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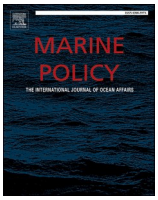

The hidden landscape: Maritime cultural heritage of the Salas y Gómez and Nazca ridges with implications for conservation on the high seas

James P. Delgado [a], Michael L. Brennan [a], Sergio A. Rapu Haoa [b], Julianna H. Rapu Leong [c], Carlos F. Gaymer [d], Diego Carabias [e], Emily Stokes [f], Daniel Wagner [g,*]

[a] SEARCH, Inc., Washington, DC, USA
[b] Fundación del Patrimonio Rapa Nui, Chile
[c] Pono Pacific, Honolulu, HI, USA
[d] Center for Ecology and Sustainable Management of Oceanic Islands, Departamento de Biología Marina, Universidad Católica del Norte, Coquimbo, Chile
[e] ARQMAR, Centre for Maritime Archaeology Research of the Southeastern Pacific, Valparaíso, Chile
[f] Middlebury Institute of International Studies at Monterey, Monterey, CA, USA
[g] Conservation International, Center for Oceans, Arlington, VA, USA

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ABSTRACT

The human history of the waters surrounding the Salas y Gómez and Nazca ridges is rich and culturally diverse. This ranges from indigenous cultures who first ventured to this remote region close to a thousand years ago to the period of European colonial exploration, as well as the rise of the modern global economy. Voyaging, fishing, and the transportation of commodities across these remote waters left signs of the human history of exploration and exploitation. A deep understanding of this rich history is critical to effectively managing its marine resources, since natural and cultural resources are intrinsically intertwined in many cultures. While most of the Salas y Gómez and Nazca ridges are located in areas beyond national jurisdiction, there has been recent interest to protect this remote region by governments, intergovernmental organizations, and the scientific community. This study provides a synthesis of the maritime heritage and cultural resources of the Salas y Gómez and Nazca ridges in order to guide future conservation, management, scientific, and public outreach efforts in this region. While uninhabited, several communities have profound connections to these remote waters, particularly communities on the islands of Rapa Nui, Juan Fernández, as well as the Peruvian and Chilean continental coasts. These communities in particular should be appropriately engaged during all development phases of the proposed protected area, as these relationships are critical to not only building interest and support, but also to developing conservation strategies that are socially responsible and equitable. While this review summarizes what we know about the maritime heritage and cultural resources of the Salas y Gómez and Nazca ridges, several knowledge gaps remain. Activities addressing those knowledge gaps should be incorporated in the design and eventual management of the proposed protected area, including research, education and outreach aimed at better understanding and appreciating the cultural significance of the region. The Salas y Gómez and Nazca ridges provide a rare opportunity to protect and study a globally significant area on the high seas, while also providing a window into the profound relationships between people and the sea.

1. Introduction

The Salas y Gómez and Nazca ridges are two seamount chains in the southeastern Pacific that include one of the most unique biodiversity hotspots on Earth [1-3]. Over 73% of the Salas y Gómez and Nazca ridges lie in areas beyond national jurisdiction, commonly known as the high seas, where they are unprotected and under threat from overfishing, plastic pollution, climate change, and potential deep-sea mining [3]. Multiple scientific studies and international organizations have identified this region as one of the most important areas to protect globally [4–8,3]. The high seas area that has been proposed for increased protections runs in a southwest-northeastern direction and is bounded on the western side by the Chilean exclusive economic zone (EEZ) around the islands of Rapa Nui and Salas y Gómez, and on the

* Corresponding author.
E-mail address: dwagner@conservation.org (D. Wagner).

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eastern side by the Peruvian national waters (Figs. 1 and 2). Widely recognized as a biodiversity hotspot, the region is home to a wide variety of unique species, as well as a diverse geology and submarine geography that includes over 110 seamounts [2,3]. Upwelling of cold, nutrient-rich waters along the west coast of South America causes plankton blooms, dominated by diatoms, that attract whales during their migrations along the coast and supports large populations of pelagic fish, especially anchovies [9-11].

This portion of the southeastern Pacific is an area defined from a shoreline perspective as connecting to the coast between Lima and Pisco, Peru and south of that border to Antofagasta, Chile; the major port of Valparaíso is in relative proximity. The Juan Fernández Archipelago is situated approximately 780 km south of the eastern end of the proposed area. All of the area around Salas y Gómez Island, and a portion around the island of San Félix in the Desventuradas Islands (composed of San Ambrosio, San Félix, González, and Roca Catedral) are directly proximal to the proposed protected area. These small land features are the only visible features above the sea surface. However, underneath this seemingly empty seascape lies a chain of seamounts over 2900 km long.

From a human perspective, the ocean is a flat and transient surface upon which people have acted but have left little trace. Instead, human actions on the ocean surface are offset vertically and imprinted on the seabed below. Such areas of maritime impacts can be isolated shipwreck sites or part of an expansive yet connected landscape, such as the Pacific theater of World War II, which left hundreds of shipwrecks and aircraft wrecked on the seabed beneath the battlefields upon which they fought. The Salas y Gómez and Nazca ridges are of the latter type, representing a broad spectrum of the ocean that people used for millennia for a multitude of actions, the material evidence for which now lies on the seafloor below.

This article seeks to complement previous efforts that summarized information on the natural significance of the [3] by synthesizing information on the maritime cultural resources of the region. The approach taken in this assessment employs the maritime cultural landscape theoretical perspective (MCL) and follows similar studies conducted by National Marine Sanctuaries in the United States [12], a larger study of the area off Hawai'i [13], and the various studies that led to the creation of Papahānaumokuākea Marine National Monument in the Northeastern Hawaiian Islands.

The MCL, initially envisioned by Christer Westerdahl as an archeological concept spanning land and sea [14], has expanded into a useful tool for describing geographical areas of associated natural and cultural features. The utility of the MCL approach for management has seen its adoption by the United States National Marine Protected Area Center in 2011 as a means for looking at ways in which cultural and environmental processes overlap and influence one another. The cultural landscapes concept has been established for nearly a century, but its application to marine resource management is quite new. Cultural landscapes identify combinations of human activity and natural resources that have left identifiable cultural and ecological patterns [15].

Utilizing that perspective, the natural resources of the study area have cultural contexts as defined by human activity, even when those activities were as transitory as an ocean voyage. While seemingly uncharted, that does not mean this is an area devoid of human interaction and understanding. The study area has been an active voyaging highway for an extended period. Navigation began long before European "discovery" with the voyages of Polynesian explorers, societies so dependent on the sea who by necessity had an intimate relationship with the ocean [16]. The use of these waters as a highway continued throughout the period of European colonial exploration and expanded in the post-colonial era as the emerging global economy led to substantial increases in maritime traffic. These voyages led to a variety of names, bestowed by different cultures and in different languages, to the islands, species and currents, as well as an emerging understanding of the characteristics of this portion of the globe. These voyages were in response to the rise of international trade networks, the extension of sovereignty, and the deployment of naval forces in conflict.

Where the natural and cultural worlds intersect is also seen in the

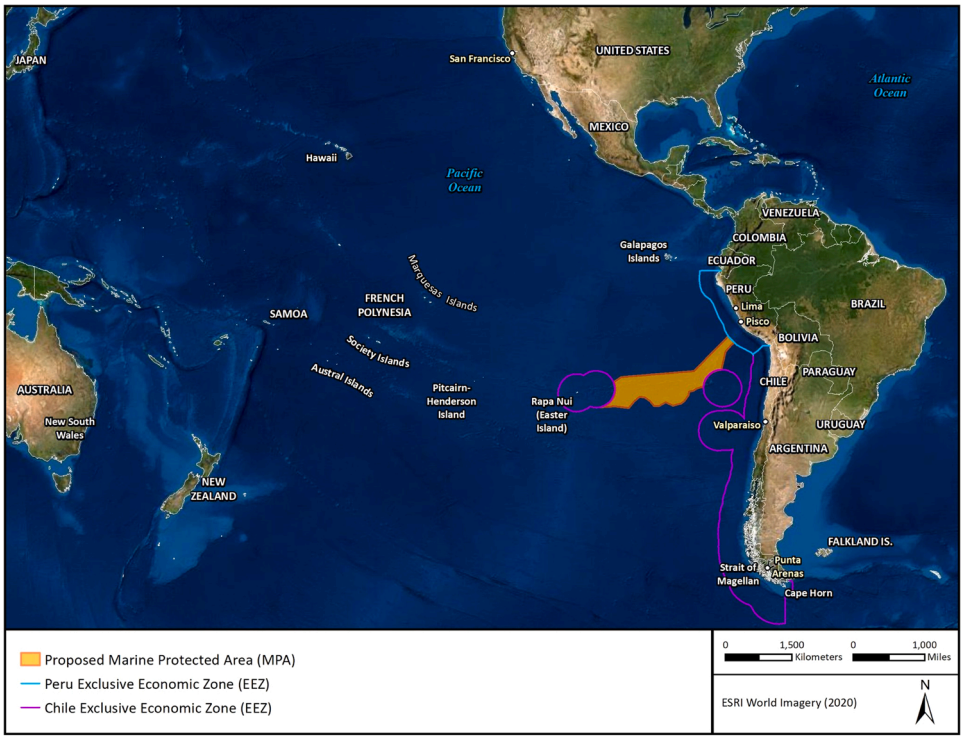

Fig. 1. Overview map showing location of the potential high seas area surrounding the Salas y Gómez and Nazca ridges that has been proposed for increased protections. The boundaries shown are those from the area recognized as an ecologically or biologically significant marine area by the Convention of Biological Diversity that are in international waters.

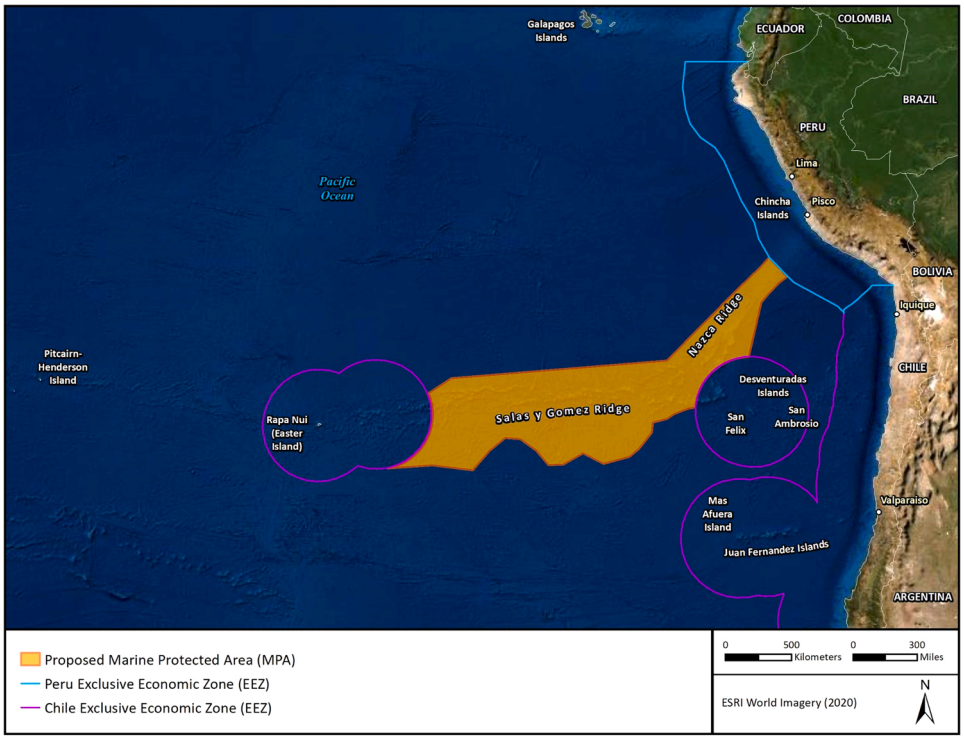

Fig. 2. Close up map showing the location of the proposed high seas protected area, as well as nearby islands and landmarks.

extraction of natural resources, both in terms of vessels transiting to load or discharge commodities, as well as activities on these waters that included offshore whaling, sealing, and fishing. Foraging from marine species also occurred, such as fish caught during Polynesian voyages, to the more modern voyages of the 18th-20th centuries when turtles, sharks, fish, and other marine species were caught to supplement the diet of people sailing through the area. In some cases, early harvesting had substantial environmental impacts, such as for the endemic Juan Ferández fur seal which was hunted until almost extinction in the Desventuradas Islands [17,18]. Finally, there is some industrial fishing, a process which began in the colonial era and continues to this day [3].

2. Indigenous Pacific islander cultural properties and context

The first settlers of the Pacific were Austronesian-speaking people who developed vessel technologies such as the catamaran and outrigger canoe that would allow for travel across large ocean expanses. The waters of the proposed high seas protected area were well known to the first Pacific Island inhabitants, who were navigators that used their voyaging canoes to colonize the Pacific. This colonization began c. 40,000 years ago. Archeology, bioanthropology (specifically DNA) and linguistics have refined modern models for the human colonization of the Pacific. Following the settlement of Near Oceania, the more modern settlement of Remote Oceania came through the use of outrigger canoes (Fig. 3) which carried people, crop plants, and domestic animals to newfound islands as long-term settlement depended on the establishment of horticulture (reviewed in [19]).

This second phase of colonization took place between 3200 and 2900 BP, with the Lapita who colonized the Tonga-Samoa region commonly known as Western Polynesia [19,20]. There was a pause of more than 1000 years between the initial Lapita settlement of Tonga-Samoa, and the subsequent expansion of Polynesian populations to the east [21,19,22]. The region that includes the proposed protected area was colonized during the *Polynesia Diaspora* into Eastern Polynesia, which began approximately a millennium or two after the initial Lapita settlement of Western Polynesia [19,22]. While scholarly debate continues, recent

Fig. 3. Petroglyphs of a double-hulled canoe taken at the Papa Vaka archeological site on the island of Rapa Nui. Photo credit: Elena Kouneski Rapu.

analyses suggest a fairly rapid Polynesian colonization of the islands stretching from the Australs to Mangareva, Pitcairn-Henderson, and finally to Rapa Nui that occurred between roughly AD 800 and 1000 [19]. Relevant to this study, evidence of Polynesian voyages and contact with indigenous cultures in the Americas seems increasingly likely and has provoked recent debates [19,23,24]. The strongest evidence for Polynesian contact with South America is the sweet potato (*Ipomoea batatas*), a plant of undoubted American origin that was widely cultivated in Eastern Polynesia (especially in New Zealand, Hawai'i, and Easter Island) at the time of European contact [25,19,26]. The Ecuadorian shores of the Gulf of Guayaquil were once farmed with sweet potatoes by the Cañari people, who referred to the sweet potato as *cumar* [27]. The similarity between *cumar* and the Polynesian word *kumara* and all of its cognates form the basis of linguistic evidence of a Polynesian-South American connection [28]. There is also growing consensus that the introduction of the sweet potato into Polynesia

occurred during a return voyage of Polynesians from South America, as Polynesians, not groups from South America, possessed the knowledge to voyage across large ocean expanses. Sweet potatoes can last for a long period of time after harvest, thus being able to withstand extended ocean voyages. Genetic analyses and lineage reconstructions further support the introduction route of sweet potato from South America into the Pacific in prehistoric times [26].

Another possible botanical transfer into Polynesia is the bottle gourd (*Lagenaria siceraria*), a plant known to have been present in the Americas by at least 9900 cal BP [29,30,19]. Chicken bones found in El Arenal in Chile have been proposed as further evidence for Polynesian contact. The reported date, calibrated to AD 1321–1407, would fall toward the end of the period of extensive Eastern Polynesian voyaging prior to the first Spanish contact, but the subject has provoked strong debate; more data will be required before a pre-Columbian transfer of chickens from Polynesia to South America can be concluded [31,19,24,32]. While more research will be required to shed light on that debate, some contact between Eastern Polynesians and indigenous American populations seems incontrovertible based on the evidence of the sweet potato [19, 26].

Further botanical transfer by Polynesians likely included turmeric (*Curcuma longa*). Turmeric has long been valued throughout Polynesia for its medicinal qualities and yellow pigment. In 1930 (approximately 300 years after European contact), Günter Tessmann reported that a species of *Curcuma* was grown by the Amahuaca tribe to the east of the Upper Ucayali River, Peru [33]. He also described the nearby Witoto people using it as corporal paint during ceremonies. It is likely that Polynesians made this introduction from Asia to South America.

What is clearer is the expansion to at least Rapa Nui (Easter Island) during the Eastern Polynesia Diaspora from c. 1000–800 BP. Montenegro et al. [34] used wind and current patterns, coupled with vessel type and mode of propulsion (i.e. paddling and or sails), to create a model of human settlement and colonization across the Pacific. The results of that modeling study suggest that the reason for the long pause in human colonization of the Pacific came because the Lapita expansion stopped at the boundary of an island void in the South Pacific and groups responsible for the initial colonizing phase lacked the navigation technologies that would allow them to conduct the longer, against the wind crossings required to reach the islands further east [34]. This would eventually be resolved by more efficient watercraft technologies (e.g. sail design, larger double hulls) that allowed them to harness contrary winds and withstand the rigors of traveling longer distances. Given what was seen historically in terms of Polynesian seafaring capabilities (e.g. double-hulled canoe) and the relatively rapid movement into East Polynesia observed archeologically, it would appear likely that enhanced navigational skill and knowledge of episodic wind anomalies were all pivotal to the successful colonization of what is arguably the most expansive and rapid human diaspora on Earth [34].

Montenegro et al. [35] subsequently noted that analyses of climate data, including El Niño Southern Oscillation events, coupled with seafaring simulations, were critical for understanding the movement across the Pacific. Sailing models by Fitzpatrick and Callaghan [36] suggest several different departure points from Polynesia that would have made a successful landfall on South America. These computer simulations also suggest that return voyages from South America were unlikely to be successful unless the departure point was further north on the coast of Ecuador. The hypothesized travel routes by Fitzpatrick and Callaghan [36] intersect the proposed high seas protected area.

Other scholars have inquired which islands in the far-eastern Pacific would Polynesian sailors have encountered if they ventured east of Rapa Nui? And if pre-Columbian South American explorers traveled west into the Pacific, would they have managed to reach the same islands? [37]. For the purposes of this study, this includes both the Juan Fernández Archipelago and the Desventuradas Islands, where no pre-contact archeological resources have been recorded to date. A combination of multi-proxy data from both archeological and paleoecological sources and a reassessment of the nature of the islands themselves is needed.

The islands of the far-eastern Pacific have long been considered pristine. As such, they have represented a unique opportunity to study natural systems in the absence of human interference. However, the islands in this region are also extremely sensitive to anthropogenic impact due to their small size, isolation, and low biodiversity relative to continental landmasses, which make them vulnerable to biological invasions. By applying paleoecological and archeological analysis at fine spatial and temporal scales, the timing and magnitude of human impact can be assessed [37]. The observation by Flett and Haberle [37] reminds us that regardless of when it occurred, the human presence is reflected in the nature of resources found throughout the region.

It is important to note that the description of the Polynesian dispersal as "exploration" and "colonization" is a western construct. Some scholars argue that the Polynesian social identity can be described as a phenomenological intersection of materiality, cosmology and practice, suggesting that the water of the Pacific Ocean is both a medium and metaphor of transformation that is grounded in phenomenology [38]. Richards suggested that Polynesian voyaging is not entirely about exploration and colonization; it is about people engaging with materials and substances, as well as the transformation of things and social identity that incurred during those encounters [38].

Scholars need to be cognizant that much of the dialog to date has been bounded by non-indigenous, western-oriented approaches which likely had no relevance for the people who conducted these voyages thousands of years ago, nor many of their descendants. Voyaging as a characteristic of Polynesian life forms a strong component in the construction of social identities. For instance, many of the rich traditions defining Maori social groups are founded on the voyages that brought them to New Zealand and the canoes that carried them. It is these accounts, including the genealogies that trace descents back to the named canoes, which allow people to feel a sense of belonging to place [38]. Tied to this is the recognition of the ocean as a living thing, an entity as well as a place with great cultural significance with transformative powers, and that voyaging had profound societal meaning [38].

The western boundary of the proposed high seas protected area comes close to Motu Motiro Hiva (Salas y Gómez Island), which is an essential part and sacred area in Rapanui culture [39]. According to Rapanui oral history, a tidal wave disturbed Ahu Tongariki, the largest ahu (stone platform) on Rapa Nui, extracting from among the rocks the skull of the creator god Make-Make (Fig. 4). The ocean carried Make--Make's skull to Motu Motiro Hiva, where he discovered large quantities of seabirds. Make-Make brought these seabirds to nest on the islets of Motu Iti, Motu Nui, and Motu Kao-Kao, just off the southern coast of

Fig. 4. Petroglyphs depicting the tuna,"kahi" in Rapanui, the fertility symbol "komari" and the creator god Make-Make taken at the Papa Vaka archeological site on Rapa Nui. Photo credit: Elena Kouneski Rapu.

Rapa Nui. Up until the 1860s, the Rapa Nui village of Orongo and the islets of Motu Nui and Motu Iti (Fig. 5) became the focal point of the Tangata Manu celebration where the tribes would gather to commemorate the arrival of manutara (sooty tern) and compete for political control over Rapa Nui.

Motu Motiro Hiva is the present day Rapanui name for Salas y Gómez Island. According to Jordi Fuentes' Spanish-Rapa Nui language dictionary [40], Motu Motiro Hiva is an incorrect name for the island and the proper name should be "Motu Motere Hiva". "Motu Motere Hiva" would translate as "island used for traveling to Hiva". "Hiva" has two meanings: it can refer to the ancestral homeland of Rapanui in Eastern Polynesia, or it can be a general term to refer to a "faraway land". "Hiva" is used in the present day to refer to the South American Continent as this is indeed a "faraway land". It is unclear when the names "Motu Motiro Hiva" or "Motu Motere Hiva" were first used and whether they represent a prehistorical knowledge of Salas y Gómez Island.

Rapa Nui was settled by Polynesians later than other areas, with a suggested date of 800 BP based on more recent radiocarbon dating [25,41]. As noted previously, many scholars have noted the close connections between Rapa Nui and South America with evidence of contact, understanding that the record has elements of complexity introduced by later European arrivals into the region [42]. More recent research supports the later date and suggests that changing wind patterns associated with the Medieval Climate Anomaly of c. A.D. 800–1300, as initially proposed by Finney [43], provided the necessary conditions for off-wind sailing to Rapa Nui and their subsequent late settlement by Polynesians [44]. Reconstructing potential voyaging routes in the extratropical southwest Pacific post A.D. 800, scholars noted that a favorable route from the west coast of Chile into the Pacific was open from A.D. 910–950, 1140–1170, and A.D. 1230–1250 [44].

A more recent study on the human settlement of Rapa Nui by Rull [45] assesses various hypotheses. This includes the question of whether the island was reached first by Polynesians or indigenous sailors from the mainland, or if there was a back-and-forth connection between Rapa Nui and the mainland prior to the arrival of Europeans. As early as 1988, Robert Langdon proposed a theory that involved contact with Spaniards who had been shipwrecked, but not at Rapa Nui, in the sixteenth century:

"…the original Easter Island settlement fifteen hundred years ago was by American Indians from Ecuador, and that their descendants reached some other parts of eastern Polynesia and intermarried with earlier immigrants from western Polynesia. He believes that a second South American migration, from the Tiahuanaco culture, arrived at Easter Island about AD 1100 and built the stone statues for which the island is famous. Langdon considers that a later immigration in the 1500s from Ra'ivavae (now part of French Polynesia) involved Polynesians who were in part descended from shipwrecked Spaniards" ([42]: 117).

Fig. 5. The ceremonial village of Orongo on the island of Rapa Nui with petroglyphs of the bird men, known as "tangata manu", in the foreground and the islets of Motu Iti, Motu Nui, and Motu Kao-Kao in the background. Photo credit: Elena Kouneski Rapu.

Langdon further believed that the new arrivals sparked conflict on Rapa Nui between the immigrants and the established people that resulted in the great war of the late 1600s, in which those identifying with South American culture were defeated, leaving an ancient material culture from South America, a predominantly Polynesian language (but including some American Indian elements), a Polynesian culture, and a people who are genetically of American Indian, Polynesian, and Spanish descent [42,46]. It is important to note that Langdon's theories have been challenged by archeologists and anthropologists [47-49].

Jean Dausset, French immunologist who co-discovered the major histocompatibility complex and won the Nobel Prize in Medicine in 1980, identified the presence of Basque genes within some reputedly pure-blooded Rapanui. Further studies by Erik Thorsby on mitochondrial DNA and the Y chromosome indicates that the ancestors of the Rapanui were indeed Polynesians. Thorsby's investigations also revealed that some individuals carried HLA alleles previously only found in Amerindians. Modeling suggests that the introduction of these Amerindian alleles occurred before the Peruvian slave-raids in Rapa Nui and possibly in prehistoric times. The introduction of Basque genes and Amerindian genes could have been separate events [50].

Debate continues, as summarized by Rull [45], whose analysis found that there is no conclusive evidence to support or dispute the various hypotheses. While all possibilities remain open, including the classical view that Rapa Nui was settled just once by Polynesians, the island could also have been first discovered by Native Americans followed by a long period of occasional occupancy (either by Native Americans or Polynesians, or both) until the full Polynesian settlement [45]. The absence of archeological evidence prior to this settlement could be due to its paucity, owing to occasional occupancy, or to the ensuing full Polynesian occupation of the island [45].

DNA analyses of genome-wide variation in 807 individuals from 17 islands and 15 Pacific coast Native American groups suggest that a single contact event occurred before the settlement of Rapa Nui between Polynesian individuals and a native American group most closely related to the indigenous inhabitants of present-day Colombia [51]. More work is needed, but the DNA study suggests a more complex model of human settlement in the southeastern Pacific. This may require reassessments of the dating and patterns of human settlement on Rapa Nui, and raises the question of direct connection between Rapa Nui and South America prior to European contact [52].

Osteology provides additional evidence for the contact between Polynesia and South America. Osteologists recognize several morphological characteristics that occur with high frequency in Polynesian human skeletons. Among these characteristics are the pentagonal skull, the rocker jaw, and the oval shape in the *fovea capitis*. Human skeletons recovered at five sites in southern continental Chile have these Polynesian morphological markers. Mocha Island skeletons were identified as being Polynesian back in 1903 [53]. The Chilean archeological sites of La Capilla de Tunquén, Camino Internacional en Concón, Las Brisas de Santo Domingo, and Puyai 8 de Papudo have also yielded Polynesian skeletons [54].

Prehistoric contact between Polynesia and South America is further supported by osteological discoveries on Rapa Nui [55]. While it is clear that prehistoric Rapanui represent an East Polynesian population, a small genetic contribution by Amerindian populations is evidenced by the presence of the Inca bone, parabolic palate form, and "angled" zygomaticomaxillary suture form in skeletons recovered along the northeastern coast of Rapa Nui. The frequencies of these traits suggest that some Rapanui skeletons are intermediate between Peruvians and Polynesians on a discrete skeletal trait [55]. The incidence of these features is not high enough to indicate that Amerindians comprised the initial wave of human settlement on Rapa Nui nor are they high enough

to indicate that an Amerindian population arrived on Rapa Nui and mixed with existing Polynesians. The data suggests, however, that some Polynesians acquired an Amerindian genetic contribution while presumably living in South America, after which they then made the return journey into Polynesia, representing a subsequent human settlement of Rapa Nui [55].

Another important source of historic information comes from Rapanui traditional fishing practices [56]. The people of Rapa Nui have for a long time recognized numerous types of fishing grounds that are identified by the type of ocean resource, type of technique required to exploit the resource, and the season during which the resource is easiest to obtain [56]. Some examples of fishing sites along the coastline include puhi, pū, rua, tavai, and hanga. Away from the coastline in the deeper ocean, Rapanui recognize toka fishing sites, and further out to sea in even deeper waters are hakanononga fishing sites. Rapanui fishers identify these hakanononga sites by the large congregation of seabirds which indicate the presence of fish. Today it is understood that these hakanononga sites occur above offshore seamounts and that the abundance of fish is associated with the local productivity generated by upwelling [56].

Prominent geological and archeological formations on land are used by fishers to triangulate their location and navigate to the hakanononga. Two main types of navigation pillars are employed when identifying hakanononga: pou and atua tapa. Pou are larger pillars and indicate the location of the hakanononga. Hills, rocky outcrops, and moai statues on Rapa Nui have served as pou. Atua tapa markers occur on either side of pou markers and are used to gauge the distance between the shore and the hakanononga. Atua tapa can be trees, outcrops, tupa, or small hills. Hakanononga fishing sites are well established in Rapanui culture, demonstrating their deep connection to offshore areas.

Traditional Rapanui fishing practices at hakanononga sites includes using large rocks as anchors and smaller rocks for sinking the bait [56,57]. This method involves first tying a large rock with a slip knot to a line. Next, bait is chewed up and tied around several hand-size rocks that are also attached to the line with a slip knot and a fishing hook. The bait rocks are lowered and released close to the seafloor, so that fish in the area see the chum and find the hook. This fishing method leads to numerous rocks and lines being deposited on the seafloor, which provides evidence on where fishing activity has occurred [56,58,57]. Basaltic rocks with fishing lines have been recorded during remotely operated vehicle surveys offshore Rapa Nui, Motu Motiro Hiva and the seamounts between them [57,58]. Furthermore, the degree of calcareous algal cover on these rocks provides information on the amount of time that has passed since they were dropped, thereby providing a method for relative dating [58].

What all of this suggests is that the region of the proposed high seas protected area was well known to pre-European contact navigators. For example, Motu Motiro Hiva was regularly visited to harvest sea bird eggs and is considered sacred to the indigenous people of Rapa Nui in modern times as well as in the past [59]. Rapanui oral traditions in recent times have resulted in Motu Motiro Hiva being considered Polynesia's easternmost tip [60]. Motu Motiro Hiva also meets the definition of Traditional Cultural Property. Traditional Cultural Properties meet specific criteria used for ceremonies or other cultural activities that may leave no material traces and may have ongoing use important to the maintenance of cultural practices [13,61]. We therefore suggest that the entire proposed high seas protected area incorporate an ethos of cooperation with the Polynesian community, and especially indigenous communities of Rapa Nui.

It is important to note that Polynesian perspectives on cultural resources may seem unfamiliar to non-Polynesian resource managers. The emphasis on structures, properties, and specific pre-defined locations in many Western cultures, is different from the emphasis on living practices and traditions in Polynesian cultures. Many Polynesians maintain active personal connections with the marine environment, placing more importance on intangible traditions, rather than tangible fixed properties [13]. It is also critically important to understand that from the indigenous perspective, living organisms and the sea itself are cultural resources. What follows in this study is therefore an assessment of known historical contexts and potential maritime heritage resources.

3. European and Russian exploration, charting and place names

The initial Spanish incursion into the Pacific by the ships of Ferdinand Magellan traversed the waters of the proposed high seas protected area in 1520. After leaving the Strait of Magellan, these ships followed the Chilean coastline before striking west and heading across the Pacific. Early Spanish navigators believed that the Islas Desventuradas (islands of misfortune) were reportedly sighted and named then, citing Pigafetta's account of the voyage: "We saw no land except two desert islands, where we found nothing but birds and trees, for which we named them the Ysolle Infortunate… We found no anchorage, [but] near them saw many sharks" ([62]: 85). Magellan's ships sailed past all of the islands and around the proposed high seas protected area. One early historian and translator of the account of the voyage, however, believed the unfortunate islands were in the Tuamotu group, as did other historians [62,63].

The first known sighting of the Desventuradas Islands was by pilot Juan Fernández, who passed them in 1563 (or 1574, accounts vary) after striking out from the coast to avoid the prevalent Humboldt Current while sailing from Callao to Valparaíso [64]. Spanish explorer Pedro Sarmiento de Gamboa, sailing south to the Strait of Magellan in 1579, noted that he passed San Félix and San Ambrosio, the two main islands in the Desventuradas, noting they were small, uninhabited and without water, but frequented by birds, seals, and fish [63]. Discussions amongst geographers over which name was originally applied to San Ambrosio noted the original name conveyed by Spanish explorers was San Nabor [65]. A Spanish naval frigate, San Pablo, visited the islands in 1789, and English explorer James Colnett landed in 1793. French explorers Jules Dumont D'Urville in the French naval corvettes Astrolabe and Zélée arrived in June 1838, and Abel Aubert Du Petit Thouars in the frigate Venus visited in 1839, as did British and Chilean naval officers in 1841, 1853 and 1874 [66].

Rapa Nui was "discovered" by Dutch navigator Jacob Roggeveen, sailing west with a fleet of three vessels, Arend, Thienhoven, and De Afrikaansche Galey from the coast of Chile to seek Terra Australis and establish a trade route into the spice islands for the Dutch West India Company in 1721–1722. After arriving in the Pacific, Roggeveen stopped on Juan Fernández, leaving there on March 17, 1722. He encountered Rapa Nui on Easter Sunday, April 5, 1722, which his log described as a low flattish island lying away to starboard and named the island Paásch Eyland (Easter Island) after the holy day [67,68]. Anchoring off the island and landing with an armed force of 134 men, Roggeveen's visit followed what would be an all too common practice marred with violence when the Dutch killed at least ten islanders. After departing the island, Roggeveen's fleet continued west, but did not encounter any other land. A Spanish naval expedition organized by Manuel de Amat, with a squadron comprising the ship San Lorenzo and the frigate Santa Rosalía, commanded by Felipe González and Antonio Domonte, respectively followed in 1770; the expedition landed on Easter Island on November 15 to take possession of it in the name of his Majesty' and named it San Carlos ([68]; Fig. 6). Brief visits were made by British explorer James Cook in 1774 and French explorer Jean--François de Galaup, Compte de La Pérouse in 1786.

The Island of Salas y Gómez was "discovered" by Spanish navigators José Salas Valdés on August 23, 1793, and again by José Manuel Gómez, who sailed past it in 1805 in the privateer frigate Victor [69]. The next visit came in 1817, when the Russian brig Rurik, under the command of Otto von Kotzebue, stopped at Salas y Gómez Island. Among the crew was German naturalist Adalbert von Chamisso, who described the island as a bare rock without vegetation but with countless swarms of seabirds [70]. The most significant aspect of the brief stop was the inspiration it

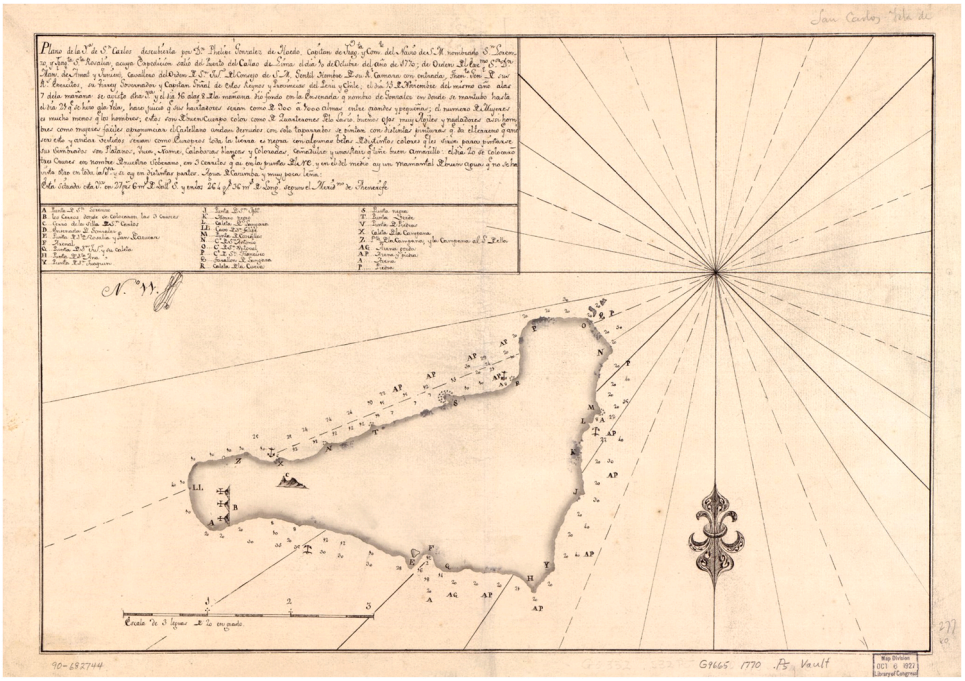

Fig. 6. A chart of the island of Rapa Nui from 1770, as "discovered" by Don Felipe Gonzalez de Haedo who named it Isla de San Carlos. Obtained from U.S. Library of Congress.

gave to von Chamisso, who remarked that "fragments of a wrecked vessel are said to have been discovered at Salas y Gómez; we looked for them in vain. It makes one shudder to think of the possibility that a human being may have been cast upon the island, for the seabirds' eggs would probably have sufficed but too well to prolong his forlorn existence between sky and ocean on that bare sunburnt rock" ([70]: 16).

The visit inspired von Chamisso to publish the major poem "Salas y Gómez" in 1829, in which upon landing, the crew finds three stone tablets inscribed with text in Spanish, five rows of crosses, and a "naked old man stretched on the rock…his long silvery hair and beard nearly covering his emaciated form who opened his eyes and died without speaking" ([70]: 17). The tablets told the story of the hapless man, sole survivor of a shipwreck on the island, who lived out a solitary, tortured existence. "Salas y Gómez" is considered one of the great poetic works of German Romanticism, and powerfully reflects how one naturalist, exploring the waters of the proposed high seas protected area, was inspired by the thought of shipwreck to create a literary work that reflects his impressions of the maritime landscape.

Another notable visit was by HMS Blossom, under the command of Captain William Frederick Beechey. After leaving Valparaíso on October 29, 1825, Beechey determined the position of Salas y Gómez and when reaching Easter Island on November 16 wrote:

"We shortly closed with this isolated spot, and found this extent much less than has been stated. It is, indeed, scarcely more than a heap of rugged stones, which the elements appear to have thrown together, and in a gale of wind would not be distinguished among the spray… a few logs of wood, or planks, which the imagination might convert into the remains of some miserable vessel whose timbers there had found a resting-place. Though several vessels have been missing in these seas. We have no intelligence of any having been wrecked here. Sala-y-Gómez, when he discovered the island, imagined he found the frame of a vessel upon it, and in all probability the wood which we saw was the same; but whether it was so or not, our curiosity and desire to land were fully awakened, though we were disappointed by the high breakers which rolled over every part of the shore" ([71]: 36–37).

While many of these voyages were transits and brief stops, the result of the various navigations was an increased awareness of the waters within the proposed protected area. The culmination of 19th century surveys were the increased efforts of Chilean naval officers and crews who surveyed the waters off the Desventuradas, as well as Salas y Gómez.

A voyage by the schooner Colo Colo under the command of Lieutenant Leoncio Señoret visited San Félix in 1841, where he discovered the remains of small stone structure that Señoret believed was the settlement of a sailor marooned on the island [18]. Subsequent voyages included visits by the bark Juana Sanchez in 1861, the steamer Antonio Varas and the Chilean corvette Chacabuco in 1868, the Chilean naval steamer Abtao in 1870, the French warship Vaudreuil in 1871, and the ship Atalante in 1873 [18]. In 1874, a detailed scientific and hydrographic expedition of San Félix and San Ambrosio was made aboard the schooner Covadonga under the command of Ramón Vidal Gormaz [18]. Vidal Gormaz' report summarized the history of known encounters with the islands, the geology, terrestrial flora and fauna, marine life, and charted the islands. In 1898 an expedition by the Chilean Navy on the cruiser Presidente Pinto under the command of J. Federico Chaigneau visited San Félix and San Ambrosio. The scientific expedition collected botanical and sediment samples and performed bathymetric surveys around the islands and between these and Juan Fernández [72].

4. Historical exploitation of marine resources

In addition to the innate scientific curiosity of explorers and the desire by them to name that which they discovered, a common theme of these voyages was that they determined that there was value to these places. Value was determined by commodities that could be exploited such as whales, fish, fur seals, or guano. Trade with China drove much of the quest, particularly as sandalwood, ginseng, tortoise shell, sea cucumbers, and seal skins sold well in China. The result was "Yankee mariners… combing the scattered islands of the South Pacific for other products attractive to the Chinese taste" ([73]: 45). This brought ships to Rapa Nui, many of them sealers and whalers seeking to provision, while others came to enslave. For example, in 1805 the American ship Nancy's captain kidnaped twenty-two men and women from Rapa Nui to work as laborers at a sealing camp established at Más Afuera (Alejandro Selkirk

Island). By the mid-19th century, one historical geographer noted that hundreds of whalers had called at Rapa Nui, with often similarly disastrous consequences [74] (Fig. 7).

5. Sealing

American whalers had ventured from nearshore whaling out into the Atlantic, to the South Atlantic, and then into Antarctic waters before venturing around Cape Horn and into the Pacific at the end of the 18th century. At the same time, American seal-hunting vessels also journeyed from the Falklands and Shetlands in the South Atlantic into Patagonian and then South and North Pacific waters. Taking advantage of waning Spanish authority, they hunted with impunity along the northwest coast of North America, as well as off the Chilean coast at the Juan Fernández and Desventuradas Islands. From 1790 to 1812, American sealing in the South Atlantic and South Pacific thrived. Seal skins were taken to Canton by the hundred thousand, which inevitably led to the depletion of seal populations. Herds which had been estimated to number millions completely disappeared as the sealers massacred their prey [75].

The ship Jefferson, commanded by Captain Josiah Roberts, sailed from Boston in late November 1791, anchored off Juan Fernández in May 1792, thence to Valparaíso, and then departed for San Ambrosio on June 26, where in seven weeks they obtained almost 13,000 seal skins, which their first officer claimed to be superior to any that ever was brought to the China Market [76]. This sparked a rush to the waters not only off Juan Fernández, but also off the Desventuradas that lasted for the next few decades. This may have involved temporary settlement, either in camps for a season, but sometimes the sealing gangs were left for a year or more living in rude huts [75].

A reminiscent account is provided by Eben Townsend, supercargo of the sealer Neptune, sailing from Juan Fernández, landed at San Félix on June 20, 1798. “We landed, but found nothing worth our attention except the head of a barrel marked “I. Winship, Boston”… The birds were very plenty and no doubt lay many of eggs in the season” ([77]: 465). In February 1806, trader and explorer Amasa Delano visited San Félix. Delano noted that “it is the island most visited by those in pursuit of seal skins, and I would recommend it for fish and eggs; but as for fish, they can be caught at any one of the islands in great plenty” ([78]: 354).

In 1793, James Colnett sent in HMS Rattler, sloop-of-war, loaned by the Admiralty to the South Seas Fisheries for the purpose of discovering such parts for the South Whale Fishers sailed into the waters of the proposed high seas protected area [79]. His search for whales found none, as “all the way to the Latitude of Saint Felix and Saint Ambrose, and also running down the Longitude to those islands, we never saw a single spermaceti whale, except a flinched one, the day before we quitted sight of the main” ([79]: 33). Anchoring off the Desventuradas,

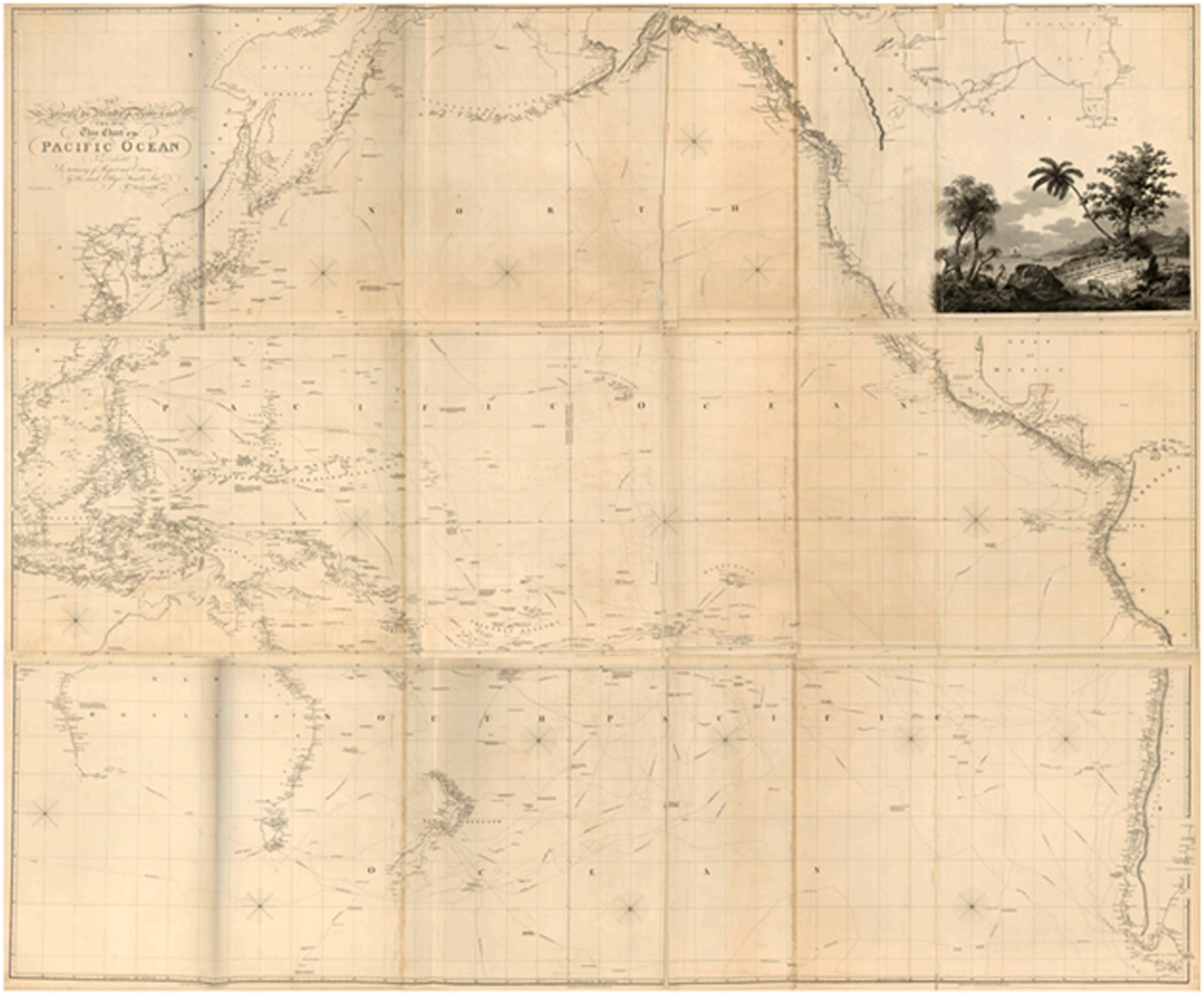

Fig. 7. Detail from the Chart of the Pacific Ocean developed by Aaron Arrowsmith in 1798, showing annotated track lines of European explorers in the area of the proposed high seas protected. In this fashion, early European explorers could both characterize, and claim possession and control of the lands and seas they encountered. Library of Congress.

Colnett sent an officer with a boat party to search off San Félix. "He returned with plenty of fish of the species of cod and bream, weighing from four to six pounds each; and informed me that he had taken soundings round the isle, and that the only bay was on the South side; but that he could not find any bottom except close to shore, which was at eighteen fathoms depth and rocky" ([79]: 33).

Landing on San Félix they found great numbers of bird nests containing added eggs. On the islands, were the remains of seals and a quantity of decayed seal-skins, supposed to have been left there by Mr. Ellis (who visited this place in 1791). "Of the danger, of getting from this island, we had a very melancholy experience; as our people were upset several times, before they got from the surf, and one of our best seamen, was unfortunately killed, having his back broken, by the jolly-boat falling, upon him" ([79]: 35). Colnett's ultimate assessment was that the Easternmost isle, appearing to be inaccessible, can never be of much use, except as a place for catching fish or taking seals "but the other island, might be made to answer, as a place of rendezvous in war or peace. It contains a space, where tents might be pitched, and the sick accommodated, if the want of wood, water and vegetables, could by any means, be surmounted. As to the first, an hull or two, of a prize, would afford a sufficient supply; as for the second, a still, might be provided, to distill salt-water; and a small quantity of soil, would be sufficient, to raised sallad [sic] herbs" [79].

The islands were soon abandoned as seal populations were essentially wiped out, leaving the population at Juan Fernández Archipelago as the major source of skins for decades. By 1815, those islands were also rapidly depleting. Captain Edmund Fanning, in command of the ship Volunteer, stopped at Más Afuera, leaving after searching for and taking some fur seal skins [80].

In May 1853, a landing party from HMS Portland stopped at San Ambrosio to see if there was guano; "there was a tarn upon the top, but no grass nor anything living but a kind of blowfly which irritated us by their numbers – there were hardly any seabirds – we found that some sealers had visited the cove which was full of fish," according to surgeon John Linton Palmer, who joined the party and painted a scene of the landing ([81]: 38; Fig. 8).

6. Whaling

Whaling, first by British and then by American ships, spread from the Southeastern Pacific throughout the rest of the Pacific starting in 1788 and ultimately into the western Arctic by the mid-19th century (Figs. 9 and 10). Off the coasts of Chile and Peru, as well as almost throughout the Pacific Ocean, sperm whales were present in great abundance. British whaling in the region declined after the War of 1812, and the destruction of British whalers by the USS Essex, the first American warship to enter the eastern Pacific in 1813. Essex's cruise, which the commander Captain David Porter, styled a "run down the coast of Chili and Peru," to the Galapagos, liberated American whalers captured by Peruvian allies of Britain and captured twelve British whalers ([82]: 108). Based on intelligence Porter gathered from American whalers, he estimated 24 American ships and about 20 British ships, laden with whale oil worth over four million off the coast of Chile and Peru [82]. Porter proceeded to break up the British whale fisheries off the coast of Chile and Peru [83]. The results of Porter's cruise were a blow from which British whaling never recovered, leaving them unable to challenge American primacy in whale fishing [73,84]. The result was a rapid spread of an American whaling fleet that had first entered the Pacific in 1791, with seven ships into hundreds of ships, most of them after 1835 in the North Pacific [85,86].

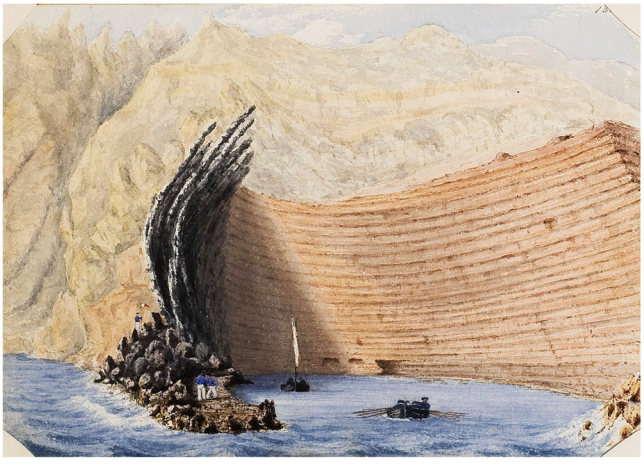

Fig. 8. Image of a watercolor painting of San Ambrosio Island by Royal Navy surgeon John Linton Parker. The image depicts the traditional European method of exploration, mapping, landing, taking samples and putting it all down on paper. This image is from Linton's 1852 to 1853 manuscript, Islands of the Pacific Album and available through a Creative Commons CC-BY-NC-ND license from Elsevier.

The two largest whaling grounds that bordered the proposed protected area were the Coast of Chile Ground and the Callao Ground ([87]; Fig. 9). Another, northwest of Más Afuera between 17–20° south latitude and 84–90° west longitude was known as the Archer Ground where ships captured large whales [88]. The Archer Ground was, however, not always profitable to hunt. The journal of William A. Abbe of the ship Atkins Adams, encompassing the last months of 1858 through the end of 1859, had the ship sailing north from Más Afuera to San Félix, and then running to the Archer Ground. Abbe noted that the crew hunted for whales there without even a blow or a breach from a sperm whale before turning back toward the Peruvian coast.

"However, indeed there appear to be more whalers than whales on the Archer Ground, and by going to leeward we may have the first chance at the whales on the off-shore ground. The Archer Ground was remarkably good last season, but so many ships are there now and so many bound there, that the chances for success will be very slim" (Abbe 1858–1859, entry for June 20, [89]). Whaler William H. Macy, writing of a whaling voyage on the ship Gorgon, noted that their right whale season had proved a failure, with the Archer ground yielding "little besides disappointment" ([90]: 44).

Analysis of whale sightings and successful hunts as charted by Maury in the 1850s and subsequently by Charles Haskins Townsend based on whaler logbooks shows activity in the area from 1780 through 1874, declining in intensity after the mid-19th century [91]. A more recent review of archeological data and whaler's logbooks tabulated from 1761 to 1920 documents the historical presence of five species of marine mammals that were exploited directly off Rapa Nui as well as Salas y Gómez [92]. Collectively, this information highlights that whaling and sealing had a profound impact on marine mammals throughout the waters of the proposed protected area.

By 1887, it was noted that "throughout the South Pacific there were formerly many other extensive and profitable cruising-grounds; but they are now nearly all abandoned, not entirely because of the scarcity of whales, but because of the low price of sperm-oil and the great expense attendant upon the long voyages to distant seas" ([88]: 322). Only a portion of the Callao Ground lies inside the boundaries of the proposed protected area, and so the incidents of whale hunting were likely less common than in other areas. Whaling voyages through the proposed protected area were transitory, especially as whalers came from other grounds to ports where they could resupply, undergo repairs, and rest. The most visited supply stations for whalers were San Carlos [Island of Chiloé], Talcahuano, San Ambrosio and Valparaíso in Chile, and Paita, Callao and Tumbes on the coast of Peru [93]. After the effective end of sea-going whaling, shore whaling using catcher boats persisted in Chile through the 20th century in waters up to 200 miles from the coast from stations at Iquique, Quintay and near Talcahuano [94].

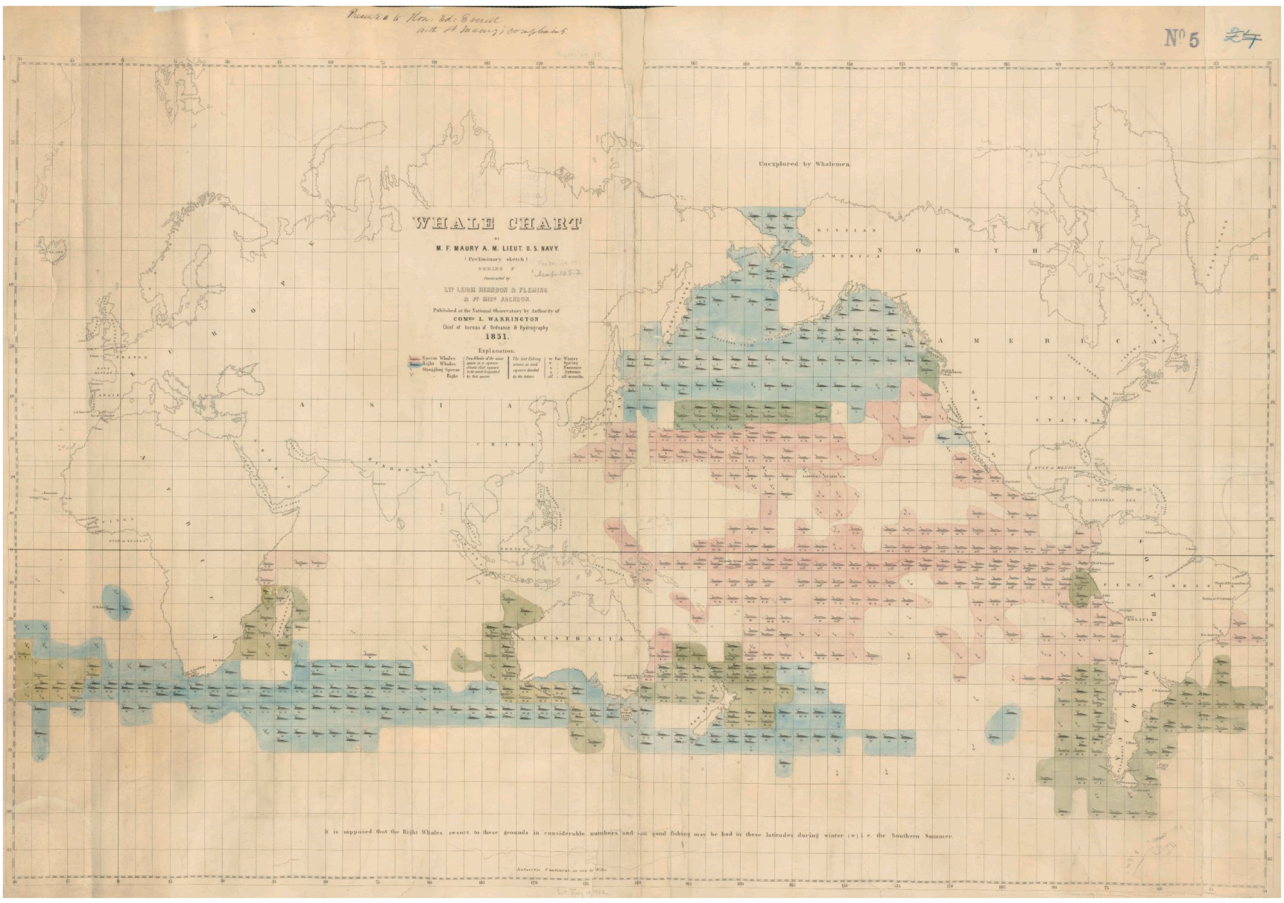

Fig. 9. Whale chart produced by Matthew Fontaine Maury in 1851. Note that waters around the Salas y Gómez and Nazca ridges are shown to include important populations of sperm whales. Obtained with permission from Norman B. Leventhal Map and Education Center.

Fig. 10. A rare photograph of the whaler Charles W. Morgan at sea. San Francisco Maritime National Historical Park, U.S. National Park Service (Public Domain).

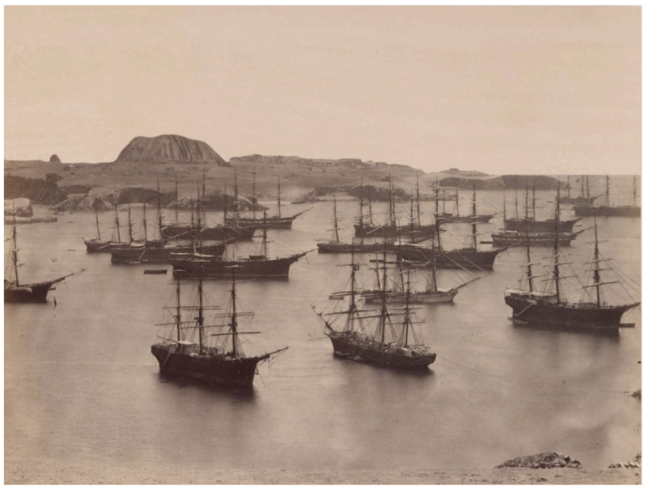

Fig. 11. A mid-nineteenth century photograph of wooden ships anchored off the Guano Islands on the Peruvian coast. This image offers a graphic sense of the scale of this extractive trade, and also of the types of vessels engaged in maritime trade and traffic through the waters of the proposed protected area from the mid-to late part of the century. U.S. Library of Congress.

7. Fishing

Pelagic fishing has taken place off the near-coastal areas of mainland Chile and Peru for thousands of years. Chilean and Peruvian offshore fishing is more recent, starting in the early 20th century and expanding after World War II (Fig. 11). In 1968, one observer noted that the "rise of the Peruvian fish industry has been one of the most striking economic developments in post-World War II Latin America" ([95]: 393). The near-shore fishing industry was small, especially the anchovy industry, as the principal diet of sea birds who deposited guano, and "the exploitation of guano became a hindrance to the development of the fish industry since the government feared that extensive fishing would lead

to extermination of the guano-producing birds" ([95]: 394). However, the decline of the guano industry, and a strong American-driven market for fish during World War II, coinciding with the decline of fish stocks off California, led to a shift by the Peruvian government to establish a robust fishing industry with American investment [95].

The same was true in Chile, and continued in the decades following the war. In Chile fishery landings rose steadily from 47,000 tons in 1945 to reach an average level of 210,000 tons between 1955 and 1958 [94]. The shellfish were taken off the Juan Fernández Archipelago by lobster fishermen who also fished off the Desventuradas Islands. Trawlers, purse seiners, and other craft harvested anchovy, hake, sardine, snake mackerel, jack mackerel cusk eel, tuna, bonito, and shellfish which was processed by freezing, canning and reduction. In 1963, Chilean plants processed 107 thousand metric tons of fish meal [94]. By 1960, Peru was the world's largest fish meal producer [95].

The advent of the large-scale Peruvian fishing industry in the mid-20th century created a robust boatbuilding industry to supply the needed vessels; by 1963 Peru became the world's greatest producer of fishing boats [95]. Rapidly evolving from wooden to steel-hulled craft, Peruvian fishing boats were exported to neighboring Chile and beyond [95]. Other subsidiary businesses in support of the fishery industry were also created and expanded. By 1968, an estimated half million Peruvians were directly or indirectly employed in the fish industry [95].

Chile's fishing fleet in 1962 was largely composed of smaller craft, rowed or sailed, or smaller motorboats, with only 261 larger motorized craft over five tons in size. Trawlers deployed otter trawls; there were 46 trawlers fishing in Chilean waters in 1962, as well as 128 purse seiners, and 87 fish carriers [94]. One consequence of the rapidly growing market as Peru and Chile exploited their fisheries was the extension of Chilean, Peruvian and Ecuadorian sovereignty to 200 miles offshore "to eliminate the competition of more modern foreign fishing vessels (including Japanese and British as well as American)…in coastal waters" in 1952 ([95]: 396; [96]: 388). The sovereignty of Chile, for example, as with other nation states with islands, meant that the 200-mile limit also applied to offshore of Salas y Gómez and Rapa Nui in 1985 [97]. Without a more prolonged discussion beyond the scope of this paper, the 200-mile territorial limit as a "solution" also led to dispute and a lack of recognition by some competitors who continued and likely continue to fish within these zones (See for example [96,98-100]).

Concern over declining fish stocks was evident by the mid-1960s, especially in regard to the decline in anchovies not attributable to El Niño events. Instead, the decline was caused by too much anchovy fishing that led to calls for moratoriums and more regulation of the industry in Peru at a time when the fishing industry was still a young enterprise [95]. A more recent assessment noted that the combined take by industrial pelagic fishing fleets and Juan Fernández-based fishers in the area bounded by the Desventuradas and the Juan Fernández Archipelago was an estimated 640 tons per year in the 1950s, a peak of 1.2 million tons in 1995, and about 300,000 tons per year in the late 2000s [101].

8. Contraband

While information documenting contraband is relatively limited in comparison to whaling, sealing and fishing, contraband was certainly present and represented a relevant political issue in the region. As early as 1788 an armed Spanish merchant vessel, the San Pablo, was dispatched from Callao by Vice-Roy De Croix to Juan Fernández, to search for Bostonian vessels which had previously called at the island. The San Pablo proceeded to examine San Félix and San Ambrosio islands for possible contraband evidence [102].

9. Maritime commerce, traffic and naval activities

The waters that stretch from South America to Rapa Nui gradually became part of trade routes as voyages of exploration and colonial ambition gave way to the increased integration of the Pacific into the expanding global economy. Large maritime events also introduced maritime traffic. The general trend of the Salas y Gómez and Nazca ridges leads to the northern coast of Chile and the southern coast of Peru. This was a region well known to sailors, as it was the focus of thousands of voyages in the mid to late nineteenth and early twentieth centuries, primarily in the guano, nitrate, coal and copper trades. Other trades with the North Pacific included passenger and freight runs to major ports by ships that rounded Cape Horn, as well as ships carrying commodities from northern ports south, especially lumber from the Pacific Northwest coast of North America.

10. California gold rush

While maritime traffic other than whalers and sealers passed through the waters of the proposed protected area in the mid 19th century, it was the California Gold Rush that brought hundreds of sailing vessels into the proposed protected area after they made their way around Cape Horn, with a number stopping at Valparaíso, Callao, Juan Fernández, or the Galapagos as they proceeded north to San Francisco. Between April 1849 and January 1850, 805 vessels had arrived at San Francisco to discharge 39,888 persons with their baggage and cargo [103]. While a number of vessels remained in San Francisco, others returned to sea to bring needed supplies and food to the rapidly expanding population. Between September and October 1849, 25 vessels sailed from San Francisco to Callao and Valparaíso [103]. Valparaíso in particular became a major trading partner with San Francisco. Prior to the Gold Rush, Valparaíso had become the largest port of exchange on the Pacific Rim, an entrepôt that surpassed its rival, Callao, by the mid-19th century thanks to regular maritime trade connections with New Zealand, South America, Central America, and China, as well as being the first major stopping point for ships coming around Cape Horn [104].

The sea route between San Francisco, Callao and Valparaíso remained active after the gold rush. One whaler passing San Félix sighted and "spoke" the clipper ship Carrier Dove, bound into Callao from San Francisco (Abbe 1858 to 1859, entries for May 16 and 17, [89]). The route remained active into the next century as the great age of sail gave way to steam and then motor vessels. Another common stopping point, Juan Fernández, brought curious gold seekers drawn to its reputation as Robinson Crusoe's island, as well as calling for water, fruit and firewood, all bringing "for the first and last time in its history a period of brisk activity" as some fifty vessels visited between 1849 and 1850 before striking north for San Francisco ([105]: 150).

11. Slavery

In addition to goods shipped between ports, at times the "commodities" were people. Rapa Nui, as the closest Polynesian island to Peru, was regarded as a labor reservoir by Peruvian entrepreneurs. From 1859 to 1862, approximately one thousand islanders were forced into leaving their island for the plantations, guano mines, and cities of coastal Peru [106]. What followed was an actual slave trade as Peruvian slave traders, with a fleet of 33 ships, kidnaped 3125 Pacific islanders to work in Peru between 1862 and 1863 [107,108]. Through this trade leprosy was brought to Rapa Nui.

The short-lived Peruvian slave trade, ultimately stopped by the Peruvian government in response to international criticism in 1863, had a profound impact on island communities. Historians estimate that approximately 2000 people died in transit to Peru or once there. The 33 vessels engaged in the trade traversed the waters of the proposed protected area. Beginning in the 1840's, "blackbirders" (the term of the time for the ships, owners and crews of ships engaged in island slave trading) of various nations, including the United States, passed through the proposed protected area through the next decades. That also included the mass kidnaping of men from south China who were "recruited" with false promises and sent to labor in Cuban sugar

plantations or Peruvian cotton fields and guano mines.

Known as the trata amarilla (yellow trade), as well as the "coolie trade," from 1847 to 1874, some quarter million Chinese were shipped to Peru (landing primarily at Callao) and Cuba [109]. Mortality rates were high on the coolie ship voyages to Peru, and mutinies in which the imprisoned coolies fought to take control of the ships became common. By 1874, when the trade ended, "mutinies had become common, some of which ended dramatically in fires, shipwrecks, emergency dockings in foreign ports, always with high mortality rates that provoked enormous outrage around the world" ([109]: 176). Mortality rates were high in Peru in the guano mines on the Chincha Islands, which lay fourteen miles off the southern coast of Peru and ninety miles south of Callao [110].

12. Guano and nitrates

Guano, deposited for centuries in thick layers, is bird excrement rich in nitrogen and phosphate, preserved by dry weather and the cool ocean currents of the Peruvian coast. Guano was the world's most highly-prized fertilizer and had its boom from the 1840s through the late 1870s, when it ran out after millions of tons had been removed and sent to North America and Europe to address declining agricultural production [110,111]. The process of extraction was brutal, hand work in acrid, choking dust that burned eyes and lungs with ammonia fumes [112]. Harsh discipline, poor living conditions and a high demand to produce led to suicides, injury, disease and deaths, with an estimated 66% mortality rate [110,112]. Guano loaded into sacks was hauled across to a vast fleet; in May 1869, it was reported that 160 ships lay off the Chinchas waiting to load even as the mines were starting to run out [110,113].

The large amount of maritime traffic in and out of the Chinchas brought a large number of vessels into this part of the Pacific, especially as the prevailing current and winds hampered coasting, requiring ships to tack far out to sea. One mariner, George W. Peck, commenting on running from Callao to Pisco Bay, explained that "although the distance is so small, the passage to them from Callao is usually a long and wearisome one, the trade winds blowing nearly a-head off shore, and merging into, and losing themselves in calms and land and sea breezes, generally contrary in sight of the coast. No directions can be given for beating up this passage; sometimes vessels make good runs in short stretches, keeping in shore; others do well by running out into the trades, and making all their latitude in a single tack – and vice versa in both cases…our Captain judged it best to make a long leg by running well out, hoping thus to keep in the strong wind and avoid the calms and uncertain airs of the coast" ([114]: 153–154).

Another source of fertilizer, sodium nitrate (also known as saltpeter), replaced guano as the focus of an expansive maritime trade. Valued not only as fertilizer, but also as a food preservative and in the production of munitions, sodium nitrate mining and shipment assumed a major role in the economies of Peru and Chile as the guano trade declined in the 1860s and effectively ended in the 1870s [115].

The major concentration of sodium nitrate, known locally as caliche, was in the desert that defined the northern boundary of Chile and the southern boundary of Peru. In the region lying between 19° and 26° south latitude, sodium nitrate was found in an arid region known as the pampa, which runs north and south in a long narrow belt for almost five hundred miles between the Andes on the east and the Coast Range on the west, and from a few miles to over one hundred miles inland [116]. The nitrate trade began to assume major importance by the mid-to-late 1870s, expanding as ships regularly called at Iquique to load the bagged product. At the same time, large deposits in Bolivia and Chile, bordering those in Peru, a treaty between Bolivia and Peru to compete against Chile, and an aggressive desire on Chile's part for nitrate fields and hegemony upon the west coast led to conflict. The Guerra del Pacífico of 1879–1884 brought naval blockades of the coast by Chilean warships, armed conflict, and the defeat of Peru and Bolivia, both whom were forced to cede their nitrate deposits to Chile; former Peruvian and Bolivian territories were also incorporated to Chile. By the mid-1880s a new administration and fresh considerations governed the nitrate trade [115].

After the War of the Pacific, the nitrate trade, now firmly in Chilean hands, boomed. New capital poured into the country and deposits rapidly developed. Mr. G. B. Chase of the United States, and Colonel J. T. North of England, were among the most active foreign operators, while the Chileans were very energetic in developing the region. The Germans also acquired large interests in the nitrate fields and were active operators, but the English companies were by far the most numerous. Though Americans were among the pioneers in the industry, their operations were small compared with those of the English, Germans, and Chileans [116].

Mined in the desert in various smaller towns, the nitrate was shipped by rail to the coast. There, a number of coastal ports stood by to load waiting ships on what became known as the "Nitrate Coast." The chief ports for the shipment of the nitrate of the province of Tarapacá were Iquique on the south and Pisagua on the north, the former being by far the more important and the real headquarters of the nitrate trade of this province. Smaller ports from which Tarapacá nitrate shipped were Junin and Caleta Buena. Farther south, the seaports of Tocopilla, Antofagasta, and Taltal were important shipping-points for the nitrates of the province of Antofagasta [116].

Chile's fortunes boomed; from 1880 to 1919 Chilean nitrate retained a virtual monopoly in the world market and this period is therefore referred to as Chile's Nitrate Age [117]. In the 1890s, up to a hundred vessels were at the various nitrate ports at a single time loading. Some vessels came by way of Cape Horn. Others came to the coast from Australia, participating in the coal trade, shipping Newcastle-mined coal to Chile and then loading nitrate up to the advent of World War I in "one of the last strongholds of British sail" as the larger sailing ships were economically viable in the nitrate trade ([118]: 142). In 1912 alone, 106 sailing ships departed Newcastle for Chilean ports [118].

The crews would unload Australian coal and load Chilean nitrate in 200 pound bags. While many of the ships that loaded were British-flagged, the wooden and later iron-hulled ships of the French-owned fleet of A.D. Bordes and the "P" Line of iron and steel clippers of Germany also played a significant role in the nitrate trade ([118]; Fig. 12). Nitrate was a dangerous cargo as it made ships prone to fire and many ships burnt while taking on cargo [118]. The other risk was navigating between nitrate ports. Lubbock gives several examples of ships being pushed off course by the strong northerly current for hundreds of miles, with lengthy voyages as a result, while other ships went ashore [118]. Other ships went missing on voyages; for instance, the ships Garonne (1882), Valentin (1885), Bio-Bio (1888), Dunkerque (1891), Antonin (1892), Perseverance (1892) disappeared at sea [118]. A number of other ships were wrecked.

13. Copper

Another Chilean product that brought large numbers of ships onto the ocean highway toward Australia was copper. Britain's copper trade, centered in Swansea, expanded in the 1840–1860s in response to the development of copper mines in Chile financed by British, American and Chilean interests. While Chilean coal was also mined, Swansea began shipping its own coal to Chile, establishing a regular route that brought coal to Chile, discharged, loaded copper ore, and returned to Swansea. Returning to Swansea via Cape Horn was only one route; another saw ships crossing the Pacific to enter the Indian Ocean and thence reach Calcutta with copper cargoes. Australian archeologists have assessed two likely Chilean copper ingots found as isolated finds on a reef in Torres Strait.

Research showed that three vessels were stranded or lost in that area in the 19th century: the British East India Company ship Hercules in June 1822, which came free after jettisoning much of its cargo; the

Fig. 12. The end of the age of sail in the waters of the proposed high seas protected area may have resulted in shipwrecks as a number of these vessels, engaged in the coal and nitrate trades between South America, Australia and Europe, disappeared after leaving port. This is the four-masted steel bark Pyrenees, built in 1891 in Scotland and engaged in Pacific trade until 1916. It did not wreck in the area of the proposed high seas protected area, but it is an excellent representation of the types of vessels that likely did in this period, although they would have been lost out of sight of land and other vessels and simply reported as missing at sea. San Francisco Maritime National Historical Park, U.S. National Park Service (Public Domain).

barque Lady Kinneard, which struck and sank with 118 tons of copper in July 1861; and the ship Oxford in August 1871. The copper ingots likely came from Hercules [119]. While farther afield from the proposed protected area, this archeological example speaks to the possibility of copper trade ships that went missing after departing Chile, heading west and possibly foundering in deep water.

By 1862, Chilean coal mines at Lota and Coronel ceased production because of the regular connection to Britain [120]. That was not the case with Chilean copper, with a market position "based on an ability to raise increasing amounts of ore at a cost lower than all other producers from a seemingly inexhaustible supply of ore" at Coquimbo and Atacama ([121]: 724–725). One copper mine, the Panucillo Copper Company of Coquimbo, exported three-quarters of their annual output to Britain [120]. Copper ore was Chile's most dominant export from 1844 to 1879, surpassed only by nitrate after that time due to a shift of the global copper trade to Australia, which found major deposits and exploited them, offering new diversity in the global market [122]. In 1850, Chile was producing 28% of the world's copper. A decade later the production figures stood at 51% [121].

14. Coal

Key to the copper, nitrate and guano trades was the coal trade. Coal became increasingly valuable as the rise of steam-powered machinery during the industrial age demanded fuel. In the Pacific, the need for coal beyond cooking and blacksmithing began with the introduction of steamships in the 1840s, beginning in South and Central America with the Pacific Steam Navigation Company and then expanding north from Central into North America with the California Gold Rush and the rise of the Pacific Mail Steamship Company. The other need for coal came with steam machinery in smelters, mines, logging camps, and in factories. In Chile, a more or less stable demand came in the 1840 s with both steam navigation and the substantial increase in the smelting of copper bars after 1842 [123].

The rise of the Chilean copper industry, and with it railroads, was the primary reason for the development of coal mining, as well as British interest not only in copper for import but also in the export of British coal to Chile [123]. The Chilean coal industry remained robust, other than suffering an economic depression that hit the country in the mid to late 1870s, but was undercut by foreign competition that imported cheaper coal from Australia as the Pacific coal trade, which Chilean coal had previously completed in with exports to California, shifted to New South Wales in Australia in part in response to a shift in British maritime trade at the end of the age of sail.

During the last quarter of the nineteenth century, the Pacific coal trade from Newcastle, New South Wales expanded, "especially to West Coast North and South America" in the face of obstacles created by the long distances from Newcastle to those markets, difficulties with loading and labor in Newcastle, and a "growing reputation for selling coal that was liable to self-ignite or shift in the ship's hold" ([29]: 26). To maintain a competitive edge, the traders employed large sailing ships with both capacity and a cheaper per voyage using "the Pacific's prevailing winds and currents" and a "novel trading pattern for their vessels of a three-leg laden circumnavigation, with NSW as the intermediate cargo at low 'backhaul' freight rates" ([29]: 26). The real cost was in ships and lives, as the number of vessel losses increased, a factor falsely claimed as poor navigation, not the inherent dangers of the coal cargo itself [29].

15. Shipping

The majority of vessels engaged in the trade were the market response to dropping freight rates through the construction of large-capacity iron and steel sailing ships for bulk trade in the 1880–1890s. These "large, low coast, standard four-mast iron sailing ships" (Fig. 12) were "full bottomed and designed for carrying cargoes in bulk" with their iron construction increasing their size over wooden ships by 15% and reducing the risk of fire, and because they cost less to operate than a steamship, they were competitive in bulk markets ([29]: 27). The shift to steel for hulls in the 1890s reduced a ship's weight by two-thirds, yet doubled its carrying capacity, while other technological changes – wire rope instead of hemp, and steam assisted winches and capstans to handle lines, sails and stow cargo reduced the need for a larger crew, cutting the size of a ship's complement to about half the minimum considered necessary to sail a small clipper a decade earlier [29].

These ships, many of them products of British yards, were actively employed in the major bulk trades out of the Pacific; mineral ore, guano and nitrate from South America, ore and coal from Australia, timber from the American and Canadian west coasts, and grain and flour from the agricultural bounty of California. British ships sailing into the Pacific and arriving at Newcastle with "a general cargo at a lucrative freight" could, if not loading Australian copper ore or wool for a return to Europe, load coal cheaply, sail to the west coasts of North or South America, discharge the coal, and then load a lucrative cargo of California grain or Peruvian or Chilean nitrate or guano ([29]: 30).

The growing industrialization of North and South America came as the economies of California, Peru and Chile rapidly expanded in the 1880s, with the result that Newcastle became the busiest port in Australia with about fifteen sailing ships loading coal each month for the industries and coaling stations of western America [29]. The cost of that trade, however, was also measured in terms of ships and lives lost. Beyond altruism, higher insurance rates for ships on coal-carrying voyages and the growing impossibility of insuring some ships "as underwriters refused to accept full risk since they suspected that many casualties had no protection against cargo shifting and that cargoes which spontaneously combusted were not the exception but the rule" ([29]: 34). The simple fact was that "foundered and missing coal-carriers represented the largest number of British and colonial vessels and lives lost worldwide" ([29]: 36). Between January 1889 and April 1896, 52 sailing ships laden with Newcastle coal were lost, wrecked, burned, missing or had suffered accidents ([29,124]; Fig. 13). In 1896 alone, eight coal-laden British vessels disappeared after sailing from New South

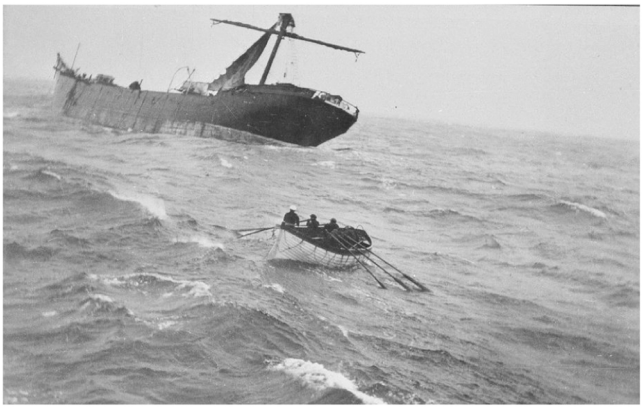

Fig. 13. Ships sank on the open ocean leaving no survivors due to storms, shipboard fires, or cargo that shifted. Lost off Cape Horn in April 1929, the wreck of the three-masted steel sailing ship and nitrate trader Pinnas after it was dismasted by a storm while on a voyage to Valparaíso is a dramatic view of what likely happened to many other ships in the waters of the proposed high seas protected area. San Francisco Maritime National Historical Park, U.S. National Park Service (Public Domain).

Wales [124].

The trend began to shift by the end of the 19th century as cheaper costs for steamships cut into the trade of the sailing ships and the introduction of the highly-efficient triple expansion steam engine and high-pressure boilers allowed a steamship to transport in three years the same tonnage that a sailing ship would take ten years to carry [124].

A popular sea chanty of the time speaks to the harsh realities of the trade:

They're loading coal aboard the 'Star' 'longside Newcastle Quay;
And out across Newcastle Bar there spreads the lonely sea,
And Jack's fond lass has fund another friend to love her ere he go,
Along the toad, the lonely road, the road to Callao.
They heaved the log for fifty days, And on the fifty-first,
The greasy cargo went ablaze, And then the hatches burst.
'Twas man the pumps, all hands to pumps, And curse ye as ye go,
A broken ship, a burning ship, Bound out to Callao ([125]: 288 as cited in [124]: 4).

By 1896, statistical evidence existed that showed that fires were more common on ships headed to North America, while casualties to ships destined for the west coast of South America were more likely to go missing [124].

16. Lumber

The flourishing lumber trade between North and South Pacific ports brought many ships to this region. For example, in the last half of 1912 three Chilean, two Peruvian, one Italian, and one German sailing ship transported lumber south and down the Pacific. Many of these ships were former British-built iron ships while some others were American "all wood four-masts schooners and barkentines," one wooden ship and two wooden five-masted schooners ([118]: 143). While early trade in lumber linked the north and south Pacific coats prior to the California Gold Rush, it was not until the 1850s that the development of Chile "created unprecedented demands for timber products" and so "lumbermen shipped increasing quantities of Douglas fir and redwood to Chilean ports during the 1850s and early sixties" ([126]: 97). The same was true for Peru, with demand for railroad ties [126]. Mills on the west coast of the United States and British Columbia supplied the product [126].

The Chilean lumber market increased after the War of the Pacific and the increased activity of the nitrate trade, especially as the old system of transporting the sacks of nitrate to the coast by pack mule was replaced by railroads, as well as the construction of rail lines to link southern Chile to the rest of the country. Much of the lumber for those projects came from the west coast of the United States rather than from Chile [126]. A national railroad project in Peru in the 1880s, as well as Australian railroad, building and industrial development sustained a boom in the lumber trade that lasted through the early 1890s [126]. The trade increased again after the turn of the century, and continued into the 1930s. The latter period of trade also brought schooners through the Panama Canal laden with lumber from ports on the Gulf Coast. The regular dispatch of sailing ships from northern Pacific and Gulf ports brought a large number of vessels through the waters that comprise the proposed protected area.

17. Maritime routes

Regular patterns of ocean trade that crossed the waters of the proposed protected area are laid out in a chart of ocean steamship routes dated 1914. Among those are the routes between Punta Arenas and San Francisco, San Francisco and Valparaíso, Valparaíso and Honolulu, Valparaíso and Tahiti, Valparaíso and Auckland, Wellington and Callao, as well as Callao and Tahiti. The ocean was and is a vast highway, and a 1915 description of Callao speaks to that fact;

"Here are gathered vessels from nearly every large country in the world. Lumber schooners from Washington and Oregon; merchantmen from China and Australia; coal vessels from England and Wales; freight ships from France and Italy; German steamers with general merchandise, and American steamers from San Francisco and New York. The flags of nearly all nations are represented" [127].

Similarly, Iquique, "the greatest nitrate port in the world," was described at the same time with 20–30 vessels at anchor at any one time, "three- to five-masted schooners, steamers of every size, a few full-rigged ships, and smaller craft in considerable numbers" ([127]: 119–120). However, 1914 and the opening of the Panama Canal marked a major change in maritime traffic to and from Chile. The canal, a "blessing to the world" was "a curse to Chile's maritime enterprise. Her ports were transformed from important stopping points on the way to the Pacific into backwater calls" ([128]: 104).

Naval activities other than official missions and expeditions to survey, saw secretive assessments of the region by foreign navies. Chilean naval expeditions investigated conditions and responded to concerns over Rapa Nui in 1870, 1875, and 1886. That period also brought various suggestions to annex the island by British, French and American officials. That ended with Chile formally annexing Rapa Nui in 1888 through the actions of Captain Policarpo Toro of the Chilean Navy [129,130]. Naval activities associated with the Latin American wars of independence (1810–1824) did not involve the distant offshore areas or the islands, but the previously mentioned cruise of USS Essex and its attacks on British whalers during the War of 1812 peripherally took place in the vicinity of the proposed protected area. Vidal Gormaz noted a visit by the steamer Antonio Varas in 1861 that supplied coal to the Peruvian Navy's frigates Apurimac and Amazonas as they had run short after a cruise to the Chiloé Archipelago during a prolonged period of tensions between Spain and Peru that erupted into war in 1865–1866 [18,128]. That conflict did not intrude upon the waters of the proposed protected area as all actions were coastal. The same was true for the War of the Pacific with its naval actions also confined to the coast of the mainland.

18. World wars

Rapa Nui played a brief role in World War I. In 1914, nine German ships used Rapa Nui as a meeting location so that larger ships coming from the west could be resupplied with coal by smaller ships coming from South America. That same year, the Germans sunk the French ship Jean in waters near Rapa Nui. During World War I, indirect naval activity took place in the proposed protected area. The most direct was the cruise of the German East Asia Squadron's warships, under the

command of Admiral Maximilian von Spee, which crossed the Pacific from its base in Tsingtao, China and rendezvoused at Rapa Nui to supply coal from German colliers that had steamed there in response to Spee's orders. They were joined there by the cruiser SMS Dresden, which had crossed into the Pacific after the start of the war. While anchored at Juan Fernández, Dresden made radio contact with the cruiser SMS Leipzig and learned of the rendezvous. The squadron steamed from Rapa Nui to Más Afuera, then to Valparaíso, and from there to engage a British fleet at Coronel, south of Valparaíso, on November 1, 1914 [131].

Following the German defeat of the British squadron in the Battle of Coronel, Spee took his ships into the Atlantic, but they were intercepted and largely sunk by a British naval force off the Falklands on December 8, 1914 [131]. Dresden survived the battle, retreating back to the Pacific. On February 27, 1915, Dresden's crew captured the British bark Conway Castle, outbound from Valparaíso with a cargo of barley south of Más a Tierra and sank it after taking off the crew. From there, the cruiser headed to Más a Tierra. Now dangerously low on coal, Dresden was effectively stranded. Dresden's radio calls for coal were intercepted by the British Royal Navy, which steamed into the anchorage and shelled Dresden until it sank after the crew set scuttling charges on March 14, 1915 [131].

Leipzig, like Dresden, acted as a commerce raider while off the coast of Chile. Leipzig, working in tandem with the German Norddeutscher Lloyd liner Prinz Eitel Friedrich, intercepted the A.D. Bordes-owned four-masted steel barque Valentine, loaded with coal and heading to the nitrate coast on November 2, 1914. Prinz Eitel Friedrich towed Valentine to Más Afuera. After taking off the crew and removing coal, the Germans sank the barque. Prinz Eitel Friedrich also captured the French barque Jean, towed it some 1500 miles to Rapa Nui and sank it on December 31, 1914 a mile and a half offshore Rapa Nui after landing the crew there. Prinz Eitel Friedrich circled the barque and shelled it until it sank. Another near-encounter with naval war activities came when the French schooner Lutece arrived at Rapa Nui with a crew of Germans. Formerly crew of the raider Seeadler, which had wrecked on the reef at Mopelia in the Society Islands, they had captured Lutece and stranded its crew when they stopped to help. The Germans wrecked Lutece when they ran aground at Rapa Nui on October 4, 1917. Ultimately taken to the mainland, they were interned there until the war's end as Chile was a neutral country.

There was no naval activity in the area during World War II; the proposed protected area was part of the Western Hemisphere Neutrality Zone [128]. However, secret correspondence between Imperial Japan and Chile in 1937 noted that the Chilean government at that time was considering selling Rapa Nui and to the highest bidder, with the Japanese view being that Rapa Nui might be of value in the future as an air base or fishing base [130]. Post-war, the area came more closely under control of the Chilean Navy, with Rapa Nui coming under direct naval control in 1952. This enhanced military presence came with the increased perception of the importance of the strategic sea corridor between South America, Australasia, and North America as well as a pelagic habitat under threat.

19. Post-war

Direct control of Rapa Nui was assumed by the Chilean Navy in 1952, who controlled Rapa Nui until 1966 when the Rapa Nui civil rights movement culminated in the Promulgation of Ley Pascua which recognized indigenous Rapanui as Chilean citizens. To this day the Chilean Navy maintains an active marines garrison and a navy governor and a port captain on Hanga Roa as well as a jet boat. Salas y Gómez Island is uninhabited, but the Chilean Navy maintains an active beacon there as an aid to navigation. A small navy crew occupies San Félix Navy Station, a collection of buildings, antenna arrays, and a runway for aircraft. The runway, formally part of a Chilean military airport, served a variety of roles which may have included electronic intelligence gathering (ELINT) as Chile allowed Britain to utilize it during the Falklands conflict in 1982 [132].

During the Cold War, San Félix was the site of a signals interception (SIGINT) base by Chile's naval intelligence service that monitored the region, including Bolivian and Peruvian communications [133]. A rumored subsurface submarine base has never been officially verified. In the post-Cold War era, the dominant role of Peruvian and Chilean naval forces in regard to the waters within the proposed protected area have been less focused on the internal tensions between the two neighbors and other South American countries; however, less focused on geopolitics, and more focused on the inherent threat to the marine resources represented within this region.

20. Shipwrecks

While this review has focused on what is generally asserted to be "intangible" cultural resources, what we hope has emerged is a sense of the broad connections this region has to broader patterns of human activity, ranging from thousands of years ago to the modern era. The basic pattern of the ocean itself played a large role in the complex series of human interactions that speak to how the ocean shaped human activities, and how human activities are shaping the ocean. The most recent human interaction, the proposed high seas protected area, is in itself an artifact of this inherent truth.

One aspect that usually defines the concept of maritime cultural heritage within protected areas is the presence of shipwrecks. While we have no definitive evidence of shipwrecks as a resource within the proposed protected area, the archival record suggests the potential for numerous shipwrecks within this region. This may be seen in wrecks of ships, identities yet unknown, lost around the islands. Such instances are hinted at in Chamisso's "Salas y Gómez", where vessels were lost where none survived to relate the tale. While solitary vessels in the early colonial period "went missing" and may have been lost, the possibility of 17th, 18th and 19th century losses within these waters may be proved by chance discovery through future deep-water mapping and characterization.

The most likely context for vessel losses in the proposed protected area relates to those maritime activities which introduced large numbers of vessels into the area. These include whaling, the guano trade, the copper trade, the coal trade and the nitrate trade, as well as pelagic fishing. Incidental and not in the waters of the proposed protected area are wartime losses of World War I. Detailed research into shipwrecks and vessels gone missing in the area was undertaken but is not conclusive. For early whalers, not every vessel that failed to return was "spoken" or reported by another ship at or near the time of its loss. The famous episode of the wreck of the whaler Essex, rammed and sunk by a whale off the Galapagos, for example, might have remained anecdotal if not for the epic survival of some of the crew under horrific circumstances and the role that wreck played in the creation of Moby Dick.

The earliest known context beyond whaling or sealing to assess is that of the wrecks associated with the guano trade. The scope of the trade was large; in 1850, 215 ships from the United Kingdom alone were dispatched to Chinchas for guano [134]. A Royal Commission on unseaworthy ships engaged in that trade reported, in 1873, the name and scale of loss, which not only provides a sense of casualties in that trade, but also of some vessels which possibly foundered in the waters of the proposed protected area. In 1850, the ship Elida, 163 tons in register, went missing; in 1851, out of 305 British ships dispatched to the Chinchas, 22 were lost, with three, the ships Asia, Arun and Argyle, gone missing.

In 1854, out of 408 dispatched, 58 were lost, with the ships Pilgrim and Seringapatam gone missing (Royal Commission 1873). In 1855, out of 478 ships dispatched, 38 were lost, with Abberton gone missing. In 1856, with 169 dispatched, saw Atalanta missing. In 1857, out of 477 ships dispatched, 19 were lost, with Sea King, Antoinette, and Galatea missing (Royal Commission 1873). In 1870, the ship Tornado, one of 231 ships dispatched that year, went missing (Royal Commission 1873).

Other ships lost in the trade in that early period included the ship Vocalist, which foundered at sea Latitude 11 North Longitude 40 West, and John Owens, which foundered at sea Latitude 26 South, Longitude 40 West, the latter locations known because the crew survived.

The potential for lost ships increased in the latter 19th century. The predominant number of potential shipwrecks in the proposed protected area are related to transpacific transits with the central South American coast, especially coal-laden iron and steel-hulled ships and barques (barks in American usage) that departed and never arrived at their next port. Exact locations are rarely cited as most of these vessels likely sank as a result of coal fires or storms. Examples powerfully indicate the last decades of working sail, with large capacity iron and steel hulled vessels engaged in the hard and dangerous work of coal hauling as part of the nitrate trade from the 1880s through World War I. Examples of ships gone missing in the coal and nitrate trade bound to and from Newcastle, New South Wales to Callao, Antofagasta, Iquique, and Valparaíso were often brief notices in various newspapers.

The Theophane, ship, 1519 tons, of Liverpool, which left Newcastle on December 11 for Mollendo and has not since been heard of, has this day been posted as missing by the committee at Lloyds (The Adelaide Advertiser, April 29, 1892: 5).

It is reported from Greenock that the barque Cumbrae, 1356 tons burden, Fisher, master, which sailed from Sydney for Valparaíso on February 9, is missing. It is feared that the vessel has been lost as she has been 80-days out (Adelaide Advertiser, May 13, 1895: 5).

The ship Menai, of 1298 tons, of Liverpool, which left Newcastle on February 23 for Tocopilla, and has not since been heard of, was posted at Lloyd's as missing on August 14. She was built in Sunderland in 1889, and owned by Messrs W. Thomas and Co., of Liverpool (The Otago Daily Times, August 26, 1895: 1).

The barque Castlebank, of Glasgow, Captain Pike. sailed from Newcastle, New South Wales, for Tocopillo, with a cargo of coal, on September 24, 1896, and has not since been heard of, has been posted missing at Lloyds. (New Zealand Herald, April 6, 1897: 4).

The Newcastle marine Board held an inquiry at the offices…this afternoon, respecting the supposed loss of the iron barque Mitredale, which left this port on April 30 last with a cargo of coal for Callao, Peru, and has not since been reported (Sydney morning Herald, December 1, 1898: 6).

The BARQUE CASWELL MISSING. It is announced that the barque Caswell from Newcastle to Guayaquil, is posted at Lloyd's as missing (Nelson Evening Mail, September 1, 1899: 3).

Hope has been abandoned for the safety of the British ship Patterdale, now 128 days from Newcastle, N.S.W., for Valparaíso (San Francisco Call, July 30, 1902: 7).

Much anxiety has been entertained for some time past for the safety of the Clan Macpherson – a fine British ship of 1680 tons. Sailing from the coal port on June 24 last, the vessel, in the ordinary course of events, should have put in an appearance at her destination a couple of months ago… The overdue Clan Macpherson is now 130 days out, and has not been reported since she left Newcastle (Sydney Morning Herald, November 1, 1909: 6).

Silverhorn…was lost with all hands when making a voyage similar to that on which the Ellisland disappeared. Bound from Newcastle to Iquique with coal, the Silverhorn was the last ship posted missing in 1907. A fire-gutted hull, believed to be that of the Silverhorn, was passed in the South Pacific (Sydney Morning Herald, March 5, 1911: 10).

This small sample highlights that there may be many dozen shipwrecks within the proposed protected area. In this regard, the possibility of encountering substantial archeological remains during future surveys is high, both for wooden vessels as well as iron or steel sailing vessels, even if sunk by fire, as seen with two wrecks found off Australia in the Indian Ocean during the surveys for MH370 [135]. The Indian Ocean wrecks were most likely also engaged in carrying coal.

The historical record also notes vessels in distress that made for Rapa Nui. The ship Indiaman, bound from Melbourne to Callao in 1872, "went ashore on Easter Island on March 25, and became a total wreck. The Indiaman…left Melbourne in ballast on March 4 for Callao, where it was intended to load guano. Sometime after leaving the vessel was discovered to be making water, and the captain decided to endeavor to reach Easter Island, it being the nearest land" (Canterbury Press, August 16, 1872: 1). In March 1873, the ship Elizabeth Kimball departed Port Gamble, Washington with a load of lumber for Iquique. Discovering the ship was leaking, the captain jettisoned what cargo he could and made for Rapa Nui, which was six hundred miles away, and saved his crew when he ran the ship aground there on May 6, 1873 (San Francisco Daily Alta California, October 14, 1873: 1).

A more recent example, the four-masted steam schooner El Dorado, which in 1913 sailed from Astoria, Oregon with a lumber cargo bound for Chile. Battered by a storm, El Dorado sank some seven hundred miles off Rapa Nui. The crew took the lifeboat and made their way to the island, arriving after nearly two weeks in the open boat (Hobart Mercury, December 31, 1913: 5). The survival of El Dorado's crew notwithstanding, a Chilean account notes the sighting of a "barca abandonada" the "Goleta norteamericana Bresley" to the west of Salas y Gómez on November 19, 1906 (Vargas [136]: 37). This account is a reminder that the seabed may well provide the only evidence of ships that left port and disappeared with no one left to tell the tale.

21. Recent scientific expeditions

Since the 1950s several scientific expeditions have surveyed the waters of the proposed high seas protected area (reviewed in [137,138]). As a result, this region is one of the better surveyed high seas regions globally [138]. In the late 1950s, the US Downing expedition surveyed the fauna of high seas seamounts of the Nazca Ridge, which included seafloor animal collections made via dredge by the R/V Horizon [139]. In 1983, limited scientific collections were made by Japanese scientists aboard R/V Ibiku-Maru [140]. The most detailed scientific investigations of the Salas y Gómez and Nazca ridges were made during a series of Soviet expeditions that occurred during 1973–1987 (reviewed in [137]). These included expeditions by the R/V Poseidon in 1973, R/V Astronom in 1975, R/V Gerakl in 1975–1976, R/V Ikhtiadr and R/V Odissey in 1979–1983, R/V Akademik Kurchatov in 1982, R/V Professor Mesyatzev in 1983–1985, and R/V Shtokman in 1987 (reviewed in [137,138]). Collectively, these Soviet expeditions surveyed 22 seamounts on the Salas y Gómez and Nazca ridges, during which they documented 192 invertebrate and 171 fish species, including 150 species that were new to science (reviewed in [137]). The Chilean National Oceanographic Committee also surveyed the high seas portions of the Salas y Gómez and Nazca ridges during expeditions in 1999 and 2016 [141]. These expeditions found that every seamount has a unique deep-sea faunal composition. And in 2019, the Japan Agency for Marine-Earth Science and Technology in collaboration with many Chilean partners conducted an expedition to the ridges aboard R/V Mirai. Collectively, these expeditions made numerous scientific discoveries in the waters of the proposed protected area, including numerous species that are new to science, as well as documenting a unique biodiversity that is marked by one of the highest levels of marine endemism on Earth. For many taxonomic groups, close to half of the species are endemic to the region and found nowhere else on our planet (reviewed in [3]).

22. Future direction and recommendations

Due to its unique biodiversity and ecological significance, many previous studies concluded that the Salas y Gómez and Nazca ridges are one of the most important places to protect globally [4,1,2,5,6–8,3,138]. This review highlights that this region is not only worthy of protection for its natural significance, but also its exceptionally rich and diverse history of human seafaring and cultural significance. Even though the exact location of tangible maritime cultural resources, such as shipwrecks, are not yet known within the proposed high seas protected area,

there is a long history of human interactions that brought people from diverse cultures to these remote waters. Cultural heritage and resources should therefore be factored into the design, management and research of the proposed area, as this region contains many historically, archeologically and culturally significant areas, some of which may even be sensitive. This point was recently emphasized in regard to the management of the high seas portion of the Middle Passage of the transatlantic African slave trade [142].

While protected areas are often established with a focus of biodiversity conservation, it is important to note that the protected area definition by the International Union for the Conservation of Nature highlights the conservation of nature and associated ecosystem services and cultural values [143]. In fact, many marine protected areas have been set up with the explicit objective of not only protecting natural resources, but also cultural ones [144,145]. For instance, cultural resources and heritage are identified as top priorities in the governance and management frameworks of the Papahānaumokuākea Marine National Monument, Natural Park of the Coral Sea, Cook Islands Marine Park, the U.S. National Marine Sanctuary System, and the marine areas of the U.S. National Parks, among others [144,145]. Similarly, Chilean marine protected areas have incorporated conservation of both natural and cultural heritages in their management planning, including the Rapa Nui Multiple Use Marine Protected Area, Motu Motiro Hiva Marine Park, Nazca-Desventuradas Marine Park, and Mar de Juan Fernández Marine Park Multiple Use Marine Protected Area [146,147]. This is particularly relevant in the case of the Rapa Nui Multiple Use Marine Protected Area and the Motu Motiro Hiva Marine Park due to the cosmovision of the Rapanui people, where natural and cultural heritage are indivisible [146,147].

Several of the above mentioned MPAs have successfully integrated cultural aspects into their design and management. Approaches utilized to integrate cultural aspects include (1) creating explicit zoning for traditional use and navigation, (2) developing permit categories that explicitly allow for cultural and spiritual practices inside the protected area, (3) including members from Indigenous and local communities into leadership positions of management bodies, (4) creating cultural working groups that advise on relevant aspects, (5) integrating traditional language, values, protocols and cultural practices into management, research and outreach activities, (6) conducting regular trainings to increase cultural capacity amongst management agencies, permittees and the public, (7) supporting research on cultural heritage, traditions, oral history, and maritime archeology, (8) developing research and outreach partnerships with organizations that are focused on cultural heritage, and (9) appropriately engaging and consulting with communities that are connected to their sites [145,148,149]. Given the cultural significance of the Salas y Gómez and Nazca ridges, similar approaches should be pursued to effectively design and eventually manage a protected area in this region.

As highlighted in this review, for some communities the high seas of this region have profound cultural significance that connects them not only to their past, but also to their future. These communities include those that inhabit the oceanic islands and continental coasts adjacent to the proposed protected area (Figs. 1 and 2), as well as some more geographic distant ones that have historical connections to this place. These communities in particular should be appropriately engaged and consulted during all development phases of the proposed protected area, as these partnerships are critical to not only building interest and support, but also to developing conservation strategies that are socially responsible and equitable. These partnerships should begin as early as possible, and be coordinated by the governments, intergovernmental organizations, and individuals seeking to champion conservation efforts in this region. Consultations should focus on those communities that are most connected to the region, in particular communities of Rapa Nui, Juan Fernández, as well as the Peruvian and Chilean continental coast, as these communities are likely going to be most impacted by the establishment of a protected area.

While this review has synthesized information on the maritime cultural heritage of the Salas y Gómez and Nazca ridges, many knowledge gaps remain. Activities addressing those knowledge gaps should be supported by governments and other organizations that are seeking to champion conservation efforts in this region, as well as by researchers seeking to advance our collective understanding. Such research should not only be guided by the information that is missing, but also by the approaches taken during previous research efforts that successfully integrated multiple perspectives, knowledge systems, values and communities that are connected to a study region [6,148]. Furthermore, given the high likelihood of discovering submerged maritime resources and shipwrecks in this region, deep-sea surveys with submersibles, remotely operated vehicles, and mapping technologies should be pursued. In addition to further research aimed at filling knowledge gaps, outreach and education activities should also be supported throughout the design and management of the protected areas in order to build interest and support.

23. Conclusions

International waters surrounding the Salas y Gómez and Nazca ridges have a well-documented range of significant natural resources that merit protection. This overview is a reminder that there are also substantial cultural resources in the region. A long history and tradition of human use, both by indigenous Pacific islanders, and later by mariners engaged in various voyages of colonial exploration, colonization, and charting, have left a rich record of human encounters with this region. That record includes documentation of the various endeavors to exploit the marine resources as well as those who lived on Rapa Nui.

As a matter of policy, entities engaged in suggesting, studying or undertaking the necessary steps to establish MPAs should be well aware and understand this rich human history. Cultural and maritime heritage resources are key to having a full understanding of resource values, with profound connections to indigenous islander and mainland communities of the past and present.

The interaction between people and the sea is a profound and common human experience that spans all eras and cultures, and as is seen with Chamisso's epic poem Salas y Gómez, can culturally link audiences far removed from the setting to this remote part of the ocean. Whether physical remains of maritime activity exist, although they highly likely do, it is the human experience and the power of these stories that can assist in connecting a global audience to this remote and extraordinary place. As work continues to better understand and characterize the values of the Salas y Gómez and Nazca ridges, increasing our understanding of the maritime history and cultural resources need to be part during the design, establishment, and eventual management of the proposed protected area. This should include meaningfully engaging, consulting, and including communities that are most connected to this place, as well as supporting research, education and outreach activities designed to increase our collective knowledge of both the natural and cultural significance of this region. The Salas y Gómez and Nazca ridges provide a rare opportunity to protect and study a global diversity hotspot on the high seas, while also providing a window into the profound relationships between people and the sea.

CRediT authorship contribution statement

James Delgado: Conceptualization, Visualization, Writing – original draft, Writing – review & editing. **Michael Brennan:** Conceptualization, Visualization, Writing – original draft, Writing – review & editing. **Sergio Rapu:** Conceptualization, Writing – review & editing. **Julianna Rapu:** Conceptualization, Writing – review & editing. **Carlos Gaymer:** Writing – review & editing. **Diego Carabias:** Writing – review & editing. **Emily Stokes:** Writing – review & editing. **Daniel Wagner:** Conceptualization, Funding acquisition, Project administration, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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