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Paper on the High Seas of Nazca and Salas y Gomez Submarine Ridges

Chile

Paper on the High Seas of Nazca and Salas y Gómez Submarine Ridges

for the Nineth Meeting of the Scientific Committee of the SPRFMO

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Content

1. Summary

The Salas y Gómez and Nazca ridges are two seamount chains of volcanic origin, which include over 110 seamounts that collectively stretch across over 2,900 km in the southeastern Pacific. Ecosystems in this region are isolated by the Atacama Trench, the Humboldt Current System, and an extreme oxygen minimum zone. This isolation has produced a unique biodiversity that is marked by one of the highest levels of marine endemism. These areas also provide important habitats and ecological stepping stones for whales, sea turtles, corals, and a multitude of other ecologically important species, including 82 species that are threatened or endangered.

Recent explorations in this region have documented one of the deepest light-dependent marine ecosystems on Earth, as well as numerous species that are new to science. Waters surrounding the Salas y Gómez and Nazca ridges are mostly located in areas beyond national jurisdiction (ABNJ) under the mandate of the SPRFMO and the IATTC, with smaller portions located in the national waters of Chile and Peru. Within this region, Chile and Peru have already protected all the ridge features that fall within its jurisdiction. However, all of the ABNJ in the region, which cover over about 70% of the Salas y Gómez and Nazca ridges, are not subject to any specific conservation and management measures by either the SPRFMO or IATTC.

Importantly, fishing and other commercial activities are at low levels in international waters of this region, so there is a time-sensitive opportunity to protect its unique natural and cultural resources before they are degraded. This paper provides a synthesis of the relevant science that has been conducted on the Salas y Gómez and Nazca ridges, and mostly based on the scientific papers of Gálvez-Larach (2009) and Wagner *et al*. (2021) and on the CBD (2013) report; nevertheless, a full list of references is provided in the Chapter 6.

Based on the information compiled we concluded that:

- Nazca and Salas y Gomez submarine ridges represent a unique and distinctive ecosystem that must be considered as a whole for any conservation and management measures.
- Since its identification as an EBSA in 2013, new scientific information on the biodiversity of Nazca and Salas y Gomez ridges has been published. Therefore, it worth a detailed scientific analysis by the Scientific Committee of the SPRFMO.
- Bottom fisheries have not been developed in the high seas of those ridges since 1992 and minor squid and pelagic fisheries occur currently. Therefore, under the precautionary principle, it is timely to consider specific conservation measures in order to protect this unique ecosystem at stage in which its components and habitats are still not decremented.
- Under the under Article 4 of the SPRFMO Convention, specific compatible conservation measures should be considered on the high seas of Nazca and Salas y Gomez ridges in order to match the conservation measures already implemented by Chile and Peru on their jurisdictional waters.

Finally, we recommend the SPRFMO´ Scientific Committee to carefully consider the scientific value of the information provided in this report and, evaluates if there is sufficient scientific evidence to recommend the Commission to proceed with further analyses, incorporating these ridges in the workplan of the Scientific Committee in order to explore management and conservation options, including area-based measures.

2. Introduction and Case Justification

The benefits the ocean brings to humanity - including the stabilization of climate and trillions of USD for the global economy and culture - are fundamental to life on earth. Putting a resource, this precious at risk is dangerous, yet ocean health is declining due to human activity, threatened by pollution, overfishing and habitat loss. In addition, one of the greatest threats is climate change, which is already causing the ocean to become warmer mand less alkaline, putting pressure on marine life from the base of the ocean food web to the top.

For long, Chile has been promoting the need to protect and preserve the ocean and advance marine protected areas (MPAs) as key measures to address the climate crisis, including during its tenure as President of the UN Framework Convention on Climate Change (UNFCCC) COP25, or “Blue COP”. We have secured 43% of our jurisdictional waters under some form of protection, including several large fully and highly protected MPAs, and have made important commitments to increase protection of underrepresented coastal and marine ecosystems.

During the 2021 Leader´s Summit on Climate, Chilean President Sebastian Piñera expressed our desire to be more ambitious and invited the international community to go further and start what we call the “second phase” of our efforts to secure MPAs. President Piñera’s proposal matches up with President Biden´s final Summit statement, which reinforced that this decade is one of decisions, implementation and of collaborative work. The science is clear. If the ocean is to remain sustainably productive, we must rebuild its health and urgently stop marine biodiversity loss. In response to science, the International Union for Conservation of Nature (IUCN), recommends protecting at least 30% of the global ocean by 2030 as the new protection target under the Convention of Biological Diversity (CBD).

We need to strike a balance between conservation and sustainable use, achieving a healthy ocean that can continue to maintain productivity and exercise its relevant role as a carbon sink and climate regulator. We know area-based conservation measures, including Marine Protected Areas (MPAS), contribute to strengthen the ocean as a reservoir of biodiversity and help substantially in the recovery of marine species. Numerous studies, including the IPCC Report on the Ocean and the Cryosphere and the Report on Transformations for a Sustainable Ocean Economy, of the Ocean Panel, suggest that the current situation cannot be afforded.

In this context, Chile has adopted a comprehensive vision to combat climate change. We believe that current processes discussed within the United Nations, such as climate change, biodiversity and the high seas are interconnected. To tackle climate change, we need to implement an integral approach and break the silo mentality that prevails in many multilateral negotiations. It is about creating a common vision that underscores the inescapable link that exists amongst these issues.

We believe that SP-RFMO should start the process of evaluating and analyzing additional options for the conservation of the resources and ecosystems existing in specific areas under its mandate, as well as to explore further recommendations at a later stage. Therefore, **we produced the current scientific report on the High Seas of Nazca and Salas y Gómez Submarine Ridges**, which has been designated as an “Ecologically or Biologically Significant Area” (EBSA), in need of protection under the United Nations Convention on Biological Diversity (CBD), **for the SP-RFMO Scientific Committee´s (SC) consideration. The objective is to determine if there is sufficient scientific evidence to explore additional options for the conservation of the resources and ecosystems existing in those ridges**, a distinctive area currently without specific conservation measures in place. Furthermore, in case the SC agrees, **we would like to advance the recommendation to the Commission to mandate the SC to include those submarine ridges in its work plan for further analysis and conservation measures recommendations.**

Including Nazca and Salas y Gómez Submarine Ridges in the SC’s work plan with a holistic perspective and analysis, will consolidate the notion that our Organization (SP-RFMO) is always at the forefront of bringing sustainability into its sector, in line with SDG 14, ensuring that science-based, precautionary conservation measures are put in place to protect biodiversity hotspots of the area. In this connection, we would like to highlight the Final Declaration of the 5th France-Oceania Summit, subscribed on July 19 this year by many countries of our Organization (Australia, Cook Islands, New Zealand, Vanuatu).

The Declaration emphasizes, amongst others : a) the importance of addressing climate change with a heightened sense of urgency and ambition, b) the critical role played by the ocean in combating climate change, preserving biodiversity, and supporting sustainable development, c) the relevance of achieving the protection objective of 30% of the global ocean by 2030 under the CBD, covered by effectively managed MPAs, d) the promotion of a new high seas treaty under UNCLOS to protect biodiversity beyond national jurisdictions and recognize these areas as a global common to be preserved for the benefit of present and future generations. We are convinced this Declaration clearly reflects the strong commitment of many nations of the South Pacific to build a sustainable ocean economy, expressing thereby their support to the fundamental assumptions of our request.

Furthermore, the current request to the SC is based, among other considerations, on the principles and rules set out in the SP-RFMO Convention. Indeed, Chile and Peru have recently created MPAs on portions of these ridges lying in their jurisdictional waters (Motu Motiro Hiva Marine Park, Rapa Nui MPA and Nazca-Desventuradas Marine Park in the case of Chile, and Nasca National Reserve in the case of Peru). Therefore, under Article 4 of the SP-RFMO Convention, we should ensure compatibility of conservation and management measures established in areas under the national jurisdiction of a coastal State Contracting Party and the adjacent high seas of the Convention Area. Moreover, Article 4, para.2(a) establish that in developing compatible conservation and management measures Contracting Parties shall take into account the particularities of the region concerned. Due to all the above considerations, Chile understands that the request to the SC to analyze if there is enough scientific evidence to include waters of Nazca and Salas y Gómez Submarines Ridges in its work plan, for further conservation measures recommendations, is legally justified and timely bound.

3. Scientific Review of the Area

3.1. Geographic Location

Extending across over 2,900 km of seafloor off the west coast of South America (Figure 1) lies a distinctive World hotspot of marine biodiversity (Rehder 1980; Newman & Foster 1983; Parin 1991; Parin *et al*. 1997; Poupin 2003; Moyano 2005; Gálvez-Larach 2009; Friedlander *et al*. 2013; Fernández *et al*. 2014; Friedlander *et al*. 2016; Mecho *et al*. 2019; Sellanes *et al*. 2019). The Salas y Gómez and Nazca ridges are two adjacent seamount chains of volcanic origin that lie in the southeastern Pacific Ocean (Mammerickx *et al*. 1975; Gálvez-Larach 2009; Gálvez 2012a; Yáñez *et al*. 2012; Rodrigo *et al*. 2014; CBD 2017; Easton *et al*. 2019).

Salas y Gómez ridge is located between 23°42' S and 29°12' S and 111°30' W and 86°30' W. Nazca ridge is located between 15°00' S and 26°09' S and 86°30' W and 76°06' W (CBD, 2013). The more adjacent ridge to the South American Continent, the Nazca Ridge, stretches across roughly 1,100 km of seafloor between the subduction zone off the Peruvian coast and the eastern edge of the Salas y Gómez Ridge. The Nazca Ridge is located mostly in areas beyond national jurisdiction (ABNJ), with a smaller northeastern section that is located in the national waters of Peru. The Salas y Gómez Ridge stretches across approximately 1,600 km between the Nazca Ridge and Easter Island (Figure 1). The central portion of the Salas y Gómez Ridge is located in ABNJ, whereas both ends of this ridge fall within the Chilean jurisdictional waters around the islands of Rapa Nui and San Felix, respectively.

The area under consideration lies exclusively on the high seas and comprises about 70% of the one identified by CBD (2013) as an EBSA (Figure 1).

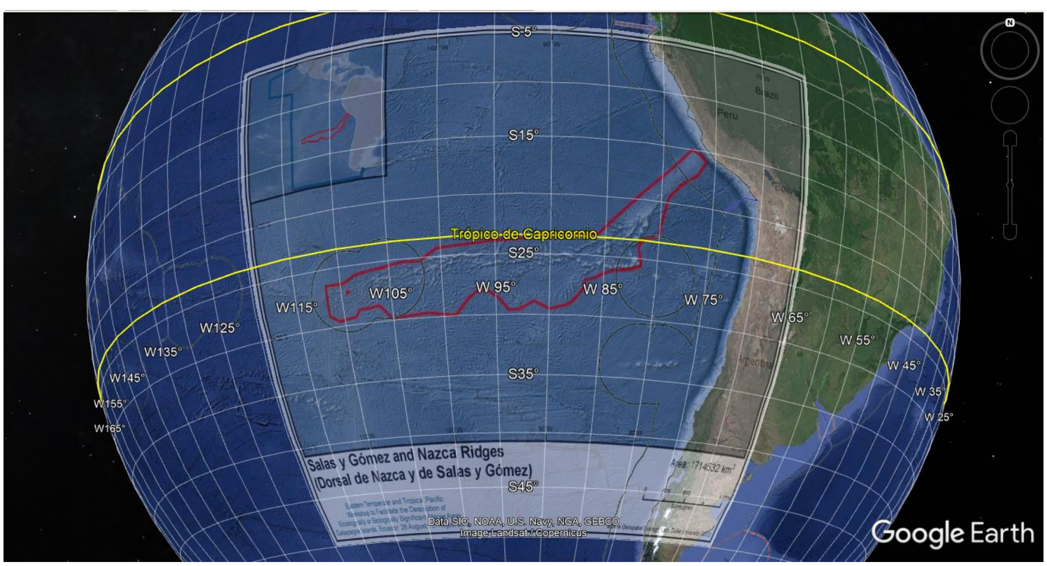

Figure 1. Area (red lines) meeting CBD's EBSA criteria overlapped with Maritime Boundaries (black lines) Source: CBD (2013); Flanders Marine Institute (2019)

3.2. Biophysical Characterization

3.2.1. Geology and Mineralogy

The southeastern Pacific is a geologically active region, with multiple geological hotspots (Sandwell *et al*. 2005; Rodrigo & Lara 2014; Harpp *et al*. 2014; García *et al*. 2020) and active hydrothermal vents (Baker *et al*. 2002; Menini & Van Dover 2019). Seamounts located on the Salas y Gómez and Nazca ridges are all thought to have been produced by a common hotspot that is located close to the present location of Salas y Gómez Island (Mayes *et al*. 1990; Kruse *et al*. 1997; Steinberger 2002; Duncan *et al*. 2003; Ray *et al*. 2012; Rodrigo *et al*. 2014; Harpp *et al*. 2014). Moving eastward along the ridges, the seamounts become progressively older, from 2 million years on the western portion of the chain, to over 27 million years towards the northeastern end (Duncan *et al*. 2003; Ray *et al*. 2012; Rodrigo *et al*. 2014). These seamounts provide a detailed chronological record of the geological formation of the Salas y Gómez and Nazca ridges that tracks the movement of the Nazca Plate as it moves northeastward before it is subducted under South America (Von Huene *et al*. 1997).

The Salas y Gómez and Nazca ridges are a long chain of tall seamounts and guyots that vary greatly in depth, and are isolated from the nearest continental margin by Atacama trench (Parin *et al*. 1997). The ridges area beyond national jurisdiction contains about 110 seamounts with summits at fishable depths down to 2'000 m, representing 41% of the seamounts in the south-eastern Pacific Ocean (Gálvez-Larach 2009). In general, the summits of these seamounts become progressively deeper from west to east, and range between just a few meters below the surface on the western portion of the chain to over 3,000 m towards the northeastern end. However, seamounts near the junction of these two ridges are shallower and extend to just a few hundred meters below the surface (Rappaport *et al*. 1997). Many of these seamounts are drowned coral atolls with nearly intact atoll structures, including drowned fringing and barrier reefs (Parin *et al*. 1997).

At the high seas on the Nazca ridge and in Salas y Gómez ridge close to Eastern Island, Corvalán *et al*. (1996) recorded several sites of Fe-Mn nodules. In addition, they found two more sites with Co-rich Fe-Mn crust on the high seas of those ridges. Lyle (1981) also recorded a site of Fe-Mn basalt coating at the Northeastern end of Nazca ridge, and three sites with Fe-Mn nodule fields on the eastern end of Salas y Gómez ridge.

García *et al*. (2020) did a review of the available submarine geological information considering Nazca and Salas y Gómez ridges, and they concluded that the most significant non-energetic mineral resources in the area correspond, in order of importance today, to: Fe-Mn nodules and crusts, gold and titanium placers, phosphorites and, potentially, Polymetallic volcanogenic massive sulfide (VMS) deposits. Moreover, they stated that "Co-rich Mn crusts have been reported around the Rapanui and Salas y Gómez islands with contents of Cu+Ni up to 0.3%; these could be extended in the submarine volcanic chain until the San Ambrosio Island, for more than 3,000 km at approximate mean depths of 2,000 m".

3.2.2. Oceanography

The Salas y Gómez Ridge and the southern portion of the Nazca Ridge are located near the center of the South Pacific Gyre, an area characterized by extremely nutrient-poor waters (Von Dassow & Collado-Fabbri 2014; González *et al*. 2019; Heinze *et al*. 2015; Dewitte *et al*. 2021). Water clarity in the central portion of this region, particularly around the Salas y Gómez Ridge, is exceptionally high. This clarity allows sunlight to reach greater depths than in other parts of the ocean. Recent scientific explorations of seamounts on the Salas y Gómez and Nazca ridges indicate that photosynthetic marine communities in this region occur below 300 m depth, one of the deepest recorded on Earth (Easton *et al*. 2019).

The deep waters of the Salas y Gómez and Nazca ridges intersects a region that has some of the most oxygen poor waters in the world (Ulloa & Pantoja 2009; Fuenzalida *et al*. 2009; Espinoza-Morribedon *et al*. 2019). Much like the Humboldt Current System, the oxygen minimum zone near the Salas y Gómez and Nazca ridges may act as an additional biogeographical barrier to dispersal, thereby leading to an increase of deep-water speciation in this region (Rogers 2000).

The northeastern part of Nazca ridge is influenced slightly by the eastern boundary currents of the South Pacific anticyclonic gyre. The Chile current carries subantarctic water north, along the coast of Chile towards the equator, along the coast of Chile. At approximately 20° S, influenced by the southeast trade winds and coastal configuration, the current turns westward, away from the coast influencing Nazca area with nutrient-rich waters (Gálvez-Larach 2009).

In general, the water column of the area is stratified by three main water masses: Subtropical Waters, up to 100 or 200 m depth; the Eastern South Pacific Intermediate Water (ESPIW), between 150 and 300 m depth and Pacific Equatorial Subsuperficial Waters, below 300 m depth (Pérez-Santos *et al.* 2017).

On a recently published study, Dewitte *et al*. (2021) provides an overview of key oceanic processes for understanding the ecosystem structure Chilean islands and seamounts comprising Nazca and Salas y Gomez ridges. This area covers about half of the South Pacific anticyclone, which is the main high-pressure system in the mid-latitudes of the South Pacific (see contour plotted with a thick red line in Figure 2). In addition, this area hosts one of the largest oxygen minimum zones (OMZs) in the world, associated with the combined effect of the thermocline ventilation forming a shadow zone in the eastern tropics and of the high respiration rates of exported organic matter. The OMZ that represents a respiratory barrier for most pelagic and benthic marine species has its western limit located near the Desventuradas island (CHL) and Juan Fernandez archipelagos (CHL), representing a potential threat for benthic communities on the surrounding seamounts. The occurrence of hypoxic conditions can, for instance, trigger a reduction of macrobenthos in the benthic zone, affecting production and restocking processes (Dewitte op cit).

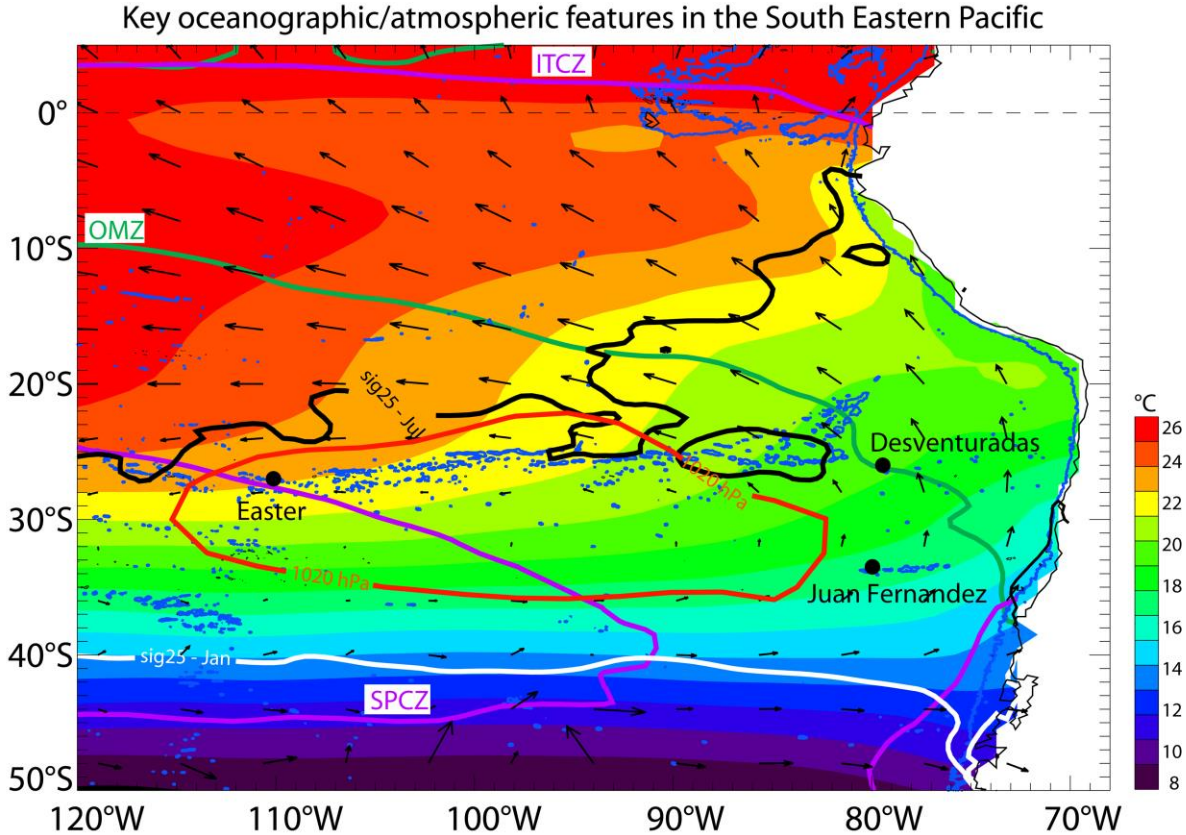

Figure 2. Some key features of the mean circulation in the South-eastern Pacific: the shading shows the mean sea surface temperature (SST) from HadISST data, 1950–2018; the arrows indicate mean 10-m winds from WASwind, 1950–2011. The contours in purple indicate the region of mean rainfall larger than 2.5 mm/day, and correspond approximately to the intertropical convergence zone (ITCZ), north of the equator, and the South Pacific convergence zone (SPCZ). The contours in thick white and black indicate the positions of the isopycnal 1,025 kg m−3 (i.e σθ = 25) in July (black) and in January (white), and delineate the region where surface waters can potentially subduct and ventilate the tropical thermocline. The contour in red indicates the mean position of the South Pacific anticyclone and corresponds to the isopleth of 1,020 hPa for surface atmospheric pressures (from NCEP data, mean over 2000–2017). The 2,000-m isobath is also shown in blue to highlight the chain of seamounts between Easter Island and the Desventuradas Archipelago. The contour in green indicates the limit of the oxygen minimum zone (OMZ) at 300 m from CARS data (oxygen concentration lower than 1 ml/L). Source: Dewitte *et al*. (2021)

3.2.3. Ecology and Biodiversity

As Watling & Auster (2017) suggested, the seamounts of Nazca and Salas y Gómez submarine ridges might be considered as home of a series of functionally interrelated communities making up part of an ecosystem which potentially comprises many seamounts, and that the communities that make up the ecosystem can range over very large distances.

Seamounts alter the flow of ocean currents, increasing flow rate, and enhancing the delivery of food particles to the suspension-feeding animals. Flow enhancement is most pronounced along the sides near the seamount summit, but also anywhere on the seamount where there is a feature, such as a ridge or pillar, that protrudes slightly above the local seafloor. On those features high densities of corals and sponges can be found (Genin *et al*. 1986). In fact, seamount benthic communities are characterized globally by octocorals, hard corals, sponges, and crinoids, among other suspension feeding invertebrate groups (McClain *et al*. 2010; Schlacher *et al*. 2014).

In general, seamounts are islands of rich megafaunal biodiversity in the deep ocean, they are home to untold numbers of fragile and long-lived species that can easily be destroyed by indiscriminate bottom fishing gear, and they also may harbor large numbers of smaller species so far undiscovered (George & Schminke 2002). Little is known about patterns of reproduction and dispersal, genetic connectivity, functional role, and the direct and indirect responses of seamount species that could be triggered by their removal (e.g., reduction or local extinction of linked coral populations and populations of associated commensal species, reduced role of corals providing prey subsidies to mobile predators with bioenergetic effects on growth and reproduction). In fact, while seamount faunas have varying degrees of heterogeneity within and between seamounts (Kvile *et al*. 2014; Clark *et al*., 2015), the degree of uncertainty associated with attempts to extrapolate limited data in order to quantify vulnerability to human activities is sufficiently large (Taranto *et al*. 2012), suggesting the highest levels of precaution are necessary for management.

Having above considerations, Watling & Auster (2017) conclude that seamounts must be considered as Vulnerable Marine Ecosystems themselves in the language of UNGA resolution 61/105 and manage them as such. Indeed, Chile took that approach in 2015 by banning all kind of bottom fishing activities on the seamounts (in the whole seamount, not in a portion of them) located under its jurisdiction (Resolucion Exenta No. 451/2015 amended by Resolucion Exenta No. 687/2016).

Despite its geographic proximity to South America, the biodiversity of the Salas y Gómez and Nazca ridges is isolated from South America by the Humboldt Current System and the Atacama Trench (Figure 1; Dassow and Collado-Fabbri 2014). As a result, the marine fauna of this region has higher biogeographical affinities to the Western Indo-Pacific than to the Eastern Pacific (Parin 1991; Parin *et al*. 1997; Poupin 2003; Rehder 1980; Sellanes *et al*. 2019; Friedlander *et al*. 2013; Friedlander *et al*. 2016; Gálvez-Larach 2009; Mecho *et al*. 2019; Newman & Foster 1983; Pequeño & Lamilla 1995; Pequeño & Lamilla 2000; Burridge *et al*. 2006; Dyer & Westnear 2010). The isolation of the Salas y Gómez and Nazca ridges has produced a unique biodiversity that is marked by one of the highest levels of marine endemism recorded so far. For many taxonomic groups, close to half of the species are endemic to the region and found nowhere else on our planet (Parin 1991; Parin *et al*. 1997; Poupin 2003; Rehder 1980; Sellanes *et al*. 2019; Fernandez *et al*. 2014; Friedlander *et al*. 2013; Friedlander *et al*. 2016; Gálvez-Larach 2009; Mecho *et al*. 2019; Moyano 2005; Newman & Foster 1983; Fernandez & Hormazabal 2014; Friedlander *et al*. 2021).

Recently, Tapia-Guerra *et al*. (2021) reported a detailed description of benthic microhabitats, macrohabitats and associated megafauna on the seamounts of Nazca ridge. These authors found that rocky and coarse sandy bottom habitats with a predominance of rhodoliths, thanatocoenosis, and other biogenic components are observed at seamounts whereas they are dominated by sessile and hemisessile fauna that are mainly suspension and deposit feeders. Based on the register of 118 taxonomic units, their results provide an expanded and updated baseline for the benthic biodiversity of Nazca ridge habitats, which seemed pristine, without evidence of anthropogenic negative impacts (Mecho *et al*. 2021a).

In addition to hosting a high diversity of unique organisms, seamounts on the Salas y Gómez and Nazca ridges provide important habitat and ecological stepping stones for whales, sea turtles, swordfish, sharks, jack mackerel, deep-water corals, shallow-water corals, and myriad other ecologically important species (Figure 3a,b,c; Gálvez-Larach 2009; Yañez *et al*. 2004, 2006, 2012; CBD 2017; Gálvez 2012; Arcos *et al*. 2001; Hucke-Gaete *et al*. 2014). In particular, the Salas y Gómez and Nazca ridges are home to 82 species that are endangered, near threatened, or vulnerable to extinction, including 25 species of sharks and rays, 21 species of birds, 16 species of corals, seven species of marine mammals, seven species of bony fishes, fives species of marine turtles, and one species of sea cucumber (IUCN 2020; Table 1). These species include two that are critically endangered, twelve that are endangered, 33 that are near threatened, and 35 that are vulnerable to extinction (Table 1). Due to its high productivity, the region also provides important foraging grounds for a high diversity and abundance of seabirds (CBD 2017; Serratosa *et al*. 2020). Recently, Friedlander *et al*. (2021) identified 55 unique invertebrate taxa and 66 unique fish taxa, concluding that community structure is highly dissimilar between and within subregions of the ridges researched ($p<0.001$ for invertebrate and $p<0.022$ for fish taxa) (Figure 3b,c).

Limited deep-sea explorations that surveyed seamounts across the Salas y Gómez Ridge found that every seamount appears to have a unique community composition, with very few species shared between opposite ends of the ridge (CONA 2017, Mecho *et al*. 2021b). Furthermore, these deep-sea explorations have documented numerous species that are new to science (Sellanes *et al*. 2019; Easton *et al*. 2019; Parin 1992; Parin & Shcherbchev 1982; Parin & Kotlyar 1989; Parin & Sazonov 1990; Schwarzhans 2014; Diaz-Diaz *et al*. 2020; Anderson & Johnson 1984; Anderson & Springer 2005; Galil & Spiridonov 1998; Garth 1992; McCosker & Parin 1995; Motomura *et al*. 2012). For instance, recent remotely operated vehicle (ROV) surveys at 160–280m depths recorded six new species of fishes (Easton *et al*. 2017), as well as two new genera of echinoderms (Mecho *et al*. 2019). This high rate of new species discoveries indicates that the marine fauna of this region still contains a large number of undiscovered species, which represent an enormous opportunity for future scientific exploration and conservation (Fernández *et al*. 2014; Easton *et al*. 2017; Reiswig & Araya 2014). As an example, live individuals of the gastropod *Architectonica karsteni* were recently found on seamounts of the Nazca Ridge (Asorey *et al*. 2020). This ancient gastropod was previously only known to occur in the South Pacific from Miocene paleontologic records (op.cit).

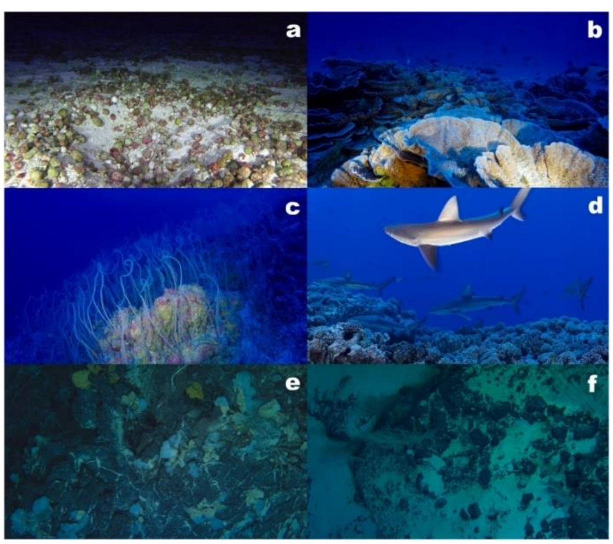

Figure 3a. Images of explorations of the marine biodiversity of the Salas y Gómez and Nazca ridges a. Rhodolith beds on Pukao Seamount at 220 m (credit: Matthias Gorny, Oceana). b. Mesophotic coral ecosystems at 80 m off Anakena, Rapa Nui (credit: Matthias Gorny, Oceana). c. Black corals at 130 m off Vaihu, Rapa Nui (credit: Matthias Gorny, Oceana). d. Sharks on coral reef at 10 m depth off Salas y Gómez Island (credit: Enric Sala, National Geographic). e. Deep-water coral and sponge community on an unnamed seamount on Salas y Gómez ridge at 520 m (credit: JAMSTEC). f. Deep-water coral community off San Ambrosio at 570 m (credit: JAMSTEC). Source: Wagner *et al*. (2021).

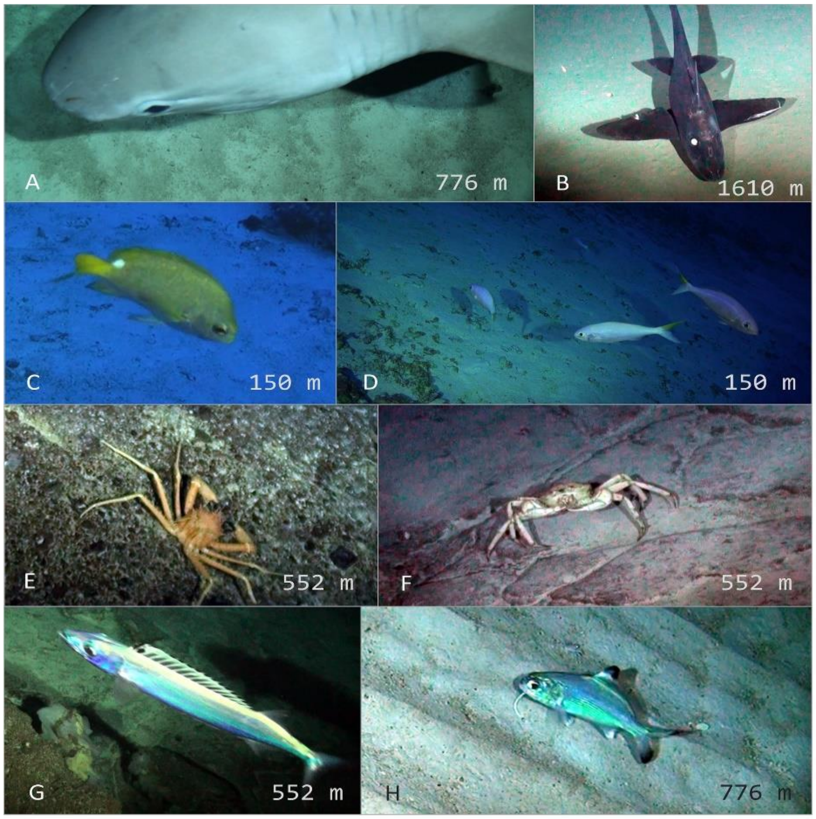

Figure 3b. Representative and unique taxa observed with deep-sea camera systems around Rapa Nui and Salas y Gómez islands. (A) *Hexanchus griseus* (B) *Hydrolagus melanophasma* (C) *Chromis mamatapara** (D) *Parapristipomoides squamimaxillaris* (E) *Homolidae, Yaldwynopsis* sp. (F) *Geryonidae* (G) *Rexea* sp. (H) *Polymixia salagomeziensis**. *endemic species. (Friedlander *et al*. 2021)

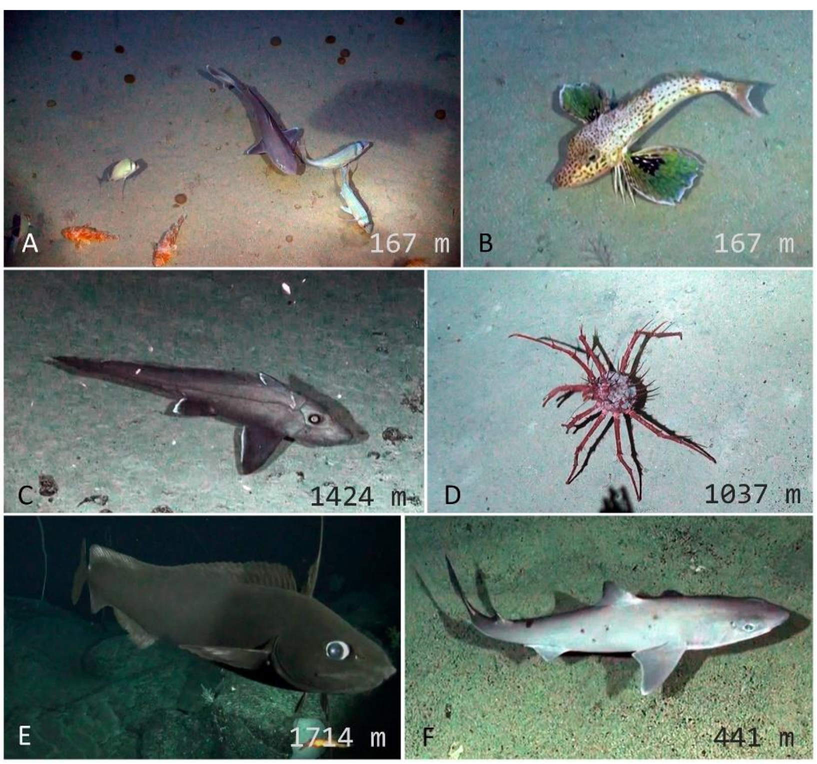

Figure 3c. Representative and unique taxa observed with deep-sea camera systems at Desventuradas Islands. (A) *Nemadactylus gayi**, *Scorpaena orgila**, *Squalus* sp. (B) *Pterygotrigla picta* (C) *Hydrolagus* sp. (D) *Lithodidae* (E) *Antimora rostrata* (F) *Squalus* sp. *endemic species. (Friedlander *et al*. 2021)

Table 1. Inventory of species from the Salas y Gómez and Nazca ridges that are listed on the IUCN red list of threatened species. (EN=endangered; NT=near threatened; VU=vulnerable to extinction; CR=critically endangered). Source: IUCN (2020) from Wagner *et al*. (2021).

Species	Phylum	Class	Order	Family	IUCN Category
Thunnus albacares	Chordata	Actinopterygii	Perciformes	Scombridae	NT
Entomacrodus chapmani	Chordata	Actinopterygii	Perciformes	Blenniidae	VU
Kajikia audax	Chordata	Actinopterygii	Perciformes	Istiophoridae	NT
Makaira nigricans	Chordata	Actinopterygii	Perciformes	Istiophoridae	VU
Thunnus alalunga	Chordata	Actinopterygii	Perciformes	Scombridae	NT
Thunnus obesus	Chordata	Actinopterygii	Perciformes	Scombridae	VU
Canthigaster cyanetron	Chordata	Actinopterygii	Tetraodontiformes	Tetraodontidae	EN
Charadrius nivosus	Chordata	Aves	Charadriiformes	Charadriidae	NT
Thalassarche eremita	Chordata	Aves	Procellariiformes	Diomedeidae	VU
Nesofregetta fuliginosa	Chordata	Aves	Procellariiformes	Oceanitidae	EN
Pelecanus thagus	Chordata	Aves	Pelecaniformes	Pelecanidae	NT
Pterodroma externa	Chordata	Aves	Procellariiformes	Procellariidae	VU
Pterodroma alba	Chordata	Aves	Procellariiformes	Procellariidae	EN
Pterodroma defilippiana	Chordata	Aves	Procellariiformes	Procellariidae	VU
Pterodroma longirostris	Chordata	Aves	Procellariiformes	Procellariidae	VU
Pterodroma atrata	Chordata	Aves	Procellariiformes	Procellariidae	EN
Procellaria aequinoctialis	Chordata	Aves	Procellariiformes	Procellariidae	VU
Procellaria cinerea	Chordata	Aves	Procellariiformes	Procellariidae	NT
Pterodroma cookii	Chordata	Aves	Procellariiformes	Procellariidae	VU
Pterodroma ultima	Chordata	Aves	Procellariiformes	Procellariidae	NT
Larosterna inca	Chordata	Aves	Charadriiformes	Laridae	NT
Phoebastria irrorata	Chordata	Aves	Procellariiformes	Diomedeidae	CR
Pterodroma axillaris	Chordata	Aves	Procellariiformes	Procellariidae	VU
Pterodroma leucoptera	Chordata	Aves	Procellariiformes	Procellariidae	VU
Thalassarche bulleri	Chordata	Aves	Procellariiformes	Diomedeidae	NT
Poikilocarbo gaimardi	Chordata	Aves	Suliformes	Phalacrocoracidae	NT

Species	Phylum	Class	Order	Family	IUCN Category
Ardenna bulleri	Chordata	Aves	Procellariiformes	Procellariidae	VU
Thalasseus elegans	Chordata	Aves	Charadriiformes	Laridae	NT
Isurus oxyrinchus	Chordata	Chondrichthyes	Lamniformes	Lamnidae	EN
Carcharhinus falciformis	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	VU
Galeocerdo cuvier	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	NT
Sphyrna mokarran	Chordata	Chondrichthyes	Carcharhiniformes	Sphyrnidae	EN
Carcharhinus brachyurus	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	NT
Sphyrna corona	Chordata	Chondrichthyes	Carcharhiniformes	Sphyrnidae	NT
Mustelus mento	Chordata	Chondrichthyes	Carcharhiniformes	Triakidae	NT
Triakis maculata	Chordata	Chondrichthyes	Carcharhiniformes	Triakidae	VU
Mobula birostris	Chordata	Chondrichthyes	Rajiformes	Mobulidae	VU
Carcharhinus limbatus	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	NT
Carcharodon carcharias	Chordata	Chondrichthyes	Lamniformes	Lamnidae	VU
Cetorhinus maximus	Chordata	Chondrichthyes	Lamniformes	Cetorhinidae	VU
Rhincodon typus	Chordata	Chondrichthyes	Orectolobiformes	Rhincodontidae	EN
Alopias vulpinus	Chordata	Chondrichthyes	Lamniformes	Alopiidae	VU
Galeorhinus galeus	Chordata	Chondrichthyes	Carcharhiniformes	Triakidae	VU
Carcharhinus leucas	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	NT
Carcharhinus longimanus	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	VU
Prionace glauca	Chordata	Chondrichthyes	Carcharhiniformes	Carcharhinidae	NT
Sphyrna lewini	Chordata	Chondrichthyes	Carcharhiniformes	Sphyrnidae	EN
Sphyrna zygaena	Chordata	Chondrichthyes	Carcharhiniformes	Sphyrnidae	VU
Centroscymnus owstonii	Chordata	Chondrichthyes	Squaliformes	Somniosidae	VU
Heptranchias perlo	Chordata	Chondrichthyes	Hexanchiformes	Hexanchidae	NT
Mobula thurstoni	Chordata	Chondrichthyes	Rajiformes	Mobulidae	NT
Isurus paucus	Chordata	Chondrichthyes	Lamniformes	Lamnidae	EN
Mustelus whitneyi	Chordata	Chondrichthyes	Carcharhiniformes	Triakidae	VU
Balaenoptera bonaerensis	Chordata	Mammalia	Cetartiodactyla	Balaenopteridae	NT

Species	Phylum	Class	Order	Family	IUCN Category
Physeter macrocephalus	Chordata	Mammalia	Cetartiodactyla	Physeteridae	VU
Balaenoptera borealis	Chordata	Mammalia	Cetartiodactyla	Balaenopteridae	EN
Phocoena spinipinnis	Chordata	Mammalia	Cetartiodactyla	Phocoenidae	NT
Balaenoptera musculus	Chordata	Mammalia	Cetartiodactyla	Balaenopteridae	EN
Pseudorca crassidens	Chordata	Mammalia	Cetartiodactyla	Delphinidae	NT
Balaenoptera physalus	Chordata	Mammalia	Cetartiodactyla	Balaenopteridae	VU
Caretta caretta	Chordata	Reptilia	Testudines	Cheloniidae	VU
Chelonia mydas	Chordata	Reptilia	Testudines	Cheloniidae	EN
Eretmochelys imbricata	Chordata	Reptilia	Testudines	Cheloniidae	CR
Lepidochelys olivacea	Chordata	Reptilia	Testudines	Cheloniidae	VU
Dermochelys coriacea	Chordata	Reptilia	Testudines	Dermochelyidae	VU
Porites lobata	Cnidaria	Anthozoa	Scleractinia	Poritidae	NT
Montipora caliculata	Cnidaria	Anthozoa	Scleractinia	Acroporidae	VU
Montipora foveolata	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Favia stelligera	Cnidaria	Anthozoa	Scleractinia	Faviidae	NT
Favia matthaii	Cnidaria	Anthozoa	Scleractinia	Faviidae	NT
Montipora nodosa	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Acropora listeri	Cnidaria	Anthozoa	Scleractinia	Acroporidae	VU
Montipora crassituberculata	Cnidaria	Anthozoa	Scleractinia	Acroporidae	VU
Montipora australiensis	Cnidaria	Anthozoa	Scleractinia	Acroporidae	VU
Acropora nasuta	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Acropora hyacinthus	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Psammocora stellata	Cnidaria	Anthozoa	Scleractinia	Siderastreidae	VU
Pocillopora danae	Cnidaria	Anthozoa	Scleractinia	Pocilloporidae	VU
Acropora lutkeni	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Pocillopora eydouxi	Cnidaria	Anthozoa	Scleractinia	Pocilloporidae	NT
Montipora incrassata	Cnidaria	Anthozoa	Scleractinia	Acroporidae	NT
Holothuria fuscogilva	Echinodermata	Holothuroidea	Aspidochirotida	Holothuriidae	VU

3.2.4. Climate Change Considerations

The world needs to move rapidly and systematically to reduce emissions of green house gases (GHGs) to the atmosphere if it is to avoid irreversible climate impacts (IPCC 2014; IPCC 2018). Greater efforts are essential to accelerate and scale decarbonisation of the global economy and pursue a pathway to net-zero emissions by the middle of the century. The sooner widespread action begins, the more cost-effective it will be, and the greater the chance of avoiding the worst impacts of rapid human-driven climate change.

Following the findings of the IPCC Special Report on the implications of 1.5°C warming above the preindustrial period (IPCC 2018), it is now abundantly clear that stronger action to mitigate GHG emissions is a global imperative that **will require an inclusive approach across the whole of the global economy**. To date, much of the attention has been directed to the role of terrestrial sources of emissions and sinks. The ocean and its coastal regions, however, offer a wide array of additional potential mitigation options.

The ocean plays a fundamental role in regulating global temperatures. Not only does the ocean absorb 93 percent of the heat trapped by rising anthropogenic carbon dioxide (CO_2), but it also absorbs approximately 25 to 30 percent of anthropogenic CO_2 emissions that would otherwise remain in the atmosphere and increase global warming. The ocean also produces around 50 percent of the oxygen on the planet through the photosynthetic activity of marine plants and algae.

The ocean's ability to contribute to these fundamentally important services, however, is at risk (IPCC 2019). Ocean warming and acidification (the latter being a direct result of the extra CO_2 dissolving into the ocean) are damaging marine ecosystems and compromising the ability of the ocean to provide food, livelihoods, and safe coastal living on which billions of people depend (IPCC 2014, 2018, 2019).

A suite of options that have been outlined on how the ocean and coastal regions can contribute to lowering projected emission trajectories (Hoegh-Guldberg *et al*. 2019) and help achieve the temperature stabilisation goals established in the Paris Agreement on Climate Change (UNFCCC 2015). One of them is maintaining intact some key marine ecosystems, as it showed in Figure 4, so the potential of marine organisms to sequester atmospheric carbon is maintained.

Marine fauna (fish, marine mammals, invertebrates, etc.) influence the carbon cycle of the ocean through a range of processes, including consumption, respiration, and excretion. When marine fauna die, their biomass may sink to the deep ocean. In addition, their movement between habitats promotes mixing within the water column, contributing to increased phytoplankton production.

Marine fauna accumulate carbon in biomass through the food chain—starting with photosynthesizing plants that are consumed by animals, which in their turn are consumed. Although there are large data gaps, a first-order assessment estimates that 7 GtCO2e has accumulated within marine fauna biomass (Bar-On *et al*. 2018). However, the net carbon sequestration benefit from marine fauna, once allowance is made for respiration over the lifetime of the animal, respiration and carbon output from the species feeding on feces and carcasses prior to final burial in the seafloor, remains undetermined.

Marine fauna activity can stimulate production by plants (Lapointe *et al*. 2014) and phytoplankton, leading to sequestration of 0.0007 GtCO2e/year (Lavery *et al*. 2010). Populations of vertebrates are an important component of the carbon cycle in ocean ecosystems (Schmitz *et al*. 2018), including predators which can regulate grazers (Atwood *et al*. 2015) and should be given consideration when developing policies to secure nature-based carbon functions. Therefore, there is no question on the positive impacts of increased marine protected areas and sustainable fishery management practices on climate change mitigation.

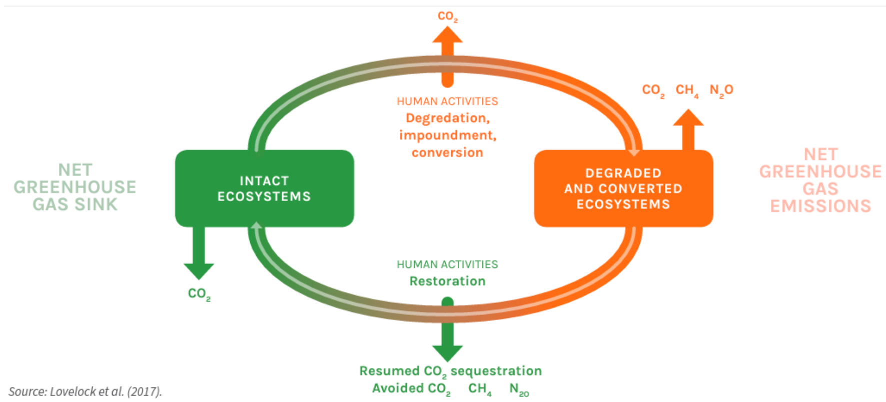

Figure 4. The carbon cycle in coastal and marine ecosystems.

Although for historical reasons the Southeastern Pacific has been one of the least studied regions in the world ocean since the beginning of the 19th century, it is now considered a key region for understanding the evolution of the global climate system. A recent analysis (Dewitte *et al*. 2021) aimed to understand the specific impact of climate change on the offshore area of Southeastern Pacific concludes that: (i) The largest changes in the circulation resulting from global warming are associated with the southward shift and intensification of the anticyclone and with coastal surface warming. Coastal upwelling is projected to be increase off central Chile, due to an increase in equatorward winds, although increased oceanic stratification and associated enhanced nearshore turbulence will yield an onshore deepening/flattening of the thermocline; and (ii) The overall increase in south-easterly trade winds of the South-eastern Pacific in a warmer climate are likely to increase the connectivity pattern between Juan Fernandez and Desventuradas islands, and along the Sala y Gomez ridge, through increasing wind-driven mean ocean currents; (iii) Deoxygenation associated with the warmer temperatures and changes in ventilation are likely to modify marine habitat and the respiratory barriers of species in the seamounts located in the vicinity of the limits of the minimum oxygen zone.

3.3. Fishing Activity and CMMs

Soviet trawling (bottom and mid-water) occurred on high seas seamounts of the Salas y Gómez and Nazca ridges for range of fishes, Chilean jack mackerel (*Trachurus murphyi*) and redbaits

(*Emmelichthys* spp.) in the 1970s and 1980s (Parin *et al*. 1997; Clark *et al*. 2007; Clark 2009; Arana *et al*. 2009). On high seas of Nazca Ridge, Chilean and Russian vessels fished for Chilean jagged lobster (*Projasus bahamondei*) and golden crab (*Chaceon chilensis*) using pots and traps, been the last operation carried out by Chilean fishing fleet until October 1992 (Parin *et al*. 1997; Gálvez-Larach 2009; Clark 2009; Arana 2014). On the Salas y Gómez and Nazca ridges there has been historic pelagic long-line fishing, which has impacted sharks, juvenile swordfish and other pelagic species (Friedlander *et al*. 2013; Gálvez 2012; Vega *et al*. 2009).

There has been historical fishing targeting Chilean jack mackerel (*T. murphyi*), squid (*Dosidicus gigas*), tuna (*Thunnus alalunga*, *T. obesus*, *T. albacares*, and *Katsuwonus pelamis*), striped bonito (*Sarda orientalis*), marlin (*Makaira indica* and *M. nigricans*), and swordfish (*Xiphias gladius*) on the Salas y Gómez and Nazca ridges (Galvez-Larach 2009; Vega *et al*. 2009; Morales *et al*.). Today most of the fishing in this region targets pelagic species and is primarily focused on ABNJ outside Peruvian national waters of the Nazca Ridge (Global Fishing Watch 2020). Catch data on jack mackerel, squid, and jagged lobster in this region are available from the South Pacific Regional Fishery Management Organization (SPRFMO 2020; Table 2), whereas catch data on tuna, billfish, and sharks are available from the Inter-American Tropical Tuna Commission (IATTC 2020; Table 3). Additional fishing effort and other types of effort data in this region are available from Global Fishing Watch (2020), which makes automatic identification system data publicly available (Table 4).

Orange roughy fishery has not been performed in this region despite some exploratory activities carried out by Chile (Payá *et al*. 2005), and therefore there is no current catch data from the Salas y Gómez and Nazca ridges for this species. According to data reported by SPRFMO, squid fishing is also low in high seas waters of the Nazca and Salas y Gómez Ridges. In 2008–2015, SPRFMO catch data only shows two vessels fishing in the area, for a cumulative effort of 20.5 hrs (Table 2). SPRFMO reported catch data for jack mackerel and other unidentified bony fishes is also low (Table 2). In 2008–2016, the total cumulative fishing effort was 2.17 hrs for jack mackerel and 297 hrs for other unidentified bony fishes (SPRFMO 2020). The total amount of jack mackerel caught in this region from 2010 to 2016 was zero (SPRFMO2020).

Data from IATTC (2020) indicate that the vast majority of fishing activity occurring in high seas waters of the Salas y Gómez and Nazca ridges targets tuna, specifically skipjack (*Katsuwonus pelamis*), bigeye (*Thunnus obesus*), and yellowfin tuna (*Thunnus albacares*; Table 3), and occurs just outside Peruvian national waters. Catch data for most species of billfishes and sharks has been zero in the last decade, with the exception of black marlin (*Makaira indica*), blue marlin (*Makaira nigricans*), striped marlin (*Tetrapturus audax*), and swordfish (*Xiphias gladius*; Table 3). However, catch for these species has also been very low, and cumulatively accounted for only 40 metric tons in the last ten years (Table 3).

Summarizing, fishing activities in the high seas of Nazca and Salas y Gomez submarine ridges has been historically low. Nevertheless, on the past few years, squid jigging, and tuna fisheries have been the most conspicuous, particularly in and on the vicinity of Nazca ridge. Bottom trawl fishing does not occur since 1980s and bottom trap fishing since October 1992, and there is not fishing effort on Chilean jack mackerel since 2011.

Table 2. Recent catch data for species managed by the South Pacific Regional Fishery Management Organization (SPRFMO) in the high seas of Salas y Gómez and Nazca ridges. Data source SPRFMO (2020) from Wagner *et al*. (2021); Arana (2014)*.

Common name	Species	Year	Effort (hrs)
Jagged lobster	*Projasus bahamondei*	1991-92	348 ton*
Squid	*Dosidicus gigas*	2016	20.5
Chilean jack mackerel	*Trachurus murphyi*	2011	2.17
Unidentified bony fishes	Osteichthyes	2008	297

Table 3. Retained catch data for species managed by the Inter American Tropical Tuna Commission (IATTC) in high seas waters of the Salas y Gómez and Nazca ridges. Catch data represents cumulative retained catch of the indicated species for the period between 2010 and 2019. Data source IATTC (2020) from Wagner *et al*. (2021).

Common name	**Species**	**Catch (MT)**
Albacore	*Thunnus alalunga*	0
Bigeye tuna	*Thunnus obesus*	3,449
Black skipjack	*Euthynnus lineatus*	0
Bonitos nei	*Sarda* spp.	0
Pacific bluefin tuna	*Thunnus orientalis*	0
Skipjack tuna	*Katsuwonus pelamis*	18,326
Yellowfin tuna	*Thunnus albacares*	3,577
Marlins, sailfishes and spearfishes	Istiophoridae	10
Black marlin	*Makaira indica*	6
Blue marlin	*Makaira nigricans*	20
Striped marlin	*Tetrapturus audax*	3
Indo-Pacific sailfish	*Istiophorus platypterus*	0
Shortbill spearfish	*Tetrapturus angustirostris*	0
Swordfish	*Xiphias gladius*	1
Blue shark	*Prionace glauca*	0
Blacktip shark	*Carcharhinus limbatus*	0
Silky shark	*Carcharhinus falciformis*	0
Oceanic whitetip shark	*Carcharhinus longimanus*	0
Various sharks	*Selachimorpha (Pleurotremata)*	0
Scalloped hammerhead	*Sphyrna lewini*	0
Hammerhead sharks	*Sphyrna* spp.	0
Smooth hammerhead	*Sphyrna zygaena*	0
Thresher sharks	*Alopias* spp.	0

Table 4. Total annual fishing (and other types) effort by vessel class for the high seas waters of Salas y Gómez and Nazca Ridges. All data reported as hours of fishing effort. Data source Global Fishing Watch (2020) from Wagner *et al*. (2021).

Vessel Class	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	Percent of total effort
Squid jigger	82,578	120,531	145,632	172,948	192,630	196,833	199,209	194,899	182,322	1,487,582	48.53%
Drifting longlines	56,785	72,650	73,405	76,751	76,333	81,127	83,902	84,225	80,089	685,267	22.35%
Unknown	39,445	53,249	52,125	62,329	66,677	71,959	97,443	101,704	105,988	650,919	21.23%
Non-fishing	4,478	7,591	8,205	9,407	10,190	11,413	10,703	10,732	6,146	78,865	2.57%
Pole & line	2,266	2,266	2,266	2,266	5,966	6,914	15,510	16,435	13,411	67,300	2.20%
Tuna purse seines	1,518	2,777	3,193	3,954	4,331	5,490	6,323	6,077	5,514	39,177	1.28%
Seismic vessel	1,572	1,572	1,572	1,572	1,572	3,876	3,876	3,884	8	19,504	0.64%
Specialized reefer	736	736	771	771	1,214	1,176	1,693	1,693	1,174	9,964	0.33%
Tug	0	1,500	1,502	1	1	1,502	1,502	1,502	1,502	9,012	0.29%
Cargo or tanker	612	612	1,015	869	801	869	1,015	1,194	287	7,274	0.24%
Trawlers	382	446	502	534	565	613	616	626	593	4,877	0.16%
Other purse seines	27	107	107	202	202	375	541	602	594	2,757	0.09%
Passenger	0	0	0	435	443	451	451	451	16	2,247	0.07%
Purse seines	0	0	0	48	48	117	126	126	57	522	0.02%
Patrol vessel	0	0	0	0	0	0	0	167	0	167	0.01%
Set longlines	16	16	16	16	16	16	16	16	16	144	0.00%

Nazca and Salas y Gómez ridges ecosystem and habitat are no subject to any specific conservation and management measure (CMM) by the SPRFMO and IATTC. In the case of SPRFMO, CMMs are applied by default despite the unique ecological and biological characteristics described for these ridges. For instance, CMM 03-2021 and its predecessors, were developed based on the experience of New Zealand and Australia bottom fisheries on the Western part of the Convention Area. Moreover, there is not “Management Areas” (paragraph 4 of CMM 03-2021) identified for Nazca and Salas y Gomez.

Notwithstanding the above, paragraph 18 of CMM 03-2021 states that “No later than at its 2022 annual meeting, the Commission shall decide on the level of protection required to prevent significant adverse impacts on VMEs, taking into account the advice and recommendations of the Scientific Committee” and, as it has been documented in this paper, seamounts of Nazca and Salas y Gomez ridges are themselves VMEs, thus an advice and recommendation should be developed by the Nineth Meeting of the Scientific Committee of the SPRFMO.

According with the conservation and management measures for the management of new and exploratory fisheries in the SPRFMO Convention Area (CMM 13-2021), any future bottom fishery in Nazca and Salas y Gomez area must be classified as “exploratory fishery”, and therefore, subject to CMM 13-2021. Nevertheless, CMM 13-2021 again does not consider the particularity of the area which has been classified as an EBSA, allowing minor fishing activities which may cause irreversible loss of endemic fauna already identified in these ridges.

Finally, on the introductory part of this paper it was noted that Chile and Perú already have conservation measures implemented on their jurisdictional waters to conserve the biodiversity of Nazca and Salas y Gomez submarines ridges (i.e., Motu Motiro Hiva Marine Park, Rapa Nui MPA and Nazca-Desventuradas Marine Park in the case of Chile, and Nasca National Reserve in the case of Peru). Those MPAs roughly covers about 30% on the entire area of Nazca and Salas y Gomez submarine ridges. Therefore, under Article 4 of the SP-RFMO Convention, we should ensure compatibility of conservation measures established in areas under the national jurisdiction of a coastal State Contracting Party and the adjacent high seas of the Convention Area. Moreover, Article 4, para.2(a) establish that in developing compatible conservation and management measures Contracting Parties shall take into account the particularities of the region concerned.

3.4. Other Activities

In addition to fishing, there are other regular activities performed in the high seas of Nazca and Salas y Gómez ridges, namely passenger's vessels, cargo or tanker ships, reefer vessels and tug vessels (Table 4). Nevertheless, those activities, in theory, have no (or very lower) impact on the marine ecosystem. Activities like submarine cable laying, scientific research cruises and seismic vessels' activities have the potential to produce some detriment in either the environment or marine fauna, although difficult to quantify.

4. CBD Criteria for Ecologically or Biologically Significant Marine Areas (EBSAs)

In 2014, the Salas y Gómez and Nazca ridges were recognized as an ecologically or biologically significant marine area (EBSA) at the 12th Meeting of the Conference of the Parties (CBD 2014), following a regional workshop to facilitate the description of EBSAs in the Eastern Tropical and Temperate Pacific (Figure 1; CBD 2013). Prior to the workshop, Parties, Governments, and other organizations provided detailed scientific justifications to describe potential EBSAs (CBD 2012). Two separate scientific proposals were submitted for the Salas y Gómez and Nazca ridges that summarized the significance of this region (Yañez *et al.* 2012; Gálvez 2012). As defined by the Conference of the Parties to the Convention of Biological Diversity, EBSAs are significant marine areas that are in need of protection or enhanced management and are evaluated based on seven criteria, including uniqueness, special importance for life history stages of species, importance for threatened or endangered species, vulnerability, biological productivity, biological diversity, and naturalness (CBD 2008). The Salas y Gómez and Nazca ridges were determined to be of high importance on all but two of the EBSA criteria (productivity and rarity), thereby underscoring the exceptional importance of protecting this region (CBD 2014). Table 5 shows the results of scoring seven EBSA criteria, which in light of new information available since 2013 could be updated, reinforcing what was obtained in the scientific workshop conducted by the CBD. Indeed, considering new information published, a rate of "low" for "Uniqueness" is questionable and should be revised.

Table 5. Summary of the CBD's EBSA criteria evaluated for Nazca and Salas y Gómez submarine ridges. Detailed justification and explanation for ranking is provided by CBD (2013).

CBD EBSA Criteria	**Description**	**Ranking of criterion relevance**			
		Don't know	Low	Some	High
Uniqueness or rarity	Area contains either (i) unique ("the only one of its kind"), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features		X		
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive				X
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.				X
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				X
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.			X	
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.				X

In addition to its status as an EBSA, the Salas y Gómez and Nazca ridges have also been recognized as an important area by the Global Ocean Biodiversity Initiative and the Global Census of Marine Life on Seamounts (Dunstan *et al*. 2011; Gálvez 2012). Furthermore, these ridges were recognized by Mission Blue as a Hope Spot, which are special places that are scientifically identified as critical to the global health of our ocean (Mission Blue 2020). The islands of Salas y Gómez, San Félix and San Ambrosio are all considered Important Bird Areas by BirdLife International, as these islands host important colonies of Christmas Island Shearwater (*Puffinus nativiatis*), Masked Booby (*Sula dactylatra*), White-throated Storm-petrel (*Nesofregetta fuliginosa*), de Filippi's Petrel (*Pterodroma defilippiana*), and Chatham Petrel (*Pterodroma axillaris*; CBD 2017). These islands, as well as Rapa Nui, are considered key biodiversity areas (KBA) by the KBA Partnership Program (KBA 2020). The waters around the islands of Salas y Gómez, San Félix and San Ambrosio are all considered critical habitats, as defined by the criteria of the International Finance Corporation's Performance Standard (Martin *et al*. 2015).

5. Conclusions and Recommendations

Based on the revision made, it can be concluded that:

- Nazca and Salas y Gomez submarine ridges represent a unique and distinctive ecosystem that must be considered as a whole for any conservation and management measures. Indeed, according with the Convention on Biological Diversity it meets the EBSA criteria and its most conspicuous components, the seamounts, are themselves Vulnerable Marine Ecosystems.

- Since its identification as an EBSA in 2013, new scientific information on the biodiversity of Nazca and Salas y Gomez ridges has been published. Therefore, it worth a detailed scientific analysis by the Scientific Committee of the SPRFMO and the IATTC to advice and recommend on conservation and management measures, including area-based measures.

- Bottom fisheries have not been developed in the high seas of those ridges since 1992 and minor squid and pelagic fisheries occur currently. Therefore, under the precautionary principle, it is timely to consider specific conservation measures in order to protect this unique ecosystem at stage in which its components and habitats are still not decremented.

- Under the under Article 4 of the SPRFMO Convention, specific compatible conservation measures should be considered on the high seas of Nazca and Salas y Gomez ridges in order to match the conservation measures already implemented by Chile in its jurisdictional waters of this region to conserve the biodiversity of an adjacent portions of those ridges.

Consequently, Chile would like to recommend the SPRFMO´ Scientific Committee to carefully consider the scientific value of the information provided in this report and, evaluates if there is sufficient scientific evidence to recommend the Commission to proceed with further analyses, incorporating these ridges in the workplan of the Scientific Committee in order to explore management and conservation options, including area-based measures.

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