

SUPPLEMENT ARTICLE

You can choose your relatives: Building marine protected area networks from sister sites

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Abstract

1. The world's oceans are often perceived as barriers that separate countries. To counter these divisions and improve protection of ocean resources, marine protected area (MPA) managers have formed alliances that bridge jurisdictional boundaries to share strategies and resources with other protected areas.
2. The National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries has embraced this sister site approach to connect MPA management based on ecological and cultural links. Designed to strengthen the management of ecologically and culturally connected areas, these relationships between protected areas serve as catalysts for effective stewardship of the ocean's biological resources and show the important benefits of transnational cooperation.
3. This paper summarizes the lessons from over a decade of sister site partnerships, including case studies from Stellwagen Bank National Marine Sanctuary and four sites in the Caribbean working together to protect a shared population of humpback whales; the Gulf of Mexico Sister Site Network being developed by the USA, Mexico, and Cuba; Papahānaumokuākea Marine National Monument and Rapa Nui in Chile; and broader collaboration among MPAs in the USA and Chile on the Pacific coast.

KEYWORDS

international, marine protected areas, sister sites

1 | INTRODUCTION

The world's oceans are often perceived as barriers that separate countries—a physical counterpart to the political barriers that can be erected between neighbours. To counter these divisions and improve protection of ocean resources, marine protected area (MPA) managers have formed alliances that bridge political and jurisdictional boundaries to share strategies and resources with other protected areas. Designed to strengthen the management of ecologically and culturally connected areas, these relationships between protected areas serve as

catalysts for effective stewardship of the ocean's biological resources and show the important benefits of transnational cooperation.

MPAs are a well-established tool for conserving marine biodiversity, maintaining ecosystem functions and minimizing human impacts to key species and habitats. However, human- and climate-driven changes to marine communities and their habitats are occurring at regional and global scales, and MPAs cannot be considered as ecological islands unconnected to change in their larger social and ecological seascape. For this reason, the Convention on Biological Diversity has established, through Aichi Target 11, not only a spatial target for MPAs, but for well-connected and managed MPA networks. MPA managers must look beyond the site boundaries that define their protections to identify and adapt conservation strategies in a changing ocean.

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The National Oceanic and Atmospheric Administration's (NOAA's) Office of National Marine Sanctuaries (ONMS) has embraced this management approach to connect MPA management based on ecological and cultural links. The United States' Sanctuary System is made up of 14 federally managed MPAs—national marine sanctuaries and marine national monuments—charged with resource conservation and balancing multiple uses. Its 'sister site' strategy is meant to encourage collaborative research and management of conservation challenges that are shared between sites in the Sanctuary System and MPA partners outside the USA (see Figure 1). Whereas each site may have unique experiences and components of the regional ecosystem, it benefits from the conservation success of its partner(s). Whether designed as pairings between sites or a network of several sites, sister site relationships aim to strengthen the management capacity and, as a consequence, the ecosystem integrity of each MPA, and help to maintain the ecological connections between the sites. This paper summarizes the origins and accomplishments of several of these partnerships and distils lessons that have been learned from over a decade of collaboration.

2 | NORTH ATLANTIC HUMPBACK WHALE SISTER SANCTUARIES: WORLD'S LARGEST NETWORK OF MARINE MAMMAL PROTECTED AREAS

Humpback whales (*Megaptera novaeangliae*) traverse the global ocean. Subpopulations tend to remain in a particular part of the ocean,

migrating between breeding and feeding grounds. This is the case with the North Atlantic humpback whale, whose range extends between the tropical waters of the Caribbean and the frigid waters of the far North Atlantic between Greenland and Norway. A segment of the North Atlantic humpback whale subpopulation migrates between the western Caribbean (e.g. Dominican Republic, Puerto Rico, Haiti) and the Gulf of Maine. In fact, over 10% of the Gulf of Maine whales, whose population is around 900 animals, are known to breed in the Caribbean (Allied Whale, personal communication, August 2018). In an effort to better protect this population at each end of its migration, Stellwagen Bank National Marine Sanctuary (SBNMS) established the Sister Sanctuary Program in 2006.

Since 2006, SBNMS has signed formal agreements with four Caribbean nations, creating the first and largest distributed MPA network to protect a transboundary population of humpback whales. This network has been formally recognized as the Marine Mammal Protected Areas Network under UNEP's Caribbean Environment Programme and its Specially Protected Areas and Wildlife (SPAW) Protocol. Agreements were signed with the Dominican Republic in 2006, French Antilles in 2011, Bermuda in 2012, and the Caribbean Netherlands in 2015 to work with MPAs in those countries to enhance research and management on the shared population of humpback whales. In 2018, the sister sanctuary network of marine mammal MPAs comprised five sites in five nations (Table 1, Figure 2). This network has significantly expanded protection (from 2,191 km² in 2007 to 669,440 km² today) for humpback whales during their annual migration away from SBNMS (Table 2).

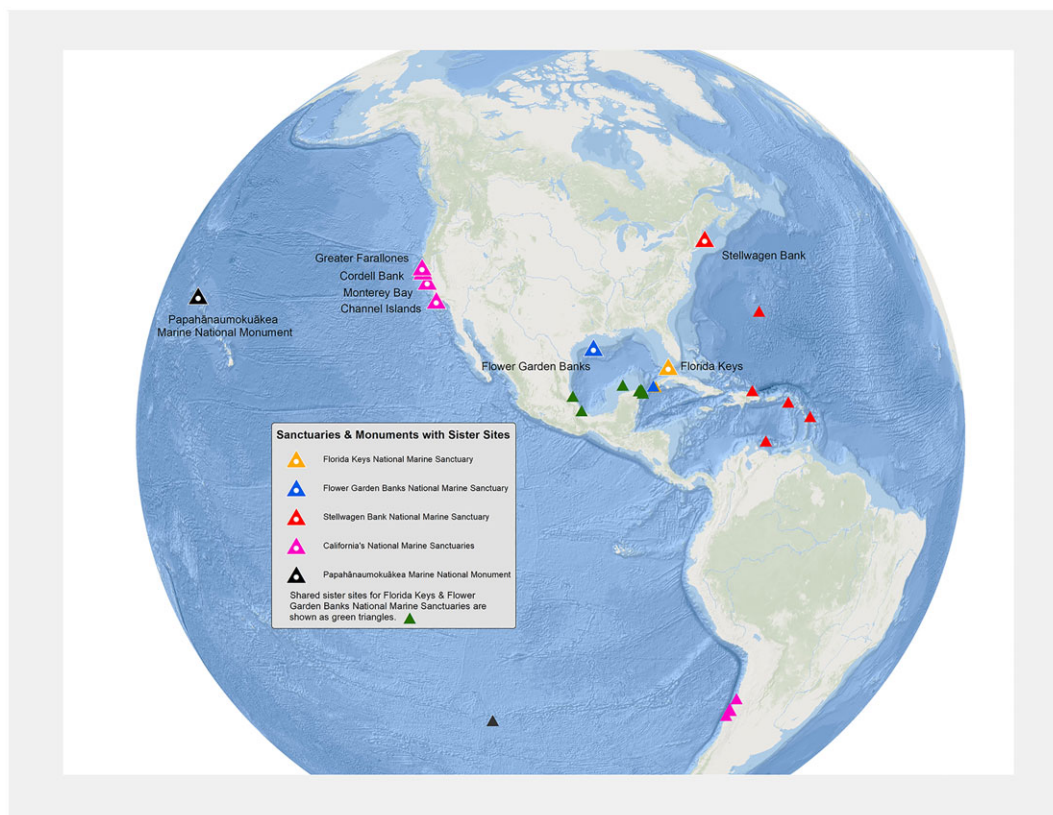


FIGURE 1 Map of NOAA Office of National Marine Sanctuaries' sister sites

TABLE 1 Sister site partnerships with NOAA's Office of National Marine Sanctuaries

Sanctuary/monument	Sister site country	Sister site
Papahānaumokuākea Marine National Monument	Chile	Rapa Nui (Easter Island)
Monterey Bay, Cordell Bank, Greater Farallones & Channel Islands National Marine Sanctuaries	Chile	Great Island of Atacama Pan de Azúcar National Park Llanos de Challe National Park National Reserve Pingüino Humboldt Chañaral Island, Choros and Damas Islands Marine Reserves
Stellwagen Bank National Marine Sanctuary	Dominican Republic French Antilles Bermuda Netherlands	Silver Bank Marine Mammal Sanctuary Agoa Marine Mammal Sanctuary Bermuda Marine Mammal Sanctuary Yarari Marine Mammal and Shark Sanctuary
Florida Keys National Marine Sanctuary	Cuba	Guanahacabibes National Park
Flower Garden Banks National Marine Sanctuary	Cuba	Banco de San Antonio Protected Area
Florida Keys & Flower Garden Banks National Marine Sanctuaries*	Mexico	National Park of Arrecife Alacranes National Park of Isla Contoy National Park of Costa Occidental de Isla Mujeres, Punta Cancún y Punta Nizuc National Park of Sistema Arrecifal Veracruzano Flora and Fauna Protection Area of the Sistema Arrecifal Lobos-Tuxpan Flora and Fauna Protection Area of the Yum Balam Biosphere Reserve of Tiburón Ballena

*Sister site agreement expected in 2019.

Through the SPAW Protocol's Marine Mammal Action Plan adopted in 2008, sister sanctuary partners have taken the lead in the region by providing funding, expertise, capacity, and participation in eight of ten priority issues, including: (a) protected areas and other management regimes; (b) research; (c) whale watching; (d) acoustic disturbance; (e) vessel strikes; (f) fisheries interactions (entanglement); (g) acoustic disturbance; and (h) marine mammal strandings.

In 2014, the Sister Sanctuary Program implemented CaribTails, an online citizen science project targeting yachters and sailors in the Caribbean, to increase the number of humpback whale fluke photographs available for research. The first year of CaribTails resulted in the doubling of fluke photographs for the undersurveyed breeding ground in the eastern Caribbean region. Fluke photographic analysis by Allied Whale in Bar Harbor, Maine (which curates the North Atlantic Humpback Whale Catalog), confirmed the first match of an individual whale migrating between SBNMS and Agoa's marine mammal sanctuary and provided data identifying a potential third breeding ground in the eastern Caribbean. These new data suggest that humpbacks in the south-east Caribbean comprise a breeding group separate from those found in the northern Caribbean, especially the Dominican Republic (Stevick et al., 2018). These new findings raise management challenges, especially given the humpback whales' recent delisting under the US Endangered Species Act.

Major benefits of the Sister Sanctuary Program include:

- An unprecedented opportunity to work with three nations containing breeding grounds pivotal to the survival of the sanctuary's shared population of humpback whales.
- Increased database of fluke photographs that allow the Sister Sanctuary Program to monitor the movements, health, and behaviour of individual whales that migrate between the sanctuaries.
- Reduced overall financial costs for humpback whale protection by sharing research, monitoring, protection, education, and outreach techniques among sister sanctuaries.

The next steps for the Sister Sanctuary Program include the development of a common vision and framework as the basis for developing cooperative management objectives for a future multilateral Humpback Whale Transboundary Management Plan to ensure protection of shared humpbacks throughout their migratory range. The European Union is promoting the concept of 'Atlanticism' through its Transatlantic Marine Protected Area Partnership programme (Ward, 2016). A central theme of this concept is transboundary protection of humpback whales. Potential future activities contributing to a healthy humpback whale population include: (a) coordinating the development of photo identification catalogues; (b) expanding the CaribTails' citizen science photo-identification programme; (c) promoting ecotourism around whales and understanding the effect of whale watching of humpbacks; and (d) using the humpback whale to connect cultures around the Atlantic, such as through virtual classroom exchanges.

3 | GULF OF MEXICO SISTER SITE NETWORK

MPAs in the Gulf of Mexico focus science, education, and management at special places that are critical for the conservation of the Gulf ecosystem (Kiene, 2011, 2018; Mahadevan et al., 2012; Ritchie & Kiene, 2012). However, the interconnections within the Gulf ecosystem mean that its MPAs do not function in ecological isolation. The currents that flow from the Caribbean through the Gulf of Mexico and into the Atlantic physically connect Florida Keys and Flower Garden Banks National Marine Sanctuaries with the marine environments that lie upstream in Cuba and Mexico. Fish, whales, and sharks migrate between US, Cuban, and Mexican waters in the Gulf, and larvae and juveniles are transported from one country to another by the Loop Current and other ocean currents. International cooperation in ocean conservation issues is therefore an essential part of

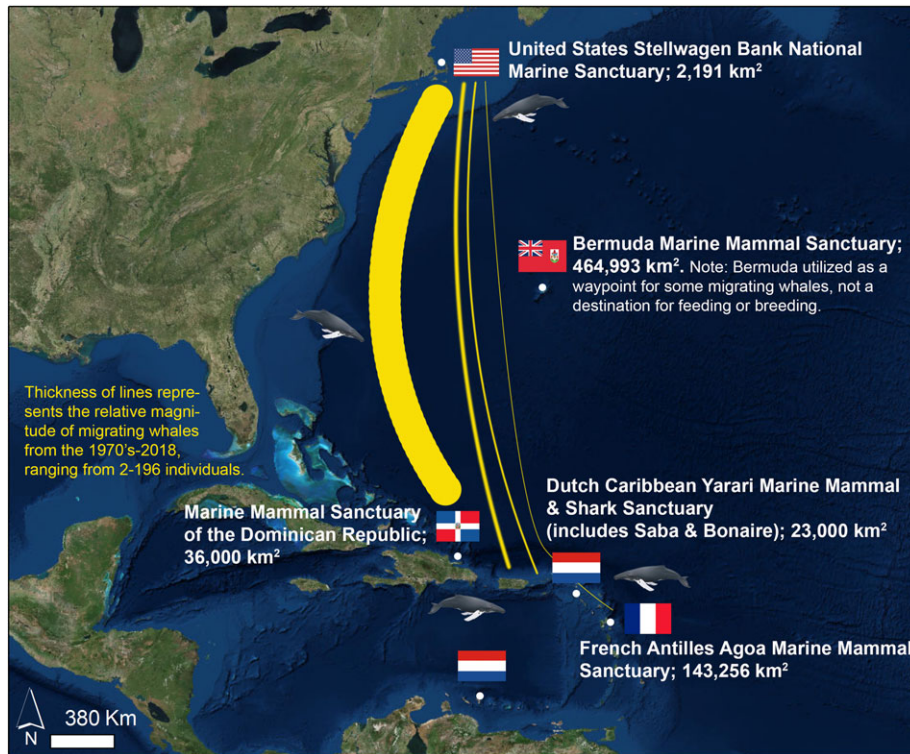


FIGURE 2 Map of North Atlantic humpback whale sister sanctuary network

TABLE 2 Marine mammal protected areas (MPAs) network (Atlantic/Caribbean)

Nation	Name	Size (km ²)	Year established
USA	Stellwagen Bank National Marine Sanctuary	2,191	1992
Bermuda	Bermuda Marine Mammal Sanctuary	464,993	2012
Dominican Republic	Marine Mammal Sanctuary of the Dominican Republic	36,000	2006
France	Agoa Marine Mammal Sanctuary	143,256	2011
Netherlands	Yarari Marine Mammal and Shark Sanctuary (comprising MPAs around Bonaire and Saba islands)	23,000	2016

protecting the ecological integrity of MPAs in all three countries and to conserving populations of threatened and commercially important species throughout the Gulf of Mexico.

Recognizing the strong physical and ecological ocean connectivity between the USA and Cuba, collaboration on MPAs was the first formal agreement adopted with the normalization of relations. Cuba's Guanahacabibes National Park and its subunit Banco de San Antonio were designated sister sites with Florida Keys and Flower Garden Banks National Marine Sanctuaries, respectively, through a 2015 Memorandum of Understanding (MOU) between Cuba's Ministry of Science Technology and Environment and the US NOAA (NOAA, 2015). The MOU is being implemented through a sister site relationship between NOAA's ONMS and Cuba's National Center for Protected Areas (Centro Nacional de Áreas Protegidas). This USA-Cuba relationship integrates with the recently approved transboundary Gulf of Mexico Large Marine Ecosystem (LME) programme funded by the Global Environment Facility to Mexico, which includes creating a network of protected area sites in the Gulf (Global Environment Facility, 2016). The Mexico sites in the network are:

- Yum-Balam Flora and Fauna Protected Area and Whale Shark Biosphere Reserve
- Isla Contoy National Park
- Isla Mujeres, Punta Cancún and Punta Nizuc National Park
- Arrecife Alacranes National Park
- Veracruz National Park
- Lobos-Tuxpan Flora and Fauna Protected Area.

The MPA network component of the LME programme is being coordinated in Mexico by the National Commission of Natural Protected Areas and in the USA by ONMS. By integrating the Cuba-US sister site programme with the Gulf of Mexico's LME programme, a set of common products to characterize and enhance MPA management are being developed.

This trilateral collaboration is being designed to give MPA site managers in Mexico, Cuba, and the USA an understanding of the ecosystem protections at all the sites in the network and an assessment of the status and trends in the condition and management of the sites. The goal is to provide the managers of the sites with tools to identify

strengths and weaknesses in how the sites address key conservation issues and inform local and collective network decisions on how technical and management resources can best be applied. The goal is also to assist marine scientists with a basic understanding of the similarities and differences between MPAs in the region and support targeted ecosystem and conservation research using the network sites to address questions about the Gulf ecosystem, including human uses of it.

Through the sister site relationship, ONMS is establishing joint marine conservation and research programmes with its partner sites in Mexico and Cuba, and Florida Keys and Flower Garden Banks National Marine Sanctuaries. ONMS is also partnering with Dry Tortugas and Biscayne National Parks to ensure all aspects of conservation in the Florida Keys are integrated in the relationship with Cuba. Flower Garden Banks National Marine Sanctuary has comparable physical and biological features to the coral reefs at Guanahacabibes' Banco de San Antonio. The sister sanctuary designation allows direct evaluation of the controls on ecosystem functions and changes at the two sites.

In 2016, this sister sanctuary relationship with Cuba facilitated NOAA Ship *Nancy Foster* to create a detailed map of Banco de San Antonio. This map (Figure 3) provides the first detailed assessment of the physical features of the bank and a basis for targeting future science missions on its shallow- and deep-water coral reefs. The expedition documented what participants described as the most diverse and abundant mesophotic reef communities (30–150 m water depth) found to date in the Caribbean region (Figure 4) and conducted what

Cuban scientists called the most significant marine research done in Cuba since the 1970s.

In addition to these assets, ONMS also brings to Cuba and Mexico:

- expertise in bilateral agreements and strategies for managing marine ecosystems and migratory species; and
- ocean awareness and educational products.

However, the benefits do not only flow in one direction. Cuba and Mexico bring to the USA:

- the opportunity to observe the baselines of ecosystem condition and the methods Cuba and Mexico have used to maintain them;
- more complete understanding of the physical and biological systems that connect US sanctuaries with the Caribbean region; and
- a crucible for the study of coastal resource use and protection that can be shared with other developing countries of the wider Caribbean.

All countries benefit from the technical expertise at all the sites in coral reef restoration, monitoring and mitigation of impacts to marine environments.

As the MPA network collaboration grows, Cuba, Mexico and the USA are seeking to understand, enhance, and protect their interconnected biological resources and address shared conservation challenges at special marine areas in the three countries. Through the

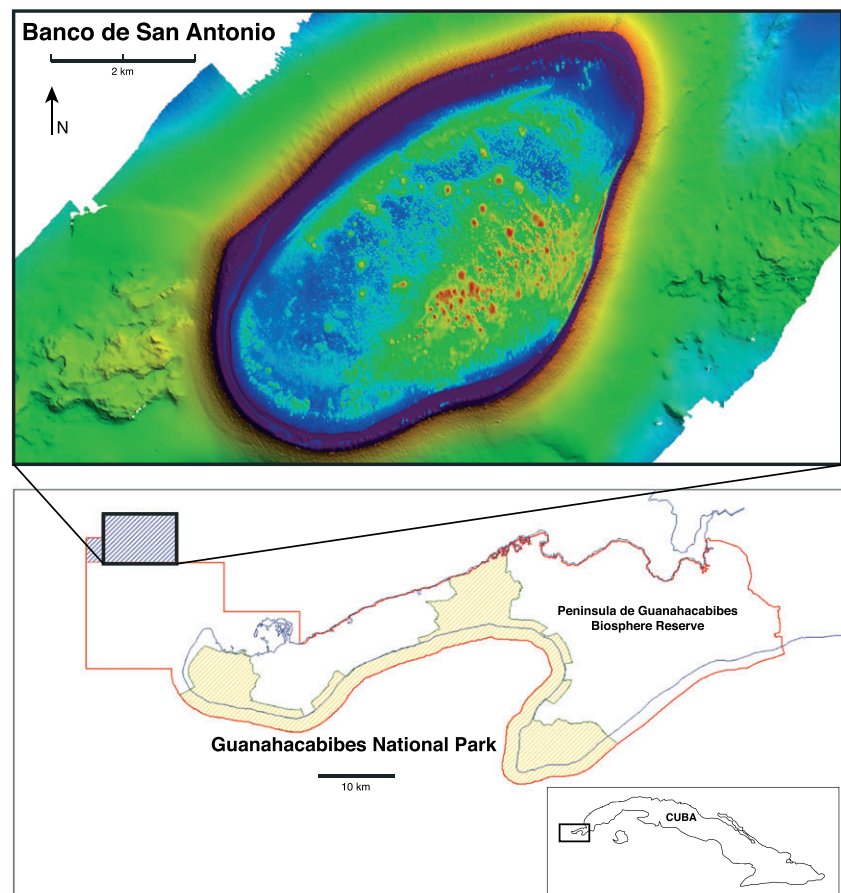


FIGURE 3 In 2017, Harbor Branch Oceanographic Institute/Florida Atlantic University's Cooperative Institute for Ocean Exploration Research and Technology and Cuban scientists explored connectivity between the Cuba and US sister sites using the National Marine Sanctuary Foundation's remotely operated vehicle (Reed et al., 2017). Mapping of Banco de San Antonio using multibeam systems on NOAA Ship *Nancy Foster* was facilitated by the Cuba–US sister sanctuary relationship. Bathymetry image: NOAA's Southeast Fisheries Science Center/NOAA Ship *Nancy Foster*. Map: Centro Nacional de Áreas Protegidas, Cuba



FIGURE 4 Mesophotic reef communities explored by Harbor Branch Oceanographic Institute/Florida Atlantic University and Cuban scientists in 2017. The expedition was organized through the sister sanctuary relationship between Cuba and the USA. Photographs: HOI/FAU NOAA CIOERT Twilight Zone Reefs Expedition

relationship, the foundation has been laid for important cooperative programmes in support of marine science, management, and education efforts in the Gulf of Mexico.

4 | PAPAĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT AND RAPA NUI

Connections between MPAs are not only ecological. In December 2012, a group of US coastal and marine managers visited Chile to begin conversations about how the two countries could collaborate on marine and land-based parks. Although the managers from both countries saw many connections, those from Hawai'i and Rapa Nui (Easter Island) had an intriguing understanding about the cultural, historical, social, ecological, and geological similarities between these two cornerstones of Polynesia, and were eager to explore future collaboration.

There is a deep connection among people who look toward the ocean as the path of their history and genealogy. Despite the thousands of kilometres that separate the islands of Hawai'i and Rapa Nui, the ocean connects their cultures. At the far reaches of the Pacific, these isolated archipelagos were both settled around 1,000 years ago from a common homeland in central eastern Polynesia. In these unique yet connected island settings, the ancestral peoples of Hawai'i and Rapa Nui developed distinct variations of Polynesian culture (Kirch, 2017).

The ecosystems of Hawai'i and Rapa Nui contain some of the highest rates of endemism and have fostered and sustained similarly unique cultural histories (Boyko, 2000; Friedlander, DeMartini, Wedding, & Clark, 2009; Glynn et al., 2007; Hurles, Matisoo-Smith, Gray, & Penny, 2003; Kane, Kosaki, & Wagner, 2014; Kay & Palumbi, 1987; Kirch, 2017; Kosaki et al., 2016; Maragos et al., 2009; Randall, 2007; Randall & Cea, 2011). In the Northwestern Hawaiian Islands, a number of stone images (ki'i) found on Nihoa and Mokumanamana are described in early historical accounts of Hawaiian culture (Emory, 1928; Kikiloi, 2010, 2012). These ki'i are much smaller than the impressive stone moai of Rapa Nui, statues that embody the sacred spirit of ancestors. However, both the moai and ki'i are similar to other stone figures found throughout Polynesia. They are thought to have

important religious significance and also marked the emergence of significant cultural shifts (Emory, 1928; Kikiloi, 2012; Van Tilburg, 1994).

When the great migrations throughout Polynesia ceased hundreds of years ago, these indigenous peoples adapted to local landscapes and seascapes and, today, continue their ancestral relationships with their native lands, territories, and resources (Buck, 1959; Johannes, 1978; Kikiloi, 2003, 2010, 2012; Kikiloi et al., 2017). The people of both Hawai'i and Rapa Nui have demonstrated a resurgence of cultural pride and identity, and self-determination. In 1999, the traditional Hawaiian double-hulled voyaging canoe, Hōkūle'a, sailed to the shores of Rapa Nui—a tangible reminder of how the ocean connects us. Today, managers and staff at Papahānaumokuākea Marine National Monument (PMNM) in Hawai'i and Motu Motiro Hiva Marine Park on Rapa Nui are exploring these connections and ways to work together to conserve their vibrant marine resources and cultural heritage.

In September 2016, during the IUCN World Conservation Congress held in Honolulu, Hawai'i, PMNM hosted a group of community leaders from Rapa Nui (Figure 5). The Rapa Nui leaders visited the NOAA Daniel K. Inouye Regional Center and were also hosted by several community partners of PMNM. The Bernice Pauahi Bishop Museum is a partner of PMNM and together they arranged for a private viewing of the museum's Rapa Nui collection that includes over 800 tao'a, or cultural treasures, made by their ancestors. It was an emotional and intimate experience for those who were present. The group was also invited to a pā'ina (Hawaiian party) at an 800-year old traditional Hawaiian fishpond, and Rapanui who reside in Hawai'i attended as well.

Based on this visit, a framework for collaboration was drafted that outlines many areas where the two sites can continue to learn from and share knowledge with each other. This framework document forms the basis for continuous dialogue and identified several areas where the sites could work together, including: (a) the strengthening of organizational and community relationships such as peer learning and mentoring opportunities; (b) documenting and sharing lessons learned; (c) enhancing potential participation in key research and management activities; and (d) identifying collaborative enforcement and surveillance technology transfer.



FIGURE 5 The lineal descendants of Pu'uhonua o Hōnaunau and Kaloko-Honokōhau (sites of national parks) initiate a welcome ceremony for the Rapa Nui delegation (September 2016). Photograph credit: Gonzalo Cid

The hospitality experienced in Hawai'i was returned during a visit in August 2017 when a Hawai'i delegation visited Rapa Nui to share the lessons of Papahānaumokuākea and the National Park Service. It was an especially significant time for the Rapanui because they were participating in a series of consultation meetings and deliberations regarding the creation of a large-scale MPA around the island of Rapa Nui that would extend to the 200 nautical mile limit of the exclusive economic zone. This consultation was unprecedented in Chile and would set standards for consultation with other indigenous peoples within Chile.

The visit to Rapa Nui was a powerful engagement. The Rapanui were most interested in lessons learned from co-management and the engagement between the native Hawaiian community and the co-managing agencies, including NOAA and the Office of Hawaiian Affairs (Kikiloi et al., 2017). The Hawai'i delegation was able to share stories about the benefits and challenges of their co-management experiences. It was made known that these oral histories were influential in the discussions and outcomes of the consultations between Chile and the Rapanui people. The most significant demonstration of commitment towards this partnership occurred in Rapa Nui when the peoples of Hawai'i and Rapa Nui exchanged prestigious cultural items that symbolize chiefly authority. These gestures acknowledged their common heritage and honoured the people and places of Hawai'i and Rapa Nui. The cultural connections are the foundation for this partnership. The collaborations were successful because of the shared cultural values and trust. Immediately following that visit, the Rapanui people voted to establish a new MPA in their waters, co-managed with the Government of Chile. NOAA will continue to support Rapa Nui and Chile as they implement this new MPA. *Pīpī holo ka'ao*—The story is salted and continues to voyage.

5 | CHILE-US SISTER SITES ON THE PACIFIC COAST

Chile and the USA have worked together for nearly a decade to cooperate on marine and terrestrial protected areas. Two key factors for this continuous collaboration are the establishment of a general, non-binding multiagency agreement, and the consistent communication of permanent middle-management staff who serve as focal points for the implementation of cooperative activities in each one of the signing agencies.

In 2013, after several years of bilateral work on protected areas, three Chilean and two US government agencies¹ signed a first-of-its-kind MOU to cooperate on marine and terrestrial protected areas. This general framework allows each of the signing agencies to have a flexible instrument to carry out cooperative activities without a budget commitment or a strict timeline of deliverables. Activities are determined by a biannual priority list agreed to by the agencies and priority sites (geographic regions) identified to establish a more specific sister-park cooperation. Most cooperative activities have focused around staff exchanges, training, or capacity building for protected area managers, study-tours to US national parks and marine sanctuaries, and sister park relationships.

Funding is always a cornerstone to carry out some of the cooperative activities, since international cooperation is not, or not always, a priority for protected area agencies (although it is recognized as an important topic in their internal strategic plans). A fundamental driver for the success of this bilateral cooperation on protected areas has

¹The Ministry of the Environment, the Undersecretariat for Fisheries and Aquaculture, and the National Forest Corporation on the side of Chile; and the National Park Service and the National Ocean Service of NOAA on the US side.

been funding support from the US Department of State (available through the US–Chile environmental cooperation agreement), and the ‘environmental diplomacy’ activities channelled through the embassies of both countries. Department of State funding has also helped to strengthen inter-institutional international cooperation between the US agencies working with Chile on protected areas.

5.1 | Site-level cooperation

In spite of the distance, Chile and the US Pacific coast share many oceanic geographic and ecosystem similarities, migratory marine species, and protected area management objectives and challenges. From Alaska to the Mexican border and to the Hawaiian Islands, marine ecosystems and coastal community issues are mirrored along the coast of Chile and its Pacific islands.

Recognizing these similarities, several individual park-to-park agreements have been signed under the MOU on protected areas, and activities such as staff exchange and management best practices have been conducted under them. Most recently, the MOU partner agencies have agreed to focus MPA cooperation on the following geographic regions: (a) US West Coast (initially California) and Chile's regions of Atacama and Coquimbo; and (b) Rapa Nui and Hawai'i (described earlier), which were formalized with two cooperation frameworks launched at the 2017 4th International Marine Protected Area Congress (IMPAC4) held in Chile.

5.2 | California–Atacama/Coquimbo framework

Under this collaboration framework, both countries agreed to develop an alliance of multiple MPAs in both regions with the purpose of mutual collaboration in the creation, management, and operation of marine and coastal protected areas, including the development of a broader network of protected areas along the east-Pacific coast. The idea of this collaboration is a result of the multiple exchanges and study tours for MPA managers under the MOU activities. Both regions, Atacama–Coquimbo and California, have similar temperate conditions characterized by coastal upwelling systems, which have a major effect on coastal ecosystems. The high concentration of nutrients triggers high primary productivity, the source of trophic webs that are very important for ecosystem processes and socio-economic activities. Both coastal areas have similar features, such as rocky sea beds, rich biodiversity, sandy beaches, and bays and islands near the coast. Kelp forests dominate the coastal landscape, which is the habitat for many species of invertebrates, fish, seabirds, and marine mammals. Large cetaceans and other smaller marine mammals, such as dolphins and sea lions, are also characteristic on both coasts. Rocky islands provide an essential habitat for seabirds and endemic flora. Large human populations living on both coasts have affected the natural resources through, for example, coastal pollution, overfishing, invasive exotic species, and habitat destruction. Climate change effects, harmful algal blooms, and other phenomena, such as El Niño Southern Oscillation, also affect these areas.

Other important common challenges include marine resource exploitation, tourism development, competing uses of the coastal

zone, and engaging coastal communities and relevant stakeholders to define sustainable and socially beneficial MPA goals and activities.

As we learned from the overall cooperative relationship under the Chile–USA MOU on protected areas, important steps include having common working goals (e.g. mutually beneficial activities such as target migratory species), focusing on a few issues with a flexible time frame, having supporting partners by engaging other governmental agencies (including as funding sources), and, most importantly, having stable and clear points of contact in each partner agency to keep the cooperation agenda moving forward.

6 | LESSONS LEARNED

The following lessons have been learned from NOAA's ONMS's past decade of international sister site partnerships.

1. *Put a ring on it.* Although establishing a formal agreement between two countries is time consuming, it has many benefits. Such agreements typically take the form of an MOU; but they can be less formal, such as a letter of intent or a document that outlines opportunities for collaboration. Such written agreements can serve to provide continuity in the partnership when key staff turnover, to elevate the partnership to agency leadership, and to help clarify and focus the partnership by stating written objectives. This can be particularly important when agency leadership changes or budget constraints can raise questions about the value of the partnership.
2. *Plan for continuity.* As already noted, staff turnover can be a significant obstacle to the long-term partnerships required for marine resource protection. Lead staff should plan for continuity by designating alternatives and establishing written workplans. Continuity can also be improved by attaching the international collaboration role to a specific position, so that in the event of a vacancy the successor will take on this role.
3. *Learn by doing.* Effective partnerships are based on action. Ideally, sister sites can support each other and expand their capacity by implementing similar practices or processes. For example, sister sites Papahānaumokuākea Marine National Monument and the Phoenix Island Protected Area worked on their World Heritage nominations at the same time and were able to share their experiences and provide mutual support. Another example is sister sites Papahānaumokuākea Marine National Monument and Rapa Nui working on site management plans at the same time. Do not be reluctant to take small steps—a flexible time frame and feasible activities are necessary to keep the relationship alive. Small actions can lead to bigger, longer term joint activities.
4. *Long-distance relationships only get you so far.* Like a romance, long-distance sister site partnerships have challenges. They can be greatly enriched and enhanced through site visits that allow involved staff to better understand the issues at the host site and develop stronger personal relationships. The time away from day-to-day management responsibilities, travel time, and funding for site visits are frequent challenges. In the USA, some site visits have been supported through US State Department funds set

aside for environmental collaboration among key trade partners. Partners also take advantage of attendance at meetings and workshops in their own or other countries to work together.

5. *Never underestimate the power of culture.* While many sister sites are based on shared species or habitats, some also share a common culture, which can be a powerful bond and opportunity. Papahānaumokuākea Marine National Monument and Rapa Nui are linked by a common Polynesian heritage and share many cultural and spiritual practices, as well as history and words. The partnership between Papahānaumokuākea Marine National Monument and Rapa Nui was cemented by an exchange of culturally significant objects, rather than by a formal agreement.
6. *All relationships are two way.* No matter how advanced one partner may seem to be in certain areas, all successful sister site partnerships are based on mutual learning. By providing time and mechanisms based on respect, MPA programmes can build a foundation for long-term successful collaboration.
7. *Partnering takes time.* Working across distances and cultures can be a challenge. MPA programmes should allow for differences in language, culture, available technology, and pace in working together. Extra time is frequently needed to translate documents, obtain agency approvals and identify priorities and opportunities for collaboration. Even working across multiple zones can be a challenge in terms of finding suitable meeting times. MPA programmes need to allow time to overcome these challenges.
8. *Science can bring us together.* In an often fractious world, science can help build bridges by providing opportunities to work together to build knowledge and solve problems. Ocean science is particularly well suited to this diplomatic mission, as it addresses a shared resource of common interest to all. Science is a key part of sister site partnerships, including that between Stellwagen Bank National Marine Sanctuary and several sites in the Caribbean that share a common population of migratory humpback whales and are sharing research to better understand their behaviour and the threats they face.
9. *Sister sites can make the concept of ecological and cultural connectivity understandable to the public.* Oceanographic, ecological, and cultural connectivity are concepts that may not be well understood by the general public. Examples from sister sites can help make this idea real and communicate it to decisionmakers and the public. For example, migratory species, such as turtles, seabirds, and whales, physically link one part of the ocean to another. The citizen science research through Carib Tails to take whale fluke photographs in the Atlantic and Caribbean helped identify specific whales who make the journey between different MPAs in this region.
10. *MPA networks can bring new resources to the table.* Sister sites are a practical and tangible way for MPA programmes to work together, but they can be even more effective when operated in the context of a regional MPA network. Regional MPA networks (such as MEDPAN, NAMPAN, RAMPAN, and CAMPAM in the Mediterranean, North America, West Africa, and Caribbean respectively) play a critical role in connecting sites to broader regional institutions and policies. As such, they

frequently have access to resources (whether monetary or in-kind) that can strengthen sister site partnerships. Sometimes, one partner may be eligible for funding that another is not. For example, Big Ocean, a global network of managers of large-scale MPAs, grew out of the early partnership between Papahānaumokuākea Marine National Monument and the Phoenix Island Protected Area. Today, Big Ocean has 17 member sites in nine countries who provide a community of practice to support managers of large-scale MPAs (Lewis et al., 2017). Big Ocean also succeeded in raising outside funds for a symposium on human dimensions of MPAs—a topic of great interest to all its members.

7 | CONCLUSION

The basic precepts of ocean literacy teach us that there is one global connected ocean. Sister sites are helping to bridge international differences and bolster resource protection efforts by connecting MPAs to better understand and manage shared resources and challenges. MPA success ultimately depends on a range of factors, including effective management, research and monitoring, social and political will, and an informed and engaged citizenry. The NOAA sister site programme is a dynamic and evolving process of international collaboration focused on ecological and cultural connections to build capacity and increase joint conservation impact. The shared objectives and actions defined by managers and scientists at sister sites provide a framework for evaluating the future success of these collaborative management strategies.

Sister sites can also form the foundation for a broader network of MPAs sharing a commitment to collaboration on science and management issues. The Convention on Biological Diversity's Aichi Target 11 calls for signatories to establish effective networks of MPAs, a commitment that has been echoed through other global and regional bodies and commitments. Sister sites can serve as a practical model for building transboundary MPA networks from existing sites, based on shared interests and resources, ultimately making their conservation impact more than the sum of the conservation efforts at individual sites.

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