



Intervention: An Evolving Priority in National Marine Sanctuaries

How Sanctuaries Restore, Conserve, Preserve, and Revitalize



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Cover photo: Examples of intervention activities in national marine sanctuaries. Clockwise from top left: Purple urchin removal in Greater Farallones National Marine Sanctuary; conservation of the turret of USS *Monitor*, managed by Monitor National Marine Sanctuary; coral outplanting in Florida Keys National Marine Sanctuary; and sacred heiau structures and seabirds on Mokumanamana in Papahānaumokuākea Marine National Monument. Photos (clockwise from top left): Nick Zachar/NOAA; Matt McIntosh/NOAA; Nick Zachar/NOAA; Kekuewa Kikiloi/Papahānaumokuākea Marine National Monument

About the National Marine Sanctuaries Conservation Series

The Office of National Marine Sanctuaries, part of the National Oceanic and Atmospheric Administration, serves as the trustee for a system of underwater parks encompassing more than 620,000 square miles of ocean and Great Lakes waters. The 15 national marine sanctuaries and two marine national monuments within the National Marine Sanctuary System represent areas of America's ocean and Great Lakes environment that are of special national significance. Within their waters, giant humpback whales breed and calve their young, coral colonies flourish, and shipwrecks tell stories of our nation's maritime history. Habitats include beautiful coral reefs, lush kelp forests, whale migration corridors, spectacular deep-sea canyons, and underwater archaeological sites. These special places also provide homes to thousands of unique or endangered species and are important to America's cultural heritage. Sites range in size from less than one square mile to almost 583,000 square miles. They serve as natural classrooms and cherished recreational spots, and are home to valuable commercial industries.

Because of considerable differences in settings, resources, and threats, each national marine sanctuary has a tailored management plan. Conservation, education, research, monitoring, and enforcement programs vary accordingly. The integration of these programs is fundamental to marine protected area management. The National Marine Sanctuaries Conservation Series reflects and supports this integration by providing a forum for publication and discussion of the complex issues currently facing the National Marine Sanctuary System. Topics of published reports vary substantially and may include descriptions of educational programs, discussions on resource management issues, and results of scientific or historical research and monitoring projects. The series facilitates integration of natural sciences, socioeconomic and social sciences, education, and policy development to accomplish the diverse needs of NOAA's resource protection mandate. All publications are available on the [Office of National Marine Sanctuaries website](#).



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Report Availability

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Table of Contents

About the National Marine Sanctuaries Conservation Series.....	i
Disclaimer	ii
Report Availability	ii
Contact.....	ii
Table of Contents.....	iii
Abstract	iv
Key Words	iv
Introduction	1
Office of National Marine Sanctuaries Approach to Intervention	3
Office of National Marine Sanctuaries Role in Intervention	5
Review of Prior Resource Protection and Intervention Activities in National Marine Sanctuaries	6
Resource Protection in National Marine Sanctuaries.....	6
Intervention in National Marine Sanctuaries	7
Concluding Remarks	14
Acknowledgements	15
Literature Cited	16



Abstract

Intervention refers broadly to human actions that intentionally modify resource characteristics in order to create a desirable state or move away from an undesirable one. Examples in the natural sciences include active species or habitat restoration. In the maritime heritage field, intervention often involves the conservation of artifacts, and for intangible cultural heritage may include the revitalization of languages or traditions. This document shares the perspective of NOAA’s Office of National Marine Sanctuaries on intervention activities as an aspect of national marine sanctuary management. It also provides partners and interested parties with an overview of intervention activities that have occurred within sanctuaries to date. It describes the evolution of approaches and purposes for intervention, beginning with measures that enhance sanctuary resource protection, to ecosystem restoration at a significantly larger scale when it is clear that natural recovery is unlikely. The intent of this report is to inform decision-making about intervention in sanctuaries and support development of partnerships, approaches, and best practices aimed at intervention.

Key Words

Intervention, ecosystem restoration, national marine sanctuaries, marine protected areas, resource protection

Introduction

Following the first national marine sanctuary designation in 1975, the National Marine Sanctuary System has grown to include 15 protected areas around islands and coasts of the Atlantic, Pacific, Gulf of Mexico, and Great Lakes. These places are home to the nation's most iconic natural and cultural marine resources, and also support sustainable uses, including recreation, tourism, and commercial activities. National marine sanctuaries are designated under the authority of the National Marine Sanctuaries Act, which provides a number of tools for protecting these places and their resources. These include regulations that moderate human activities, management plans that guide activities at sanctuaries, enforcement and potential assessment of civil penalties for damage of sanctuary resources, and consultation with federal agencies to prevent or limit actions that may harm sanctuary resources (NOAA Office of National Marine Sanctuaries [ONMS], 2022a). The Office of National Marine Sanctuaries (ONMS) also enacts its mission to protect these special places through research and monitoring, education and outreach, and community engagement. Intervention—the focus of this report—is another management strategy, and it involves the manipulation of sanctuary resources for the purpose of improving them in targeted ways.

This document provides context for the spectrum of work related to intervention for natural and maritime heritage resource management in national marine sanctuaries. The term *intervention*, as applied here, refers broadly to human actions that intentionally modify resource characteristics in order to create a desirable state or move away from an undesirable one (Hobbs & Cramer, 2008; Hobbs et al., 2011). For natural resources, activities that solely aim to maintain a desirable state for the resources and associated ecosystem services without modifying resource characteristics are considered *resource protection* or *conservation*, neither of which are considered intervention; these will be discussed for context, but are not the primary focus of this document.

By contrast, different terms are used to describe activities associated with maritime heritage resources. These are historical, archaeological, and cultural properties that represent the immeasurable bonds between maritime places and the people that interact with them, some of which date back to time immemorial. Archaeological sites and artifacts cannot be restored to their original condition, so the term *restoration*, which is applied to many types of natural resource interventions that aim to correct an undesirable state (Hobbs et al., 2011), is not used in this field. Rather, the terms *conservation* and *preservation* are used to describe actions that prevent further deterioration of artifacts and archaeological sites, and for cleaning and stabilization techniques. For these reasons, the broader term *intervention* is used to refer collectively to actions applied to either natural or maritime heritage resources.

Below, we describe the ONMS approach to interventions in national marine sanctuaries and how it is adapting to address rapidly changing environmental conditions. This includes a range of existing and new approaches that have been considered under the diverse and dynamic circumstances that characterize national marine sanctuary management. To date, approaches have not been applied system-wide, as what is appropriate for individual national marine sanctuaries must be determined and adapted to the specific needs and situations surrounding an event, a changing condition, or other management objective. National marine sanctuary

managers should always consider decisions about intervention in the context of the broader mandate to maintain and enhance sanctuaries' natural ecosystem integrity and conserve cultural heritage.

Office of National Marine Sanctuaries Approach to Intervention

National marine sanctuary managers prioritize resource protection when developing and implementing sanctuary management plans. They also respond to incidents of damage with appropriate legal action and management responses that restore lost resources and services to the extent possible. But when sanctuary resources or ecosystems become highly degraded, either by acute impacts at a small scale or more gradually on a large scale, and it is clear that natural recovery is unlikely, it is appropriate for ONMS to consider intervention at any and all scales necessary to fulfill the NMSA charge to restore and enhance natural habitats, populations, and ecological processes within national marine sanctuaries.

For ONMS, a greater emphasis on ecological restoration would adapt traditional operating norms of national marine sanctuaries to meet new challenges. We recognize that, where possible, preserving ecosystem structure and function through conservation and resource protection remains the preferred course of action. We also recognize that the relationship between humans and ecosystems is two-way, and strive to support sustainable uses of national marine sanctuaries. However, it is increasingly apparent that the impacts of human pressures and global stressors on sanctuaries often exceed the ability of ONMS to protect ecosystems using standard resource management practices alone. Widespread and global stressors such as climate change, diseases, and some water quality issues, which may be beyond the control of sanctuary management actions, present clear threats to sanctuary resources. Without intervention, some resources may be lost completely before these large-scale threats can be addressed.

ONMS works with its partners inside and outside of NOAA to monitor, understand, and, when possible, abate threats, and to implement complementary intervention strategies as needed to best meet its resource protection mandates in the face of these threats. Although some interventions may be novel in scope or scale, they have the potential to ensure the persistence of resources amid large-scale global stressors. ONMS supports their implementation at scales commensurate with our understanding of risks and benefits, while ensuring that monitoring and research continues. ONMS also recognizes the continued importance of abating stressors at scales manageable by national marine sanctuaries. **Interventions are designed to complement, rather than replace, resource protection.**

While increasing the emphasis on the restoration of natural resources using a range of approaches, ONMS also intends to broaden the scope of interventions considered for maritime heritage resources. For example, some threats to natural resources could also affect the integrity of maritime heritage resources. Climate change will certainly affect the integrity of archaeological, historical, and cultural resources and associated cultural ecosystem services (particularly heritage benefits and sense of place). ONMS Maritime Heritage Program guidance addresses climate change impacts to tangible and intangible maritime heritage resources within national marine sanctuaries and marine national monuments (ONMS, 2021b). Preservation, stabilization, and mitigation tactics will continue to be used where appropriate for tangible resources. Some site stabilization strategies have not yet been implemented within the National Marine Sanctuary System, but are widely used elsewhere and are of interest to ONMS managers.

Site stabilization may include covering or reburying sites that have been inadvertently or intentionally exposed (partially reestablishing the physical protection and near anaerobic equilibrium) by backfilling or using tarps and gravel media, structural reinforcement of the historic fabric of the site (e.g., sand bags), erosion control measures for ocean sediments (e.g., artificial seagrass), galvanic protection of metals by electric current or sacrificial anodes, and more (see ONMS, 2021a). One example of a forthcoming use of this strategy is planned reburial of exposed organic shipwreck structure disturbed by looting in FKNMS.

ONMS also recognizes new needs and opportunities for interventions that relate to intangible cultural heritage. ONMS strives to work with tribal governments, Indigenous communities, and traditional cultures to help restore lost practices and knowledge, incorporate culturally important values in resource management, and ensure ONMS is fulfilling its trust responsibility. Examples of *revitalization* include support for the use of Indigenous languages, or reinstatement of ceremonies or other practices conducted at historically important sites. These actions strengthen cross-cultural connections and promote the weaving of traditional and modern approaches to resource management. They also help restore and highlight a sense of the reciprocal relationship between Indigenous cultures and their environment, which historically has had immense existential and practical importance.

Office of National Marine Sanctuaries Role in Intervention

Staff of individual national marine sanctuaries understand their particular setting and the status of natural and cultural resources through partner engagement, monitoring, condition reporting, vulnerability assessments, management planning, and other local experience. With information on the sources and locations of impact, and the likelihood of success in controlling the problems, they determine priorities for resource protection and intervention. They can then work with partners to decide what specific actions are appropriate.

National marine sanctuaries are also responsible for the issuance of permits to conduct intervention activities when those activities violate sanctuary regulations. Permits from other agencies may also be required (e.g., National Marine Fisheries Service, U.S. Army Corps of Engineers, and state agencies). Consultation with federal agencies, state agencies, tribal governments, or other organizations (including those pursuant to Section 106 of the NHPA and Executive Order 13175) may be required. Regardless, national marine sanctuary managers have been developing guidance on permitting that describes the actions for which permits will be issued with minimal delay, those for which extra time might be required, and those that are unlikely to be permitted (e.g., Florida Keys National Marine Sanctuary, 2019). This informs the restoration community about sanctuary priorities and aligns the expectations of partners.

There are numerous ways national marine sanctuaries can facilitate, participate in, and advance intervention. Both laboratory and field work are conducted to develop technologies. Each may require experimental design, collection of samples, and potentially damaging manipulation. National marine sanctuary staff are typically involved in developing and evaluating these procedures. Partners may request use of sanctuary facilities, such as storage, lab space, equipment, dive support, and vessels, or the installation of markers or buoys. Sanctuary staff also closely track intervention actions when they occur and participate in or approve and track maintenance and monitoring activities. Whether a national marine sanctuary is responsible for the maintenance and monitoring of specific intervention projects, or for a collection of projects underway in a particular area, depends on resource availability and the agreed-on responsibilities of individual project leads.

Some national marine sanctuaries can mobilize public engagement in restoration or other interventions through volunteer networks already in place. Support from such groups can facilitate implementation of large-scale or intensive projects, as well as routine maintenance and monitoring. Local groups may also be effective in providing early warning of problems and minimizing user conflicts that threaten restoration sites. One collaborative, ecosystem-level project already underway is Mission: Iconic Reefs, an unprecedented, multi-decadal effort involving many partners in an attempt to restore seven ecologically and culturally significant coral reefs within Florida Keys National Marine Sanctuary (FKNMS).

Local and national outreach capabilities within ONMS, sometimes in cooperation with the National Marine Sanctuary Foundation, can promote the transfer of intervention methods and technology. This may be accomplished through a variety of print and online media, training, presentations, conferences, workshops, and congressional contacts. ONMS may also document and distribute contributions as technical reports through its National Marine Sanctuaries Conservation Series (ONMS, 2020).

Review of Prior Resource Protection and Intervention Activities in National Marine Sanctuaries

ONMS continues to prioritize resource protection in national marine sanctuaries while working with partners to advance and implement intervention to conserve resources for the future. The following sections provide additional context on the types of resource protection and intervention activities that ONMS has engaged in to date.

Resource Protection in National Marine Sanctuaries

National marine sanctuaries have historically focused on management approaches that fall in the category of resource protection as a primary means of maintaining intact ecosystems or the integrity of maritime heritage resources. Such approaches have included promulgation of regulations, permitting, zoning, infrastructure (e.g., visitor centers, signage, aids to navigation), education to change negative human behaviors, research, tribal and Indigenous engagement and consultation, and interagency collaboration. All are efforts to control or manage human behavior and impacts on the coastal and marine environment. Specific management actions have included:

- Reviewing permit requests or otherwise influencing the protective actions of other federal, state, and local agencies or groups of partners;
- Assisting in the development of regional water quality monitoring programs to understand watershed-level impacts, which in turn helps identify measures to reduce those impacts prior to the water's edge;
- Mapping national marine sanctuaries to identify essential habitats in support of zoning, fisheries management, and protection of resources at risk;
- Using commercial fisheries economic data to refine zoning plans;
- Developing techniques and installing mooring buoys to protect coral reefs, seagrass, shipwrecks, and other resources from anchor impacts;
- Establishing voluntary speed guidelines, no-anchoring areas, and areas-to-be-avoided to reduce the risk of ship groundings, oil spills, and collisions with marine life;
- Tracking ships using automatic identification systems to monitor speeds and locations, then notifying companies about adherence to voluntary speed guidelines or restricted zones;
- Implementing regulations to minimize disturbance to animals (e.g., approach distance, low overflight zones);
- Using acoustic sensors on buoys to alert navigators to the presence of whales;
- Using data collected by community science programs to detect and assess impacts from oil spills and invasive species, and to inform fisheries decisions;
- Using on-water sanctuary staff and volunteers to distribute information about sanctuary regulations and best practices to visitors;
- Developing educational programs that infuse marine science and stewardship into educational curricula; and

- Supporting research to better understand ecosystem dynamics and impacts of climate change.

Intervention in National Marine Sanctuaries

In addition to the protection activities above, national marine sanctuaries have conducted intervention actions. Broadly speaking, these focus on manipulation of resources rather than controlling human activities, and may be conducted when immediate measures are required to save injured areas or wildlife, or to prevent further deterioration that would be inevitable were it not for the intervention. The decision to intervene (either immediately or at any time thereafter) is made when scientists and managers conclude that it is unlikely that unassisted natural recovery will succeed (or proceed at an acceptable rate), and that is often related to the extent or severity of degradation. Below are examples taken from both the natural and cultural resource areas.

Natural Resources and Ecosystems

The term most commonly used to describe intervention that assists the recovery of an ecosystem that has been damaged, degraded, or destroyed is ecological restoration, which “attempts to return an ecosystem to its historic trajectory,” with “sufficient biotic and abiotic resources to continue its development without further assistance or subsidy” (Society for Ecological Restoration International Science and Policy Working Group, 2004). The emphasis of “historic trajectory” recognizes the increasing likelihood that, given the magnitude of global environmental change, restoration to a particular historical state is generally not possible. Instead, restoration may aim to move an ecosystem toward a state that differs from the historical ecosystem, but maintains some key ecosystem functions and/or services (Hobbs et al., 2009).

Here we refer to ecological restoration as a broad spectrum of activities that range from the removal of threats that caused or resulted from the disturbance and could prevent natural or unassisted recovery (passive restoration; *sensu* Meli et al., 2017) to the intentional manipulation of the altered elements of a system to accelerate or influence the successional trajectory of recovery (active restoration; *sensu* Meli et al., 2017; Holl & Aide, 2011). Active and passive restoration actions are not distinguished as such in this document, as restoration is so varied in national marine sanctuaries and represents a continuum of approaches at a restoration location (e.g., vessel salvage, habitat stabilization and repair, key species propagation and transplanting, invasive species or unwanted predator removal, restricting access) or elsewhere (e.g., pollution abatement, water circulation control; see Greening et al., 2011).

Ecosystem-level restoration has historically not been the highest management priority for national marine sanctuaries. While ONMS has always recognized that national marine sanctuaries are affected in both positive and negative ways by human use, its priority has been to protect ecosystems from unsustainable uses in order to maintain ecosystem structure and function. Until recently, ONMS has not attempted ecosystem-level intervention (restoring ecosystem structure and function). Rather, it has focused more on localized restoration following acute impacts, which has typically involved habitat- and species-level restoration (e.g., Hudson & Diaz, 1988). As resource management approaches in the National Marine Sanctuary

System continue to evolve, they attempt to be responsive to changes in the conditions of the system, whether anthropogenic, natural, or some combination. Increasingly, ecosystem-level changes are being documented within national marine sanctuaries, as they are elsewhere, and resource protection and management activities, including intervention actions, must be flexible and responsive.

The National Marine Sanctuaries Act (NMSA) contains language that clearly includes a wide range of intervention activities as appropriate tools for natural resource management in national marine sanctuaries. The purpose of the National Marine Sanctuary System is, in part, “to maintain and restore biological communities in...national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes...” (16 U.S.C. 1431). Restoration is also mentioned as a potential element of a management plan, which contains the “...proposed...strategies for managing sanctuary resources..., including interpretation and education, innovative management strategies, research, monitoring and assessment, resource protection, restoration, enforcement, and surveillance activities” (16 U.S.C. 1434). Furthermore, “the Secretary may...develop and test methods to enhance degraded habitats or restore damaged, injured, or lost sanctuary resources...” (16 U.S.C. 1440). Additionally, anyone who causes the “destruction or loss of, or injury to, sanctuary resources” is liable to the United States for the amount necessary to compensate for response costs and damages (including interest), which shall be used “to restore, replace, or acquire the equivalent of any sanctuary resource” (16 U.S.C. 1443). Until recently, most restoration activities within the sanctuary system have been funded through the natural resource damage assessment process (see ONMS, 2022b). The NMSA provides the agency with a broad range of authorities, although only a few of these have been used extensively over the years.

Archaeological, Historical, and Cultural Resources

The concept of intervention is also applicable to certain maritime heritage resources, including intangible cultural resources, and natural species and locations and traditional practices imbued with cultural significance and meaning. ONMS defines *maritime heritage* as “the wide variety of tangible and intangible elements (archaeological, historical, and cultural resources) that represent our human connections to our Great Lakes and ocean areas” (ONMS, 2018). The NMSA includes archaeological, historical, and cultural resources in its criteria for identifying exceptionally valued marine areas.

Archaeological resources are artifacts, features, properties, and site locations possessing broad information about past human behavior based primarily on the analysis of physical remains. In the sanctuary context, these may be submerged habitation sites, resource production sites, landings, shipwrecks, sunken aircraft, navigational infrastructure, etc. Historic resources are artifacts, features, and site locations associated with historical-period persons, events, or types of construction that have made a significant contribution to the broad patterns of our history. Some historical resources may also be considered cultural resources. Cultural resources are defined as “physical evidence or place of past human activity: site, object, landscape, structure; or a site, structure, landscape, object, or natural feature of significance to a group of people traditionally associated with it” (National Park Service, 2015). Cultural resources and locations,

as well as intangible elements of cultural heritage (e.g., traditions, religions, beliefs, customs, and practices; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020) contribute to, and help define, community identity.

An undisturbed or “pre-disturbance” submerged heritage site refers to a site that has not been subject to archaeological excavation, looting, or commercial salvage, wherein the artifacts and features are in near equilibrium with the marine environment and still possess the contextual information of their original locations. Storm events and human activities (dredging, anchoring, salvage) can disturb sites and enhance deterioration and loss of site data. But unlike many natural resources, archaeological sites, the subset of maritime heritage resources often exemplified by shipwrecks, are non-renewable resources. The integrity of a submerged archaeological site cannot be recreated once the site is damaged or destroyed. Thus, decisions about protection efforts for these properties are critically important, and intervention actions tend to focus on preservation, stabilization, and mitigation rather than efforts to recreate or restore an original state. In the preservation and museum community, “restoration” most often refers to the re-creation of the original “pre-wrecked” vessel or aircraft in its new state.

While in certain cases archaeological sites have warranted careful excavation and artifact conservation for public display and benefit, the general preferred approach for ONMS is management of historic properties in place, or “*in situ* preservation.” *In situ* preservation is the protection and management of the maritime heritage resource in its original location using a range of methods to create or maintain a protective environment for the site. *In situ* preservation is a widely accepted method for resource protection that recognizes the rapidly increasing number of newly discovered submerged sites and the lack of proper conservation and curation capacity for recovered artifacts. All material culture, whether located in the terrestrial or marine environment, is subject to biological, physical, and chemical degradation, and will eventually deteriorate over time. Therefore, the ONMS objective for *in situ* preservation is the maintenance of the near equilibrium, low deterioration state of the original, undisturbed heritage site, in order to maximize our knowledge of and benefit from the resource. This approach is consistent with best management practices derived from UNESCO (2001) and adopted by ONMS and numerous federal partner agencies.

Site monitoring and the regular re-evaluation of site conditions provides the information needed for maintaining or modifying *in situ* preservation methods, or for making the decision to intervene and recover materials. Additional protection is afforded by regulations, including permitting requirements for access and activities, zoning, enforcement, and penalties. Where site assessment has not been completed, or where the heritage resource is particularly sensitive and vulnerable to damage and loss from visitation, ONMS may withhold selected site information, such as location, per Section 304 of the National Historic Preservation Act (54 U.S.C. 307103). Buoys may also be installed to control access and minimize anchor damage. In some cases, *in situ* management of heritage sites also entails active intervention methods, such as site stabilization activities described in NOAA’s *In Situ Preservation Policy Supplement* (NOAA, 2021).

Examples of interventions for intangible cultural heritage include the recognition of culturally significant locations and cultural keystone species, the assurance of access for cultural practices,

the continuation of language and traditional knowledge systems, the protection of sensitive cultural information, and the acknowledgement of sovereign rights regarding place and resources. Better understanding of the Indigenous cultural landscape can facilitate these types of interventions for intangible cultural heritage.

Prior Intervention Actions

As described above, intervention in national marine sanctuaries encompasses a spectrum of activities, and the terms used for some, particularly those related to maritime heritage resources, differ from those commonly used for natural resource intervention. These include *in situ* preservation of historic properties, revitalization of cultural practices, or the reinstatement of traditional place names. These differences are evident in the examples of intervention activities discussed below.

Natural Resource and Ecosystem Intervention

Intervention efforts have been conducted in a number of national marine sanctuaries (Table 1). Many have been linked to legal settlements of natural resource damage cases (e.g., ship groundings), but others have been motivated by unusual mortalities and damage, anthropogenic pollution, excessive historical harvesting of key resources, or the desire to restore prior conditions, such as freshwater inputs and flow.

To date, most natural resource intervention has focused on restoration—either the repair of damaged or lost habitat or restoration of species that have declined in population. Following ship groundings and other mechanical impact incidents (mostly in the Florida Keys), pioneering work was done in the 1980s on techniques for framework stabilization and transplantation of shallow corals (e.g., Hudson & Diaz, 1988). They included rubble removal, cementing, and various methods to stabilize substrate, restore damaged habitat complexity, and support reattachment of broken corals (Jaap, 2000). Seagrass restoration at propeller scar and blowhole sites involved in-filling affected areas with loose sediment and biodegradable tubes filled with sand to bring substrate up to grade. Seagrass from donor sites has been transplanted and fertilized using bird roosting stakes (Kenworthy et al., 2002). On the West Coast (Monterey Bay National Marine Sanctuary), marsh restoration was accomplished by moving sediment into the marsh to elevate substrate, recreate marsh creeks, and restore plants (Fountain et al., 2022).

Species-based restoration has been varied and innovative, and has included:

- Creation of land- and ocean-based coral nurseries for coral propagation (primarily asexual, though recent work shows promise for the use of sexually produced larvae);
- *In situ* cutting and transplantation of deep-sea corals in preparation for a restoration project at a site damaged by trawling;
- Restoration of oysters in West Coast estuaries;
- Transplantation of abalone from an unstable landslide zone to a boat grounding site;
- Repopulation of a breeding colony of common murrens following an oil spill using recordings and mirrors to promote recruitment; and
- Reintroduction of sea otters after extirpation by hunting.

Additional detail on these and other natural resource intervention efforts may be found in Table 1.

Archaeological, Historical, and Cultural Resource Intervention

National marine sanctuaries have used intervention to preserve both tangible and intangible heritage resources (Table 1). As mentioned above, *in situ* preservation as a first approach is precautionary, and precedes invasive excavation and recovery, allowing managers to properly determine the significance of heritage resources and appropriate level of further archaeological intervention. Site monitoring informs both *in situ* preservation and decisions to intervene and/or recover materials. For example, following more than a decade of monitoring the USS *Monitor* shipwreck, sanctuary managers determined that removal and conservation of certain artifacts, including the vessel's turret, were needed to prevent rapidly accelerating deterioration and the loss of valuable historical information.

Intervention related to intangible cultural heritage (cultural practices, events, and knowledge) can include revitalizing the use of Indigenous names for species and places, using Indigenous and local traditional knowledge to inform management, and restarting cultural practices or events. These are examples of interventions that can help strengthen sanctuary social-ecological systems. In some cases, ONMS may lead these efforts (e.g., drafting sanctuary condition reports that draw on Indigenous and local traditional knowledge), and in others, ONMS may provide support for partner efforts (e.g., providing boat support for Chumash community tomol crossings). Additionally, restoration of physical resources, including historic properties and natural resources, can simultaneously restore intangible integrity of the sanctuary for local communities. Restoration of cultural keystone species¹, facilitating access to cultural locations or viewsheds, and appropriately sharing historical knowledge of place names are only a few examples of restoring intangible cultural heritage of cultural resources.

Engagement with local communities, and particularly government-to-government consultation with Indigenous nations, is critical to determine appropriate interventions to enhance or restore cultural resources, practices, and intangible elements of maritime heritage, as well as natural resources valued by communities. In some cases, consultation with Indigenous communities is a legal requirement (e.g., Indian tribes and Native Hawaiian organizations per the NHPA and Executive Order 13175/NOAA Policy 13175). Additional actions or steps to take as interventions are planned may include:

- Acknowledging the sovereignty of Indigenous nations, which can be closely associated with natural and cultural resources;
- Acknowledging the intangible value and meaning of physical resources. Natural resource restoration may also restore intangible integrity;
- Completing cultural impact assessments²;

¹ Cultural keystone species are defined as “culturally salient species that shape in a major way the cultural identity of a people, as reflected in the fundamental roles these species have in diet, materials, medicine, and/or spiritual practices” (Garibaldi & Turner, 2004).

² In Hawai‘i, these assessments provide quantitative and qualitative data related to the physical and intangible characteristics of resources (e.g., temple structure and orientation, temple function, temple

- Developing or supporting the development of a tribal cultural landscape or maritime cultural landscape in partnership with tribal and Indigenous communities;
- Communicating possible risks and tradeoffs associated with interventions to Indigenous leaders and communities; and

Developing partnerships with Indigenous communities that can lead to culturally appropriate protocols for weaving Indigenous and non-Indigenous knowledge systems. Such partnerships can enhance intervention strategies and create synergistic outcomes.

Table 1. Examples of intervention activities that have been implemented in national marine sanctuaries.

Intervention Action	Example	Sanctuary
Event response	Vessel salvage (with or without additional biological restoration); debris removal (with or without additional biological restoration)	Greater Farallones National Marine Sanctuary (GFNMS), Monterey Bay National Marine Sanctuary (MBNMS), Channel Islands National Marine Sanctuary (CINMS), Flower Garden Banks National Marine Sanctuary (FGBNMS), FKNMS, Olympic Coast National Marine Sanctuary (OCNMS), Papahānaumokuākea Marine National Monument (PMNM), Thunder Bay National Marine Sanctuary (TBNMS)
Pollution abatement	Removal of abandoned or derelict vessels; removal of legacy potentially polluting wrecks; capping abandoned wellheads/pipelines/removal of platforms; removal of ghost fishing gear	GFNMS, MBNMS, CINMS, FGBNMS, FKNMS, OCNMS, TBNMS, SBNMS
Invasive and nuisance species removal	Lionfish culling (FGBNMS, FKNMS); sea urchin removal (GFNMS); <i>Acanthaster</i> crown-of-thorns starfish removal (National Marine Sanctuary of American Samoa [NMSAS]); predator removal (FKNMS); <i>Undaria pinnatifida</i> removal (MBNMS)	FGBNMS, GFNMS, NMSAS, FKNMS
Water circulation control	Bridge construction	FKNMS
Substrate enhancement	Algae and nuisance species removal	FKNMS
Disease control	Stony coral tissue loss disease abatement (FKNMS, FGBNMS); stony coral gene banking (FKNMS)	FKNMS FGBNMS

name, traditional knowledge systems). This is a helpful step to take before intervention efforts begin and following the conclusion of intervention activities to monitor and improve as needed.

Intervention Action	Example	Sanctuary
Area closures	Fishing closures; diving closures; low overflight prevention; voluntary speed control areas; areas to be avoided; management of access	Many sanctuaries
Habitat protection	Mooring buoy installation (FKNMS, FGBNMS, GFNMS); artifact protection (FKNMS, TBNMS)	FKNMS, FGBNMS, SBNMS, TBNMS, GFNMS
Species restoration	Coral culture (<i>in situ</i> and <i>ex situ</i>), sea urchin, crab, and sponge culture, enhancement, and transplanting, and coral reattachment (FKNMS); black abalone translocation (MBNMS); sea otter reintroduction (OCNMS); bull kelp outplanting (GFNMS); coral outplanting (FKNMS, MBNMS, GFNMS); seabird population restoration (MBNMS, GFNMS)	FKNMS, MBNMS, OCNMS, MBNMS, GFNMS
Habitat enhancement	Reef substrate reconstruction or stabilization, prop scar filling, and bird roosting stakes (FKNMS); seabird attraction (GFNMS, MBNMS); marsh reconstruction (MBNMS); transitional aquatic habitat enhancement between lagoons and wetlands (GFNMS)	FKNMS, GFNMS, MBNMS
Curation and conservation of heritage resources	USS <i>Monitor</i> gun turret recovery, conservation and exhibition (Monitor National Marine Sanctuary [MNMS]); diagnostic artifact recovery, curation, and exhibition (MNMS, TBNMS, FKNMS, PMNM); artifact burial	MNMS, TBNMS, FKNMS, PMNM
Language preservation	Hawaiian language use (Hawaiian Islands Humpback Whale National Marine Sanctuary [HIHWNMS], Papahānaumokuākea Marine National Monument [PMNM]); species and place naming protocols (PMNM); Samoan language use (NMSAS)	HIHWNMS, PMNM, NMSAS
Revitalizing cultural practices	Reconstruction of fish ponds (HIHWNMS); boat support for Chumash canoe journeys (CINMS) and Tribal Journeys (OCNMS); historic landing site refurbishment; ceremonial site refurbishment; seabird conservation, translocation, and salvage for cultural use (PMNM)	HIHWNMS, CINMS, PMNM, OCNMS

Concluding Remarks

The role of ONMS in interventions required to meet NMSA mandates to maintain and enhance ecosystem integrity and cultural heritage in national marine sanctuaries continues to evolve. This mandate already serves as a benchmark for evaluating resource status and trends within condition reports and several performance measures used to evaluate the overall performance of ONMS. As stressors on ocean resources continue to mount, more assertive and elaborate forms of intervention may become necessary.

While ecosystem-level restoration is often an overarching goal within national marine sanctuaries, there is often a need to focus intervention on particular species or groups of species in order to create the potential for ecosystem-level change. The restoration of keystone and foundation species, for example, creates conditions that enable many other species to thrive. And, of course, efforts to reduce environmental stressors are also often necessary to produce conditions that enable the success of the intervention. It is becoming more and more evident that controlling both climate and non-climate stressors is the biggest challenge to successful intervention for both natural and maritime heritage resources.

ONMS celebrated 50 years of resource management in 2022, a span of time that witnessed not only explosive growth of environmental protection, but also the degradation of ecosystems at unprecedented levels. Many of the same drivers and pressures that caused ecosystem declines also put maritime heritage resources at risk and impaired relationships with Indigenous cultures. Successful, cooperative resource management in the future will require adaptation of previous approaches. ONMS recognizes this and is in an ideal position to engage in the partnerships required to meet the challenges of new intervention needs. ONMS will leverage scientific, institutional, and community partnerships to support natural and historic resource interventions, and also recognizes the need to maintain and improve foundational relationships with Indigenous communities and engage these communities when evaluating intervention approaches. Combining our efforts on the protection and revitalization of naturally and culturally important resources and practices will allow us to develop, demonstrate, and apply improved models for marine and Great Lakes protected area management in the 21st century.

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