islands Humpback Whale NMS - Kim Hum ● NERR System - Erica Seiden ● NOAA Coral Reef Conservation Program - Susie Holst 45 min presentation + 15 min Q&A
10 min 3:05-3:15 PM	Break
25 min 3:15-3:40 PM	Breakout Groups - Round 2 <ul style="list-style-type: none"> ● How can we measure the conservation impacts of our partnerships (e.g. when we don't directly control outcomes) at the site level? ● How can we improve our partnerships in order to achieve sanctuary conservation goals? ● Should we establish management effectiveness indicators for the system as a whole? What would this look like?
20 min 3:40-4:10 PM	Breakout Groups - Round 3 <ul style="list-style-type: none"> ● How well do we communicate our management effectiveness to the public and our partners? (How can we improve?) ● How can we update our goals, objectives and management strategies based on what we learn through evaluation
20 minutes 4:10-4:30 PM	Breakout Group Highlights, Plenary and Wrap Up - Lauren Wenzel, MPA Center <ul style="list-style-type: none"> ● Key points from breakout sessions ● What are some major themes or recommendations that should be part of the guidance

Time	Activity
	<ul style="list-style-type: none"><li data-bbox="472 289 1133 321">• Recap on Management Effectiveness Definition



NATIONAL MARINE
SANCTUARIES

AMERICA'S UNDERWATER TREASURES