SPRFMO
South Pacific Regional Fisheries Management Organisation

9th MEETING OF THE SCIENTIFIC COMMITTEE

Held virtually, 27 September to 2 October 2021

SC9-DW15

Proposed Plan for a 2022 industry acoustic survey on alfonsinos and redbait

European Union

Proposed Plan for an 2022 industry acoustic survey on alfonsinos and redbait

1 Introduction

During the beginning of the 2021 fishing season in the South Pacific, EU fishing vessels encountered large concentrations of Alfonsinos (BYS, Beryx splendens, Splendid alfonsino) and to a lesser extent also concentrations of redbait (EMM, Emmelichthys nitidus, Cape bonnetmouth). An approximate amount of 3000t was caught in this period. These concentrations were encountered above some of the seamounts of the Nazca ridge and Salas y Gomez ridge, west of Antofagasta, Chile (figure 1). To our knowledge, such concentrations of these species have not been encountered before in this part of the South Pacific. With the aim of better understanding the biology, biomass and spatio-temporal distribution of these species, the EU proposes to carry out a dedicated industry acoustic survey in those areas during the spring of 2022.

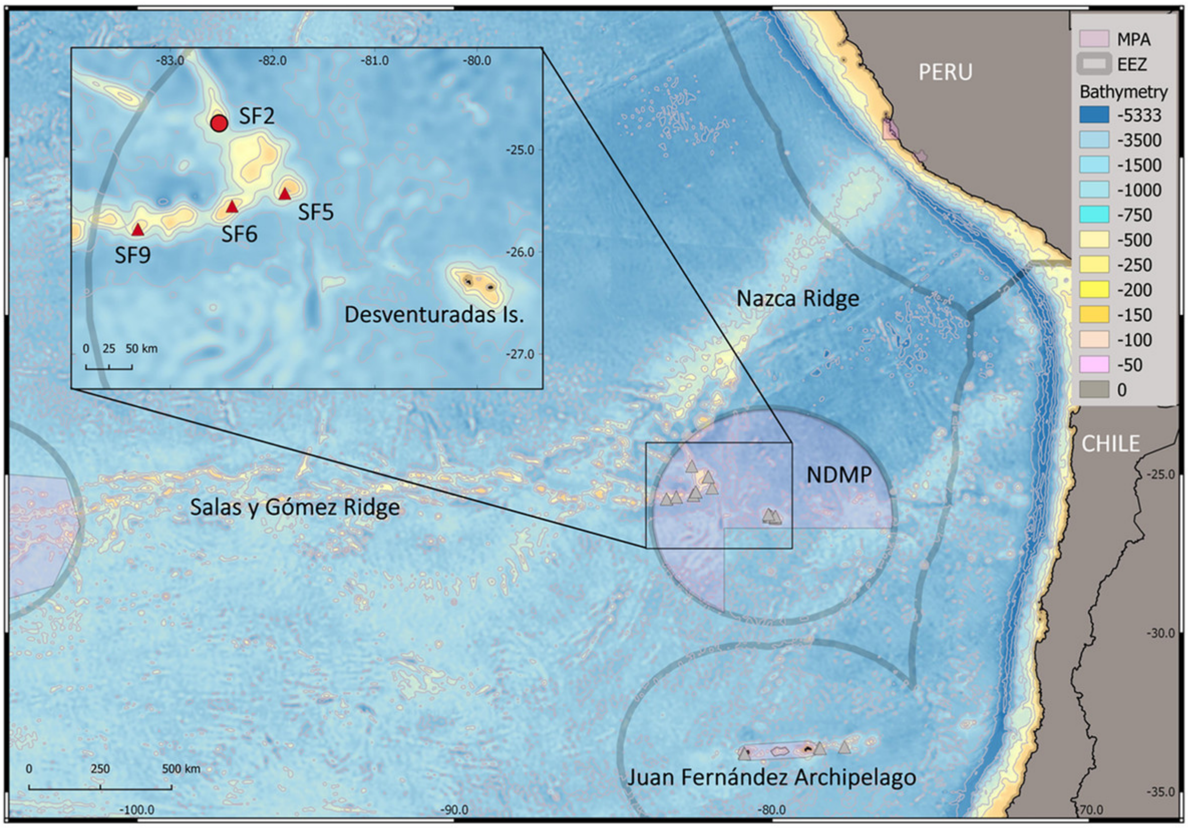

Figure 1: Salas y Gomez Ridge and Nazca Ridge

2 Background on alfonsinos and redbait

2.1 Splendid alfonsino

Figure 2 Bery splendens

Scientific name:	Beryx splendens
Family:	Berycidae
Other names:	Redfish, golden eye perch
Description:	A deep-bodied redfish. The upper parts of the head and body, and the base of the fins, are bright orange-red. The sides of the body are silvery pink. The dorsal fin has four close-set spines and 13 15 soft rays. The anal fin has 3 4 close-set spines and 25 29 soft rays. The lower margin of the operculum (the hard bony flap covering the gills) is finely serrated. Alfonsino have large eyes with a blood red iris.
Size:	Up to 70 cm in length and 4 kg. Usually up to about 40 cm in length.
Life span:	Up to about 23 years.
Habitat:	Alfonsino are bentho pelagic species found in waters of 25-1 300 m depth, commonly in aggregations over rocky bottoms. They are distributed along the European and African coasts, around oceanic islands of the Atlantic Ocean and in the Indian Ocean. Alfonsino is also found in the northern Tasman Sea, along the Pacific coast of the Japanese Archipelago, the Southern Emperor and Northern Hawaiian ridges and westwards towards Chile. Alfonsino tend to aggregate on seamounts. Aggregations are usually associated with rocky/sandy substrates. Juveniles are pelagic.
Prey:	Fish, crustaceans and cephalopods.
Predators:	Larger bony fish and sharks.

Reproduction:	Alfonsino reach reproductive maturity at 5 8 years old. Spawning occurs during the summer. Females are serial spawners and release eggs 10 12 times at intervals of about four days during the spawning season. Females produce 270 000 675 000 eggs per spawning event. Eggs hatch after about 8 days.

2.2 Redbait

Figure 3 Emmelichthys nitidus

Scientific name:	Emmelichthys nitidus
Family:	Emmelichthyidae
Other names:	Pearl fish, picarel, red baitfish, red herring, southern rover, Cape bonnetmouth
Description:	Redbait have slender reddish pink bodies, with a darker bluish-grey back and a silvery white belly. The first 9 10 spines of the dorsal fin are connected by membrane, and are followed by two or three short isolated spines. The pectoral fins are rounded and the caudal fin is forked. The fins are pinkish.
Size:	Up to 50 cm in length.
Life span:	Up to about 8-10 years.
Habitat:	Redbait are a widespread pelagic species that occurs in association with seamounts, mid-oceanic ridges and continental shelfs in the southwest Atlantic, Indian and south Pacific Oceans. They can be found at depths of 20 500 metres. Redbait form schools by size and by depth. Juveniles tend to occur near the surface while adults are found in deeper water closure to the sea floor. Adults move up into the water column at night.

Prey:	Large planktonic crustaceans, cephalopods and small fish.
Predators:	Seals, seabirds and tunas.
Reproduction:	Redbait reach reproductive maturity at 2-4 years of age depending on region. Males mature slightly before females. Spawning occurs over 2 3 months during spring. Redbait are serial spawners, with eggs being released about every three days during the spawning season. Females produce 11 000 27 000 eggs per spawning event depending on their body size. Spawning occurs mostly at night. The eggs are positively buoyant and hatch 2 4 days after fertilisation depending on temperature.

3 Aim

The 2022 industry acoustic survey on alfonsinos and redbait in the northeast of the South Pacific ocean aims to achieve the following objectives:

- Carry out a dedicated acoustic survey on top of a listed number of seamounts of the Nazca ridge and Salas y Gomez ridge with one or two commercial fishing vessels using calibrated echosounders and applying standard acoustic survey procedures. This involves recording acoustic data on pre-agreed transect and biological sampling to assess species composition, size composition and biological and genetic properties of the fish encountered.
- Process and analyse biological and genetic samples, taken during the survey, at appropriate biological and/or genetic laboratory facilities.
- Carry out a scientific scrutiny of the acoustic recordings of the survey, to estimate the abundance by species and size group
- Publish the results of the survey for the attention of the SPRFMO Science Committee 2022.

4 Survey area

The survey area consists of a number of seamounts on the Nazca ridge and Salas y Gomez ridge, as indicated with the red areas below (figure 4). Nine survey areas have been identified:

- Area 1 20NM radius round centre position S20-46 W080-52
- Area 2 20NM radius round centre position S21-25 W081-38
- Area 3 20NM radius round centre position S22-05 W081-18
- Area 4 20NM radius round centre position S22-36 W083-43
- Area 5 12NM radius round centre position S23-15 W082-10

- Area 6 20NM radius round centre position S23-25 W083-21
- Area 7 20NM radius round centre position S24-00 W084-44
- Area 8 20NM radius round centre position S25-30 W085-20
- Area 9 20NM radius round centre position S25-45 W084-25

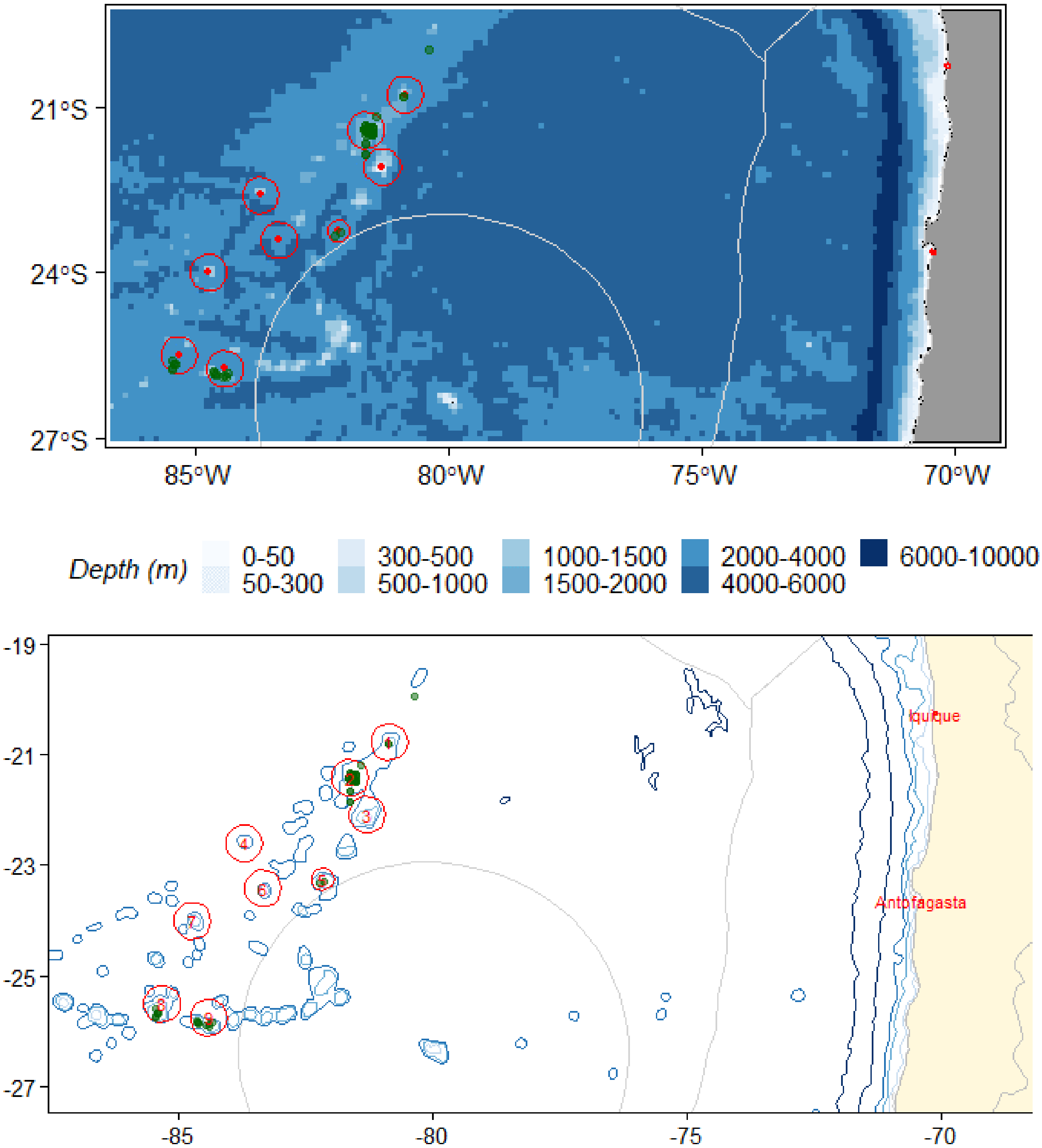

Figure 4 proposed survey area for 2022 industry acoustic survey (green areas indicate fishing positions in 2021)

5 Survey approach

Because the main target species of the survey are known to be associated with specific features in the environment, the acoustic survey will be carried out using the star acoustic survey principle (Doonan et al., 2003; Clark et al., 2016) (Hampton et al., 2013) instead of the more traditional transect based approach (Simmonds and MacLennan, 2008). It is likely that the 8 branches without duplicate approach will be used (Doray et al., 2008, see figure 5). For a 20 NM radius around a seamount, this would equate to a star survey transect of around 100 NM that would take 10 hours steaming time. Assuming that two survey hauls would be carried during each star survey, the total time per star survey would be around 11 hours.

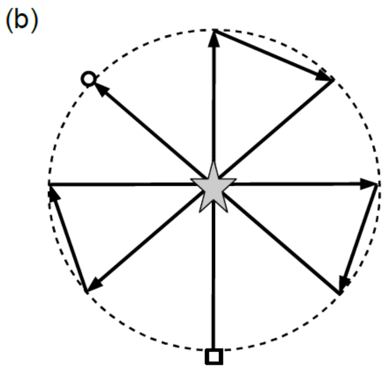

Figure 5 Star acoustic survey with 8 branches without duplicates (Doray et al 2008).

The survey is expected to take approximately 3 weeks of ship-time. The likely timing of the survey is April 2022. Surveying will only take place during night-time when the target species are known to be in the upper water layers. Survey hauls will only be carried out in water depths far shallower than the top of the seamounts which can be monitored with the acoustic equipment.

During the survey one acoustic scientist and one biological scientist will be on board to coordinate the acoustic work and the biological sampling. If fishing operations are deemed necessary by the acoustic scientist, small pelagic survey hauls will be carried out with the aim to generate a biological sample of the observed acoustic marks. Biological sampling hauls will be small (~ 1-5 ton). Assuming two hauls per star survey and around 9 star surveys in total, this would amount to 20-100 tons catch. Given the catches that have been observed in 2021 (up to 200 tons per haul) and also in previous years (see table 1), the catch volume for the survey cannot be expected to have a significant impact on the stock. If the combined survey catches would, due to unforeseen reasons, exceed 200 tons, the survey will be continued without additional sampling hauls. Table 1 provides a summary of alfonsino catches (ALF, BYS) and redbait catches (EMM, EMT) as reported occurring in all areas, 2000-2019.

Table 1. Summary of alfonsino catches (ALF, BYS) and redbait catches (EMM, EMT) in tonnes, as reported occurring in all areas, 2000-2019.

Year	ALF	BYS	EMM	EMT	Total
2000	33	-	-	-	33
2001	33	-	-	-	33
2002	22	-	1,410	-	1,432
2003	191	-	3,778	-	3,969
2004	315	-	2,393	-	2,708
2005	215	-	-	-	215
2006	338	-	-	-	338
2007	892	-	-	-	892
2008	1,499	-	-	-	1,499
2009	5	-	-	-	5
2010	244	-	-	-	244
2011	240	47	-	-	287
2012	154	167	-	0	320
2013	169	73	0	-	242
2014	1	0	-	-	1
2015	48	3	30	-	81
2016	167	0	0	-	168
2017	229	0	0	-	229
2018	260	0	0	0	260
2019	45	13	-	-	58
Grand Total	**5,098**	**304**	**7,611**	**0**	**13,014**

The impact of the survey on other species is likely to be minimal. The main operation during the survey will consist of acoustic surveying that is not impacting on other species. During survey hauls there could be minor catches of other species, but given the capped amount of catch, this is likely to be very small.

Risk to potential bycatches of other species are considered in section 6.

5.1 The fishing gear

The gear used will be a midwater otter trawl (OTM – see Figure 6), towed behind the ship just below the water surface or further down the water column, but without reaching the seabed.

The mesh size of the net codend is between 40 to 55 mm. The expected fishing depth during the biological sampling hauls will be the upper layer of the water column, until a depth of approximately 200 meters. Catch sensors in the net give information about the amount of caught fish. There are sensors every quarter of the codend, and there is no discards chute. The fishery will not have any bottom impact and hence no impact on vulnerable marine ecosystem habitats or bottom species is expected.

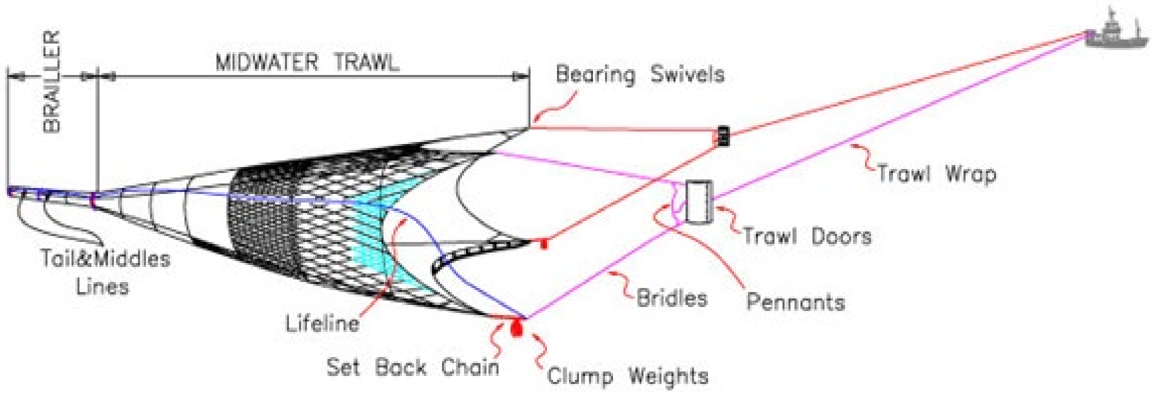

Figure 6. Schematic overview of typical midwater trawl (OTM) gear used to target pelagic species including jack mackerel, alfonsino and redbaits.

6 Risk assessment

The risk assessment below will detail the possible impact of the survey on by-catch (non-target species), with a separate focus on fish species including sharks, skates and rays, sea turtles, sea birds, marine mammals and Vulnerable Marine Ecosystems (VMEs). In this risk assessment, an evaluation has been made of the potential spatial overlap between the survey area and non-target species (fish and ETP-species) and VMEs, catchability of the non-target species, and the likelihood of mortality if the species are caught.

6.1 Fish species, including sharks, skates and rays

Catch data

For fish species, a combination of data sources were reviewed to determine the likely and/or potential bycatch associated with the proposed biological survey. The primary data source was the SPRFMO 'Annual catch data extract June 2021'[1]. Searches were also undertaken of the SPRFMO 'Annual catch Chondrichthyes SPRFMO Area'[2] database and the most recently available summary of SPRFMO bycatch records (SPRFMO 2020).

Of key interest were any records of 'other species of concern' as defined in Annex 14 of CMM 02-2021 (on data standards).

- *Carcharhinus longimanus*, Oceanic whitetip shark, OCS
- *Carcharodon carcharias*, Great white shark, WSH
- *Cetorhinus maximus*, Basking shark, BSK
- *Lamna nasus*, Porbeagle shark, POR
- *Manta* spp., Manta rays, MNT
- *Mobula* spp., Mobula nei, RMV

[1] https://www.sprfmo.int/assets/08-Data-releases-Public-domain/2021-Jun-03-Annual-Catch-data.xlsx

[2] https://www.sprfmo.int/assets/08-Data-releases-Public-domain/2020-Annual-Catch-for-chondrichthyans-caught-in-SPRFMO.xlsx

- *Rhincodon typus*, Whale shark, RHN

a) The SPRFMO dataset 'Annual catch data extract June 2021' was downloaded from the SPRFMO website in August 2021, and the data were treated as follows:

- All participants were selected.
- Data for years 2000-2019 were selected.
- Data for the following areas were selected:
    - EEZ-CHL
    - EEZ-ECU
    - EEZ-PER
    - FAO87
    - HS-SPRFMO
    - HS-SPRFMO-FAO87
- Data for the following gear types were selected:
    - Blank
    - 01.1.0 (surrounding nets with purse lines)
    - 03.0.0 (trawls)
    - 03.2.0 (midwater trawls)
    - 03.2.1 (midwater otter trawls)
    - 99.0.0 (gear not known or not specified)
- Catches in kg were converted to catches in tonnes.
- Catch data for each species were combined within years and countries within a pivot table to create grand total catches per year per species for the 2000-2019 period, as presented in Table 2.

The SPRFMO dataset 'Annual catch Chondrichthyes SPRFMO Area' was downloaded from the SPRFMO website in August 2021, and the data were treated as follows:

- All participants were selected.
- Data for years 2000-2019 were selected.
- Data for the following areas were selected:
    - FAO87 (the only relevant area represented in the data)
- Data for the following gear types were selected:
    - Blank (the only option available after treatment)
- Catches in kg were converted to catches in tonnes.
- Resulting data are presented in Table 3.

The summary of current SPRFMO bycatch records (SPRFMO 2020) includes data obtained through a review of Fishing Activity information from 2007 and Observer information from 2008. All fish species recorded in these data are presented in Table 4.

Table 2. Reported catches from towed and unspecified gears from the HS SPRFMO, Area 87 and EEZs adjacent to Area 87, 2000-2019. (Source: SPRFMO 'Annual catch data extract June 2021') with additional analysis following review of species-specific information in Fishbase (www.fishbase.org) and Sealifebase (www.sealifebase.ca) where relevant.

Species Code	Species	Common name	Sum of Catch Weight (t)	Number of reports	Survey overlap with species distribution	References
CJM	*Trachurus murphyi*	Chilean jack mackerel	22,804,740	191	Limited	https://www.fishbase.se/summary/Trachurus-murphyi.html
GIS	*Dosidicus gigas*	Jumbo flying squid	11,264,410	125	Limited	https://www.sealifebase.se/summary/Dosidicus-gigas.html
MAS	*Scomber japonicus*	Pacific chub mackerel	5,124,537	134	Limited	https://www.fishbase.se/summary/Scomber-japonicus.html
MZZ	*Actinopterygii*	Marine fishes nei	24,688	28	N/A – species group	N/A
SQU	*Loliginidae, Ommastrephidae*	Various squids nei	22,106	4	N/A – species group	N/A
ORY	*Hoplostethus atlanticus*	Orange roughy	3,131	21	Limited	https://www.fishbase.se/summary/Hoplostethus-atlanticus.html
ALF	*Beryx spp.*	Alfonsinos nei	2,646	19	Target species	https://www.fishbase.se/summary/Beryx-splendens.html
SKX	*Elasmobranchii*	Sharks, rays, skates, etc. nei	2,579	5	N/A – species group	N/A
BRU	*Brama australis*	Southern rays bream	1,244	9	Limited	https://www.fishbase.de/summary/Brama-australis.html
UBA	*Cubiceps caeruleus*	Blue fathead	674	7	Limited	https://www.fishbase.se/summary/Cubiceps-caeruleus.html
MOW	*Nemadactylus spp*	Morwongs	277	10	N/A – species group	N/A
ONV	*Neocyttus rhomboidalis*	Spiky oreo	261	11	Limited	https://www.fishbase.de/summary/Neocyttus-rhomboidalis.html
SSO	*Pseudocyttus maculatus*	Smooth oreo dory	244	11	Limited	https://www.fishbase.se/summary/Pseudocyttus-maculatus.html
YTC	*Seriola lalandi*	Yellowtail amberjack	128	11	Limited	https://www.fishbase.se/summary/Seriola-lalandi.html
BWA	*Hyperoglyphe antarctica*	Bluenose warehou	127	11	Limited	https://www.fishbase.de/summary/Hyperoglyphe-antarctica.html
BPQ	*Brama japonica*	Pacific pomfret	70	2	Limited	https://www.fishbase.de/summary/Brama-japonica.html
EMM	*Emmelichthys nitidus*	Cape bonnetmouth	30	1	Target species	https://www.fishbase.se/summary/Emmelichthys-nitidus.html
TAK	*Nemadactylus macropterus*	Tarakihi	23	1	Limited	https://www.fishbase.se/summary/Nemadactylus-macropterus.html
CBA	*Rachycentron canadum*	Cobia	13	1	Not reported in region	https://www.fishbase.de/summary/Rachycentron-canadum.html
CDL	*Epigonus spp.*	Cardinal fishes nei	9	11	N/A – species group	N/A
JAX	*Trachurus spp.*	Jack and horse mackerels nei	7	13	N/A – species group	N/A
POA	*Brama brama*	Atlantic pomfret	6	1	Limited	https://www.fishbase.se/summary/Brama-brama.html
SKJ	*Katsuwonus pelamis*	Skipjack tuna	6	1	Limited	https://www.fishbase.se/summary/Katsuwonus-pelamis.html
TUN	*Thunnini*	Tunas nei	4	2	N/A – species group	N/A
EDR	*Pseudopentaceros richardsoni*	Pelagic armourhead	3	1	Limited	https://www.fishbase.se/summary/Pentaceros-richardsoni.html
BEP	*Sarda chiliensis*	Eastern Pacific bonito	2	1	Limited	https://www.fishbase.de/summary/Sarda-chiliensis.html
BIP	*Sarda orientalis*	Striped bonito	1	1	Limited	https://www.fishbase.de/summary/Sarda-orientalis.html
LXX	*Myctophidae*	Lanternfishes nei	1	1	N/A – species group	N/A
SWO	*Xiphias gladius*	Swordfish	1	1	Limited	https://www.fishbase.se/summary/Xiphias-gladius.html
SNK	*Thyrsites atun*	Snoek	0	1	Limited	https://www.fishbase.se/summary/Thyrsites-atun.html
MOX	*Mola mola*	Ocean sunfish	0	1	Limited	https://www.fishbase.de/summary/Mola-mola.html
BET	*Thunnus obesus*	Bigeye tuna	0	1	Limited	https://www.fishbase.de/summary/Thunnus-obesus.html
LAG	*Lampris guttatus*	Opah	0	1	Limited	https://www.fishbase.de/summary/Lampris-guttatus.html

Table 3. Reported catches of Chondrichthyes from Area 87 2000-2019. (Source: SPRFMO 'Annual catch Chondrichthyes SPRFMO Area').

Year	Area	Fishing Method	Species / Group Code	Species / Group Name	Catch weight (t)
2000	FAO87	Not indicated	SKX	Sharks, rays, skates, etc. nei	438
2001	FAO87	Not indicated	SKX	Sharks, rays, skates, etc. nei	648
2002	FAO87	Not indicated	SKX	Sharks, rays, skates, etc. nei	795
2003	FAO87	Not indicated	SKX	Sharks, rays, skates, etc. nei	289
2004	FAO87	Not indicated	SKX	Sharks, rays, skates, etc. nei	409

Table 4. a) Summary of captures of fish species of concern and the fate in trawl fishing from SPRFMO submissions (Observer coverage by days) b): Summary of captures of fish species of concern and their fate in purse seining from SPRFMO submissions (Observer coverage by set). (Source: SPRFMO 2020).

a)	Fishery	Species code	Species	Common name	Year	Weight (kg)	Number (and fate)	Observer coverage
Jack mackerel (Trawl)		POR	*Lamna nasus*	Porbeagle	2009	12	-	18%
Jack mackerel (Trawl)		POR	*Lamna nasus*	Porbeagle	2015	62	7 (dead)	83%
Jack mackerel (Trawl)		POR	*Lamna nasus*	Porbeagle	2016	97	8 (unknown)	80%
Jack mackerel (Trawl)		POR	*Lamna nasus*	Porbeagle	2017	53	2 (dead)	100%
Jack mackerel (Trawl)		POR	*Lamna nasus*	Porbeagle	2018	11	1 (dead)	40%
b)	Fishery	Species code	Species	Common name	Year	Weight	Number	Observer coverage
Purse seining		POR	*Lamna nasus*	Porbeagle	2017	-	1 (unknown)	13%

Risk assessment – Fish species not listed as 'other species of concern'

Most fish species identified individually in the reported catch of trawl or unspecified gear types within Area 87, adjacent EEZs or HS-SPRFMO regions for the period 2000-2019 have a wide distribution, occurring across extensive areas of the Pacific Ocean or even further (Table 2). No fish species identified individually is known to have a localised distribution around the proposed survey area on the Nazca ridge and Salas y Gomez ridge.

It is apparent that there is not good information available on stock structure, however, and it cannot be ruled out that there are localised stocks of some fish species present, for example for orange roughy (SPRFMO 2009). It is also noted that some data as presented in Table 2 are grouped, including for MZZ (Acinopterygii) – 28 records comprising 24,688 t; it appears highly likely that some of the catch in this category will be of fish species not represented elsewhere in the data. However, overall, the MZZ data represent a very small proportion of the total catch during this period (0.06%).

Table 2 also shows grouped data for SKX (Elasmobranchii) – 5 records comprising 2,579 t. The SKX catches were reported from Area FAO 87, but no gear codes were reported with the data; nevertheless, these are the same five records as presented in Table 3, and it seems unlikely that these catches were taken in midwater trawls given the absence of other, similar catches of sharks, skates and rays elsewhere in the data, including in the jack mackerel fishery (Table 4).

The spatial overlap of the survey with the distribution range of all fish species not listed as 'other species of concern' is assessed as being low-medium. Catchability for all fish species is precautionarily assumed to be high. Risk of mortality is also assumed to be high, but the quantities taken will be monitored closely and are expected to be very small.

Summary Risk

Spatial overlap	Catchability	Risk of mortality
Fish species not listed as 'other species of concern' – Low to Medium	**Fish species not listed as 'other species of concern' – High**	**Fish species not listed as 'other species of concern' – High**

Risk assessment – 'Other species of concern'

- *Carcharhinus longimanus*, Oceanic whitetip shark, OCS

No reports of oceanic whitetip shark were identified in the SPRFMO data examined (Table 2 – Table 4).

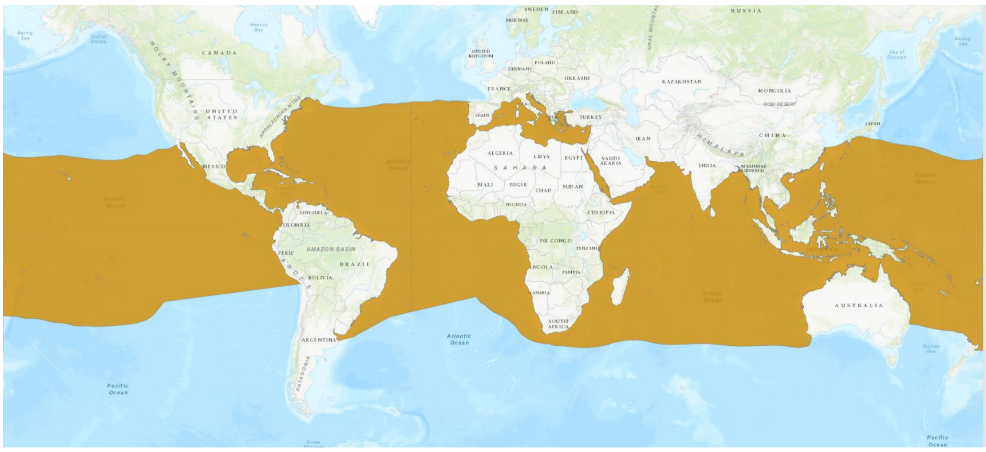

Figure 7. Geographic range of oceanic whitetip shark (Rigby et al. 2019a).

Oceanic whitetip shark is known to be severely overfished in the Western and Central Pacific Ocean (Tremblay-Boyer et al. 2019), but there is no direct estimate of status for this species in the Eastern Pacific Ocean. However, oceanic whitetip shark is known to be truly oceanic (Figure 7) and to show a clear preference for open ocean water between 10^{o}N and 10^{o}S (Rice & Harley 2012a); this is outside of the proposed survey area. Catches of oceanic whitetip shark in EPO longline fisheries have greatly exceeded those in purse seine fisheries (estimated 98.5% versus 1.5% in 2017-18 – IATTC 2019a, and 92.9% versus 7.1% in 2016-17 – IATTC 2018a), further suggesting that this species is at low risk of capture in the proposed survey.

Best practice handling and release methods will be employed for oceanic whitetip shark to the extent practicable (e.g. WCPFC CMM 2019-04). There are no data available on post-release survival of this species from midwater trawls; in tows of very short duration with small catch sizes, however, it is considered likely that mortality rates will be low due to the minimal period of physiological stress and the low risk of crushing within the net (e.g. Hutchinson et al. 2015).

- *Carcharodon carcharias*, Great white shark, WSH

No reports of great white shark were identified in the SPRFMO data examined (Table 2 – Table 4).

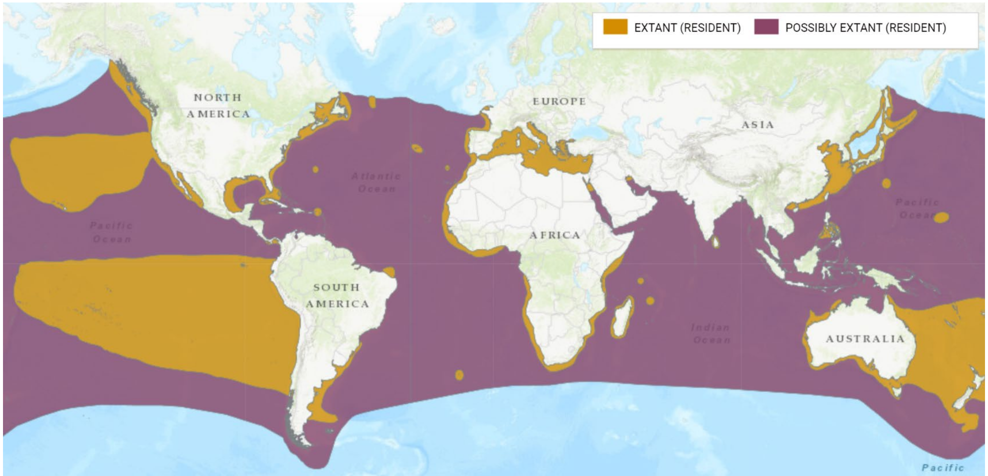

Figure 8. Geographic range of great white shark (Rigby et al. 2019b).

Great white shark is a coastal and oceanic pelagic shark species with a circum-global distribution, occurring most frequently in temperate waters (Rigby et al. 2019b, Figure 8). It is known to undertake very long migrations, including across ocean basins. Population estimates have been derived for the southwestern Pacific (Bruce et al. 2018) and the northeast Pacific (Burgess et al. 2018), but not for the southeast Pacific (FAO area 87); whilst great white shark is considered to be extant in this region, data appear to be particularly limited. It is unclear if the southeast Pacific is not a key region for great white shark, or if it is simply poorly studied in this area. Spatial overlap is consider to be medium.

Great white shark is known to be caught mostly in inshore fisheries by a range of gears, and is rarely caught in offshore pelagic fisheries (Rigby et al. 2019b); this indicates that this species is at low risk of capture in the proposed survey.

Best practice handling and release methods will be employed for great white shark to the extent practicable (e.g. WCPFC CMM 2019-04). There are no data available on post-release survival from midwater trawls for great white shark. However, while the survey tows will be short, minimising the risk of severe physiological stress during the fishing event, safely releasing a potentially large, powerful animal may pose challenges. As such, the risk of mortality if great white shark is caught is assumed to be medium.

- *Cetorhinus maximus*, Basking shark, BSK

No reports of basking shark were identified in the SPRFMO data examined (Table 2 – Table 4).

Basking shark occurs in temperate and tropical waters of the Pacific and Atlantic oceans but is not present in the Indian Ocean (Figure 9). In temperate waters, basking sharks are often found near the surface, whilst in tropical and equatorial waters it is thought to occur deeper, below the thermocline (Rigby et al. 2021). Individuals are known to aggregate, but also to undertake very long migrations, sometimes between ocean basins. Whilst there is some suggestion of genetic differentiation between localised populations, the evidence is weak (Lieber et al. 2020). Similar to great white shark, there are population estimates for basking shark in a number of regions, globally, but these are mainly in the Atlantic Ocean, and it is unclear if the southeast Pacific is not a key region for basking shark or if it is simply poorly studied in this area. Overall, spatial overlap is consider to be medium.

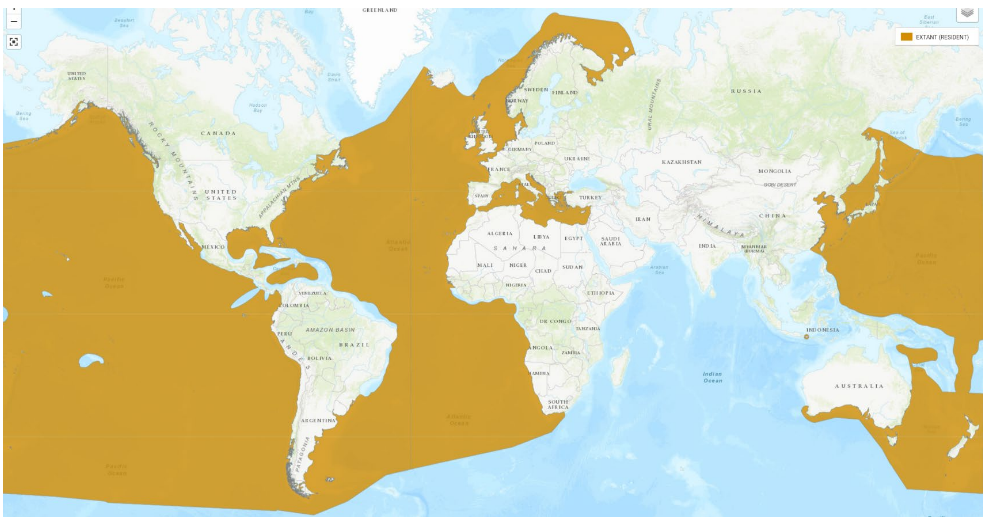

Figure 9. Geographic range of basking shark (Rigby et al. 2021).

Basking shark are taken in trawl fisheries, for example in the deepwater trawl fisheries off New Zealand, which is known to be a global hotspot for this species; in some cases, multiple sharks were taken in a single tow (Francis 2017).

Overall, whilst little is known about the risk posed by the use of midwater trawls in the southeast Pacific, from a precautionary perspective it is appropriate to assume that basking shark is at medium risk of capture in the proposed survey.

Best practice handling and release methods will be employed for basking shark to the extent practicable (e.g. WCPFC CMM 2019-04), but it was not possible to identify data on post-release survival from midwater trawls for this species. As for great white shark, while the survey tows will be short, minimising the risk of severe physiological stress during the fishing event, safely releasing a potentially large, powerful animal may pose challenges. As such, the risk of mortality for basking shark is assumed to be medium.

- *Lamna nasus*, Porbeagle shark, POR

Several reports of porbeagle shark were identified in the SPRFMO data examined (Table 2 – Table 4).

Porbeagle shark has an anti-tropical and disjunct distribution, occurring in the North Atlantic and across the southern hemisphere. Their known distribution in the Eastern Pacific is further south than the proposed survey area (Rigby et al. 2019c, Figure 10).

The first assessment of southern hemisphere porbeagle shark was undertaken by Hoyle et al. 2017. Stock structure is not well understood and it was considered unlikely that the population comprises a single well-mixed stock for management purposes. The assessment was therefore split in to five areas, with one area comprising the Eastern Pacific, and was limited to the region south of 30 ^{0}S. Overall, it was concluded that the stock has been fished sustainably over a long period of time and the impact of fishing was determined to be low across the entire Southern hemisphere range of porbeagle shark (Hoyle et al. 2017).

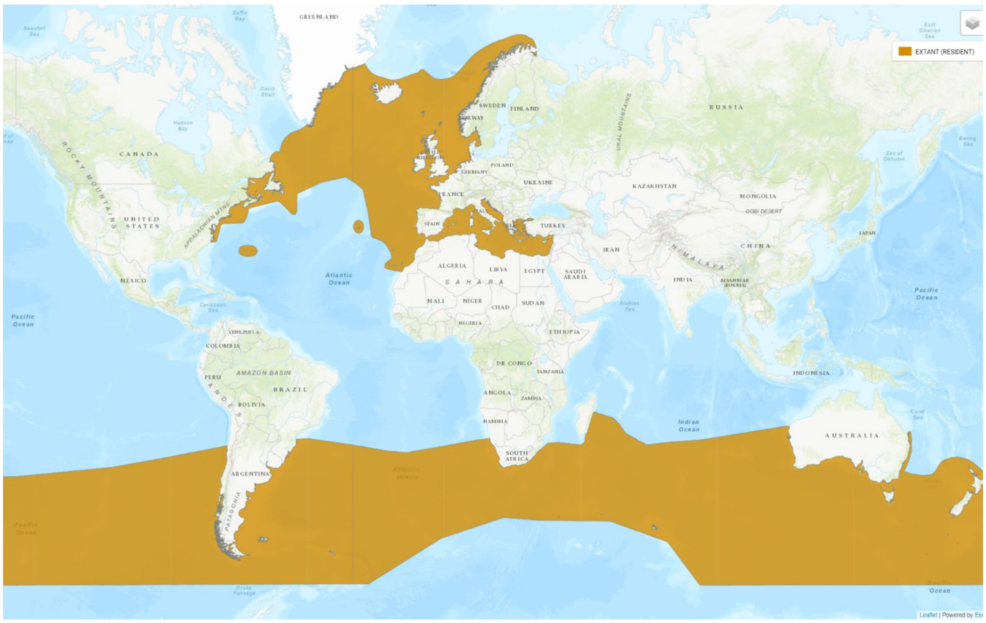

Figure 10. Geographic range of porbeagle shark (Rigby et al. 2019c).

Porbeagle shark are taken in trawl fisheries, including in the jack mackerel fishery which occurs within Area 87 of the southeastern Pacific. However, in the main the jack mackerel fishery occurs further south than the proposed survey area, so it is assumed that the proposed survey would have a low spatial overlap with porbeagle shark.

Overall, little is known about the risk posed to porbeagle shark by midwater trawls in the southeast Pacific, but from a precautionary perspective it is appropriate to assume that this species is at medium risk of capture in the proposed survey.

Best practice handling and release methods will be employed for porbeagle shark to the extent practicable (e.g. WCPFC CMM 2019-04). The data available on post-release survival from midwater trawls suggest that the risk of mortality is high (Table 4). As for oceanic whitetip shark, though, in tows of very short duration with small catch sizes it is considered likely that mortality rates for porbeagle shark will be low due to the minimal period of physiological stress and the low risk of crushing within the net (e.g. Hutchinson et al. 2015).

- *Manta* spp., Manta rays, MNT and *Mobula* spp., Mobula nei, RMV

Risks posed to Manta and Mobulid species are anticipated to be very similar, and so they are combined for this analysis. No reports of Manta or Mobulid species were identified in the SPRFMO data examined (Table 2 – Table 4).

The identification of the Mobulidae can be difficult and is complicated by the fact that the genus Manta has recently been split into the giant manta ray (*Manta birostris*) and the reef manta ray (*Manta alfredi*). There are also three devil ray species that appear to occur in EPO waters; Chilean devil ray – *M. tarapacana*, bentfin devil ray – *M. thurstoni*, and spinetail devil ray – *Mobula mobular*.

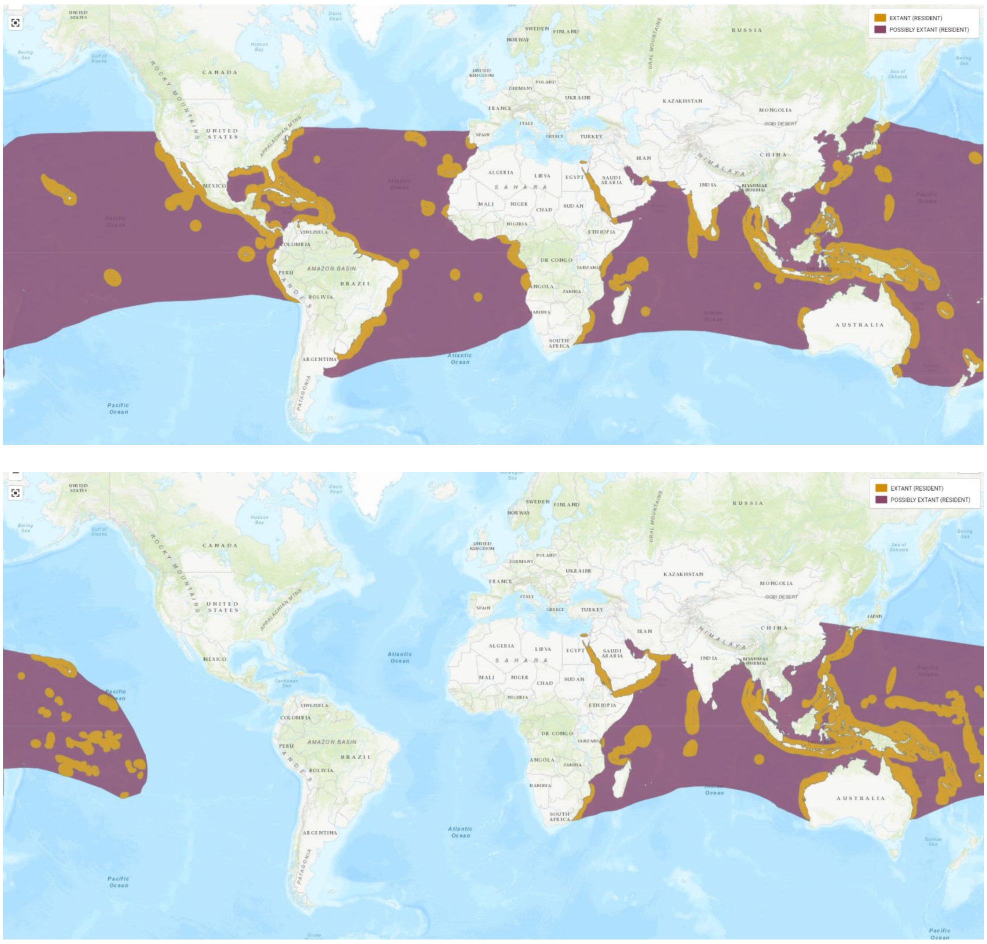

Figure 11. Geographic range of giant Manta ray (top – Source: Marshall et al. 2018) and reef manta ray (bottom- Source: Marshall et al. 2019)

Giant manta ray (Marshall et al. 2018) and reef manta ray (Marshall et al. 2019a) are assessed in the IUCN Redlist as Vulnerable. The distribution of giant manta ray is almost exclusively outside of the area of the proposed survey (Figure 11, top), so it is assumed that there would be a low spatial overlap. Reef Manta ray is not considered to occur in the region (Figure 12, bottom).

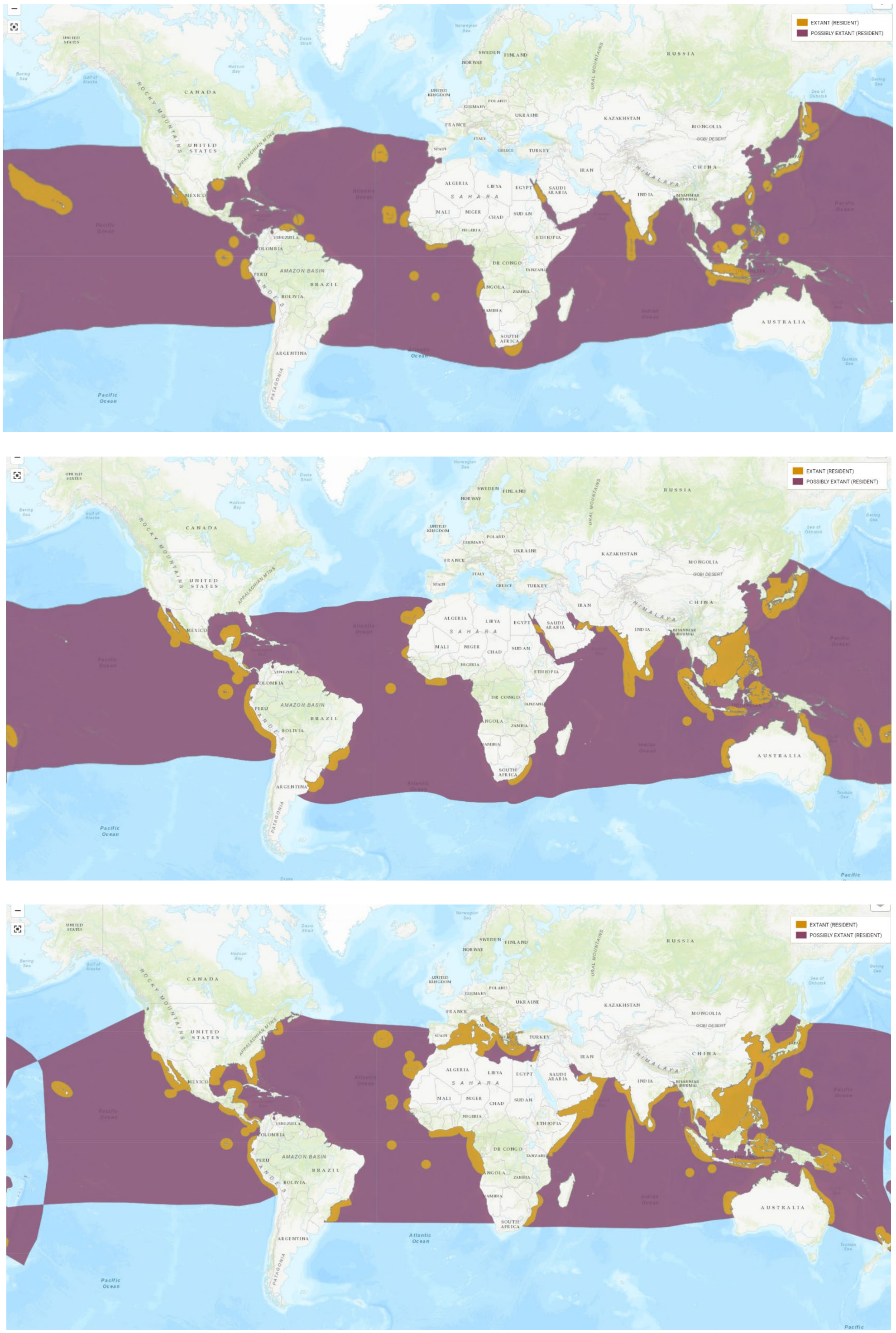

Figure 13. Geographic range of Chilean devil ray (top – Source: Marshall et al. 2019a), bentfin devil ray (middle – Source Marshall et al. 2019b) and spinetail devil ray (bottom- Source: Marshall et al. 2020)

Chilean devil ray (Marshall et al. 2019b), the bentfin devil ray (Marshall et al. 2019c) and the spinetail devil ray (Marshall et al. 2020) are assessed in the IUCN Redlist as Endangered. In all cases, their distribution has a very low overlap with the proposed survey area (Figure 13).

Overall, little appears to be known about the risk posed to Manta and mobulid species by midwater trawls in the southeast Pacific, but from a precautionary perspective it is appropriate to assume that these species are at medium risk of capture in the proposed survey.

Best practice handling and release methods will be employed for Manta and Mobulid rays to the extent practicable (e.g. WCPFC CMM 2019-04). Data on the post-release survival rates of Manta or devil rays from midwater trawl gear are not apparently available. For purse seine interactions, Francis & Jones 2017 showed that rays that are not entangled during the fishing process, even if they are lifted aboard the vessel in the brail, have a good chance of long-term survival (three out of three rays survived in their study after being lifted aboard). On the basis that survey tows as proposed will be very short, minimising the risk of physiological stress, the risk of mortality from midwater trawl gear is assumed to be medium.

- *Rhincodon typus*, Whale shark, RHN

No reports of whale shark were identified in the SPRFMO data examined (Table 2 – Table 4).

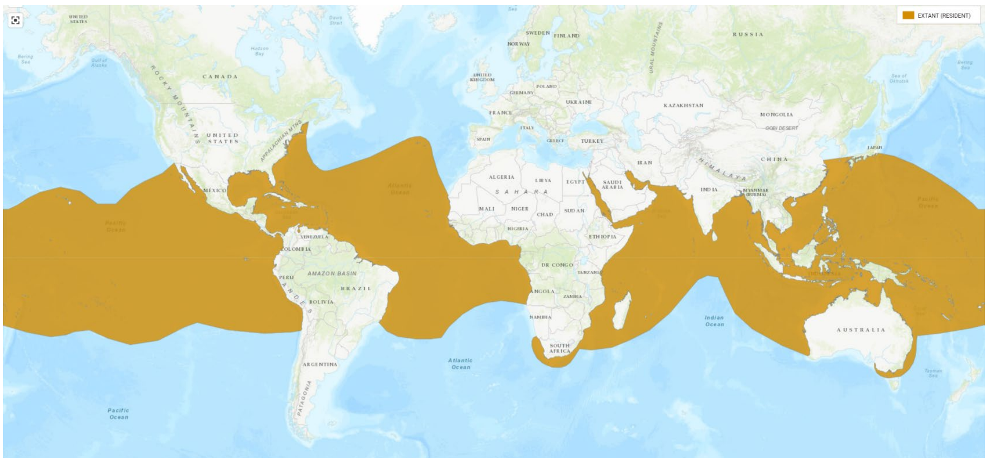

Figure 14. Geographic range of whale shark (Pierce and Norman 2016).

Whale shark has a circumtropical distribution through all tropical and warm temperate seas, apart from the Mediterranean. Their core distribution is between approximately 30°N and 35°S, and whales sharks appear to be temperature limited, as they are rarely sighted in water with a surface temperatures of less than 21°C (Pierce and Norman 2016, Figure 13).

An analysis of tuna purse seine observer data on whale shark interactions was undertaken for the EPO by Román et al. 2018. Although these data are limited to the distribution of the purse seine fishing activity, interactions were nevertheless found to occur exclusively to the north of the proposed survey area, with a hotpot of interaction close to the coast off northern Peru and Ecuador (Figure 14). This is consistent with what is known about the geographic range of whale shark, and it is therefore considered that there would be a low spatial overlap for whale shark with the proposed survey.

Overall, little is known about the risk posed to whale shark by the use of midwater trawls in the southeast Pacific, from a precautionary perspective it is appropriate to assume that this species is at medium risk of capture in the proposed survey.

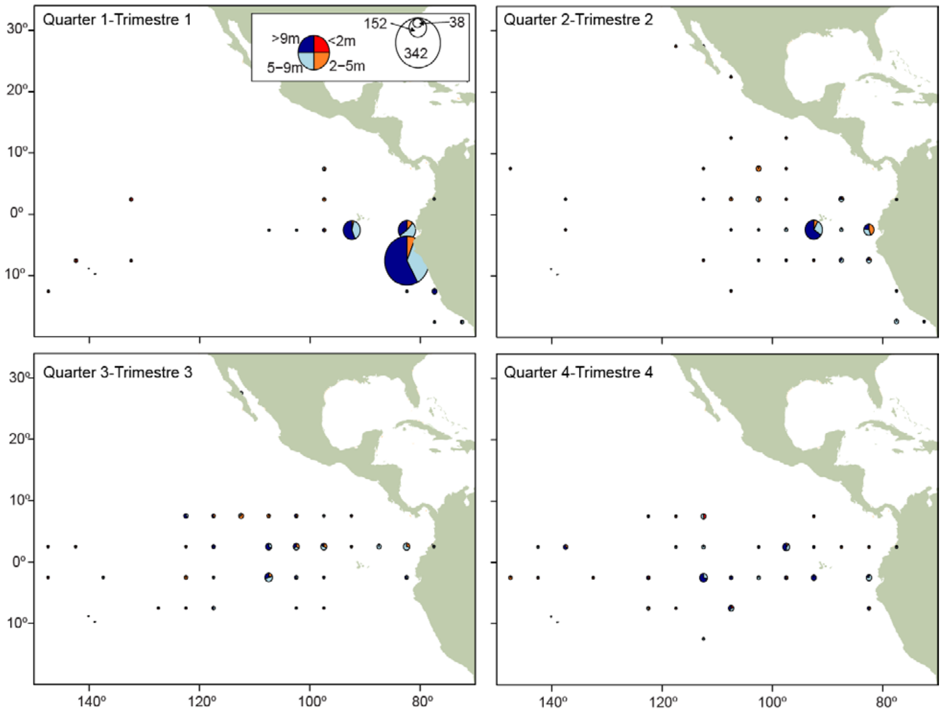

Figure 15. Spatial distribution, by 5° area, of interactions of whale sharks, by length category, with the purse-seine fishery, all set types combined, by quarter, 2005-2016 (Source: Román et al. 2018).

Best practice handling and release methods will be employed for whale shark to the extent practicable (e.g. WCPFC CMM 2019-04), but there are no data available on post-release survival from midwater trawls. As noted for great white shark and basking shark, though, the survey tows will be short, minimising the risk of severe physiological stress during the fishing event. Nevertheless, safely releasing a potentially large, powerful animal such as a whale shark may pose challenges, and so the risk of mortality for this species is assumed to be medium.

Summary Risk

Spatial overlap	Catchability	Risk of mortality
Oceanic whitetip shark – Low	**Oceanic whitetip shark – Low**	**Oceanic whitetip shark – Low**

Great white shark – Medium	**Great white shark – Low**	**Great white shark – Medium**
Basking shark – Medium	**Basking shark – Medium**	**Basking shark – Medium**
Porbeagle shark – Low	**Porbeagle shark – Medium**	**Porbeagle shark – Low**
Manta and Mobulid ray species – Low	**Manta and Mobulid ray species – Medium**	**Manta and Mobulid ray species – Medium**
Whale shark – Low	**Whale shark – Medium**	**Whale shark – Medium**

6.2 Sea turtles

Distribution data

Fisheries bycatch is classified either as the highest threat, or among the highest threats, to sea turtles globally. A total of five out of seven sea turtle species globally occurring were identified as overlapping with the designated survey area to varying degrees (Kot et al., 2018).

These five species are Loggerhead sea turtle (*Caretta caretta*), Green turtle (*Chelonia myda*s), Leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtle (*Eretmochelys imbricata*) and Olive Ridley sea turtle (*Lepidochelys olivacea*). Population trends for these five species are decreasing, populations are severely fragmented (with the exception of Leatherback sea turtle), and numbers of mature individuals are continuously declining (Abreu-Grobois & Plotkin 2008, Casale & Tucker 2017, Mortimer & Donnelly 2008, Seminoff 2004, Wallace et al. 2013). These species are either classified as Endangered (Green turtle), Vulnerable (olive ridley, loggerhead and leatherback) or Critically endangered (hawksbill sea turtle) (IUCN 2020).

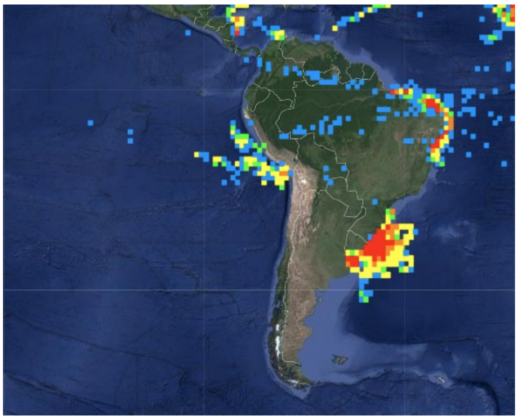

Figure 16. Observations of loggerhead turtles (Kot et al, 2018)

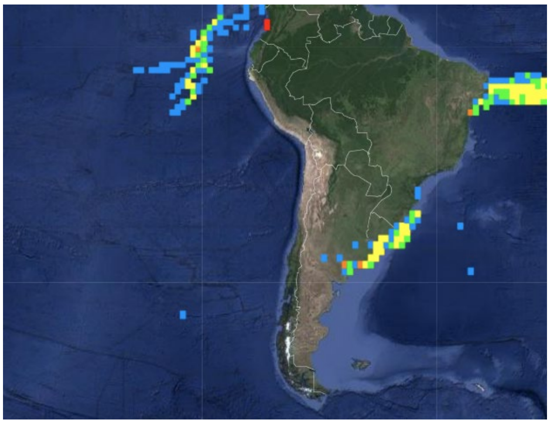

Figure 17. Observations of green turtles (Kot et al., 2018)

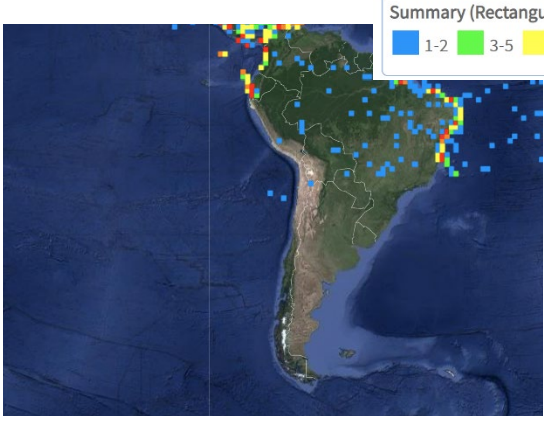

Figure 18. Observations of hawksbill sea turtle (Kot et al, 2018)

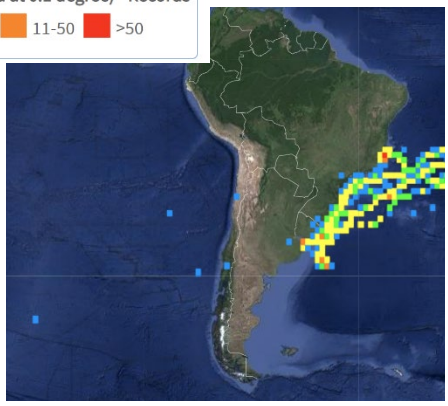

Figure 19. Observations Leatherback sea turtle (Kot et al., 2018)

For olive ridley turtles, no observations have been registered in or near the proposed fishing area (Kot et al., 2018). Salas y Gómez ridge is part of the foraging area for leatherback sea turtles in the South Pacific Gyre (Shillinger et al., 2008).

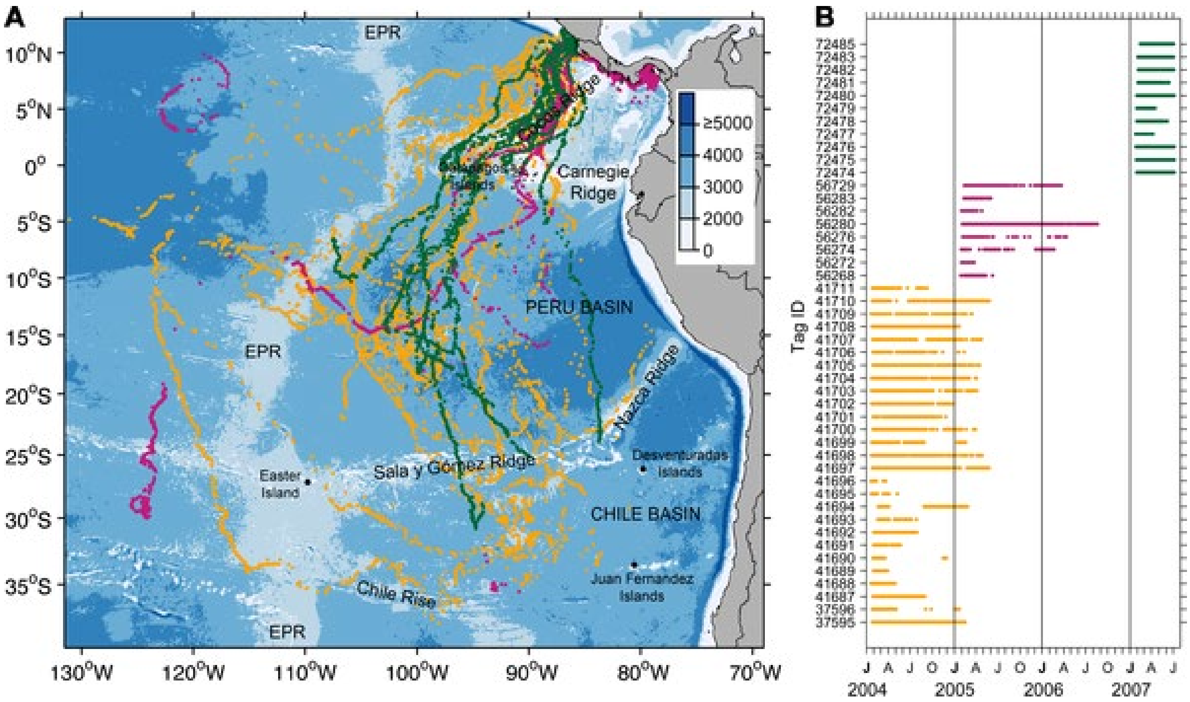

Figure 20 Map and Timeline of leatherback sea turtle tracking data (Figure 1 in Shillinger et al, 2008).

Risk assessment

Although all five species discussed above have a wide range of occurrence as detailed by Kot et al. (2018), the areas where they occur in greater numbers generally are further towards the equator. Observations recorded in the proposed fishing area are made in low numbers, with the exception of loggerhead turtles where observations overlap in greater numbers with the upper boundaries of the survey area. Furthermore, leatherback sea turtle data suggest that the proposed survey area is part of their foraging area. Therefore, the spatial overlap from the survey with green turtle, hawksbill sea turtle and olive ridley sea turtle is considered to be low, whereas for loggerhead sea turtle and leatherback sea turtle it is precautionary considered to be 'medium'.

Catchability is determined by the position of the stock/species within the water column relative to the survey gear. Low, medium and high should be interpreted based on the likelihood of a gear encountering a species. Where a survey overlaps a large proportion of a species distribution range, the risk when taking biological samples is higher because the species has no refuge, and the potential for impact is high. For all turtle species, the overlap of the survey with the distribution range is low-medium as discussed above. The gear relative to the position of the species in the water column is high: all species can occur epipelagic (between 0-200m), which is also the expected fishing depth during the biological sampling (the upper layer of the water column, until a depth of approximately 200 meters). However, an analysis of global distribution of sea turtle catches (Figure 21) show that catches of turtles in trawl nets are low and none were registered for the South Pacific trawl fisheries between

1990-2011. This is partially caused by the fact that in this study (Wallace et al., 2013a) spatial distribution of bycatch records, bycatch rates, and fishing effort varied by fishing gear and across regions. However, the study also states that coastal trawl fisheries may pose the biggest threat, and the South Pacific was not identified as high risk regional management units (RMU) with insufficient bycatch data.

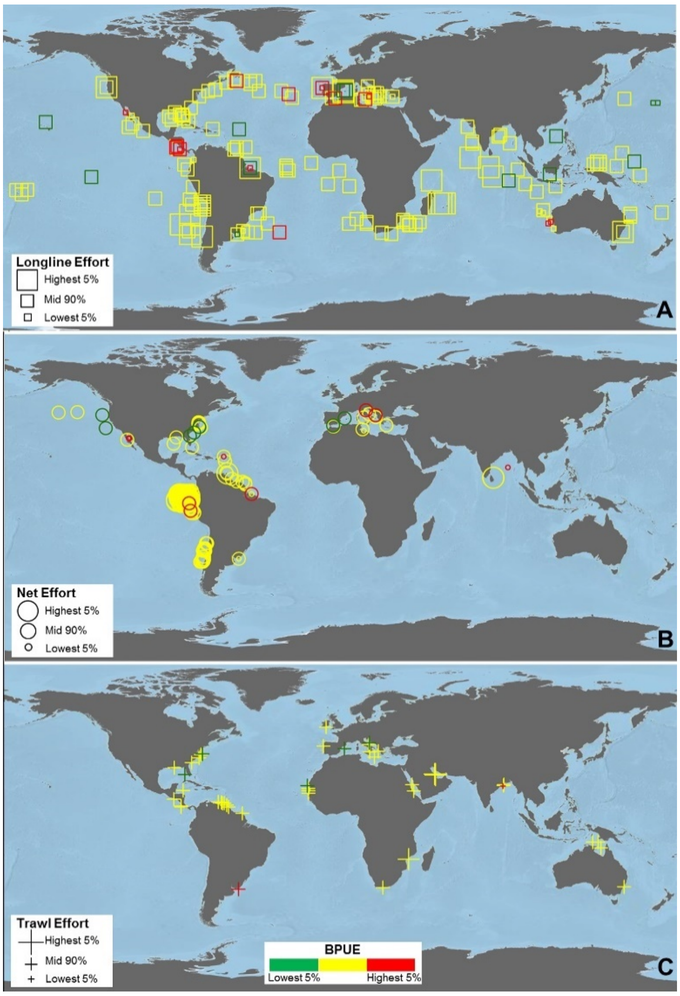

Figure 21. Global distributions of sea turtle bycatch records for longlines (squares, A), nets (circles, B), and trawls (crosses, C) from 1990 to 2011. Symbol size is displayed in three size classes corresponding to amounts of effort (in number of sets) observed in each record; symbol color corresponds three classes of bycatch rates (bycatch per unit effort, or BPUE: number of turtles per set). Only records that reported both a bycatch rate and amount of observed fishing effort were plotted (N = 1,467 records; n [longlines] = 868 records, n [nets] = 377 records, n [trawls] = 222 records). Symbol sizes and colors correspond to low values (lowest 5% of total records), medium values (between lowest 5% and highest 5%), and high values (highest 5% of total records) for each gear category; display of records was prioritized to show high BPUE values, followed by low and then medium values. Where bycatch locations were not provided in the original source, records were mapped relative to general area of operation for the fishery reported (Figure 1 from Wallace et al., 2013a).

Based on the above, the catchability for all species is deemed 'medium'.

Information about mortality rates for sea turtles caught in pelagic fisheries is lacking. In trawl fisheries, the direct initial mortality rate for sea turtles caught in the fishing gear has been estimated to roughly 10-25% (Tagliolatto et al. 2020, Wallace et al. 2013a). Information on indirect mortality after release is lacking. Given that survey hauls are very short, the risk of mortality for sea turtles caught in pelagic midwater trawls is considered to be ‘low’.

Summary Risk

Spatial overlap	Catchability	Risk of mortality
Loggerhead sea turtle - Medium	Loggerhead sea turtle - Medium	Loggerhead sea turtle – Low
Green turtle - Low	Green turtle - Medium	Green turtle – Low
Leatherback sea turtle - Medium	Leatherback sea turtle - Medium	Leatherback sea turtle -Low
Hawksbill sea turtle - Low	Hawksbill sea turtle - Medium	Hawksbill sea turtle – Low
Olive Ridley sea turtle - Low	Olive Ridley sea turtle - Medium	Olive Ridley sea turtle - Low

Data available from the jack mackerel fishery (partially in the same areas, though not over the seamounts) shows that no interactions with sea turtles have been reported for the jack mackerel fishery. This, combined with the information above, leads to an assessment of an overall low risk of the alfonsino and redbaits survey to sea turtles.

6.3 Birds

Distribution data

CMM 09-2017 (minimising bycatch of seabirds; SPRFMO, 2017a) notes that some species of albatrosses and petrels are threatened with global extinction and notes the overlap in the distribution of albatrosses and petrels with fishing effort in the Convention Area. The Agreement on the Conservation of Albatrosses and Petrels (ACAP) is cited as having established best practice seabird bycatch mitigation measures for trawl and demersal longline fisheries (SPRFMO, 2017a).

SPRFMO has signed a memorandum of understanding (MoU) with the Secretariat for the Agreement on the Conservation of Albatrosses and Petrels (ACAP) (SPRFMO, 2014b) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) (SPRFMO, 2016) to facilitate cooperation on efforts to minimise the incidental bycatch of albatrosses and petrels and advance shared objectives with respect to stocks and species with in the South Pacific and Antarctic regions (SPRFMO, 2016), respectively. ACAP applies to the following species:

Albatrosses (22 species)
Diomedea exulans
Diomedea dabbenena
Diomedea antipodensis
Diomedea amsterdamensis
Diomedea epomophora
Diomedea sanfordi
Phoebastria irrorata
Phoebastria albatrus
Phoebastria immutabilis
Phoebastria nigripes
Thalassarche cauta
Thalassarche steadi
Thalassarche salvini
Thalassarche eremita
Thalassarche bulleri
Thalassarche chrysostoma
Thalassarche melanophris
Thalassarche impavida
Thalassarche carteri
Thalassarche chlororhynchos
Phoebetria fusca
Phoebetria palpebrata

Petrels (9 species)
Macronectes giganteus
Macronectes halli
Procellaria aequinoctialis
Procellaria conspicillata
Procellaria parkinsoni
Procellaria westlandica
Procellaria cinerea
Ardenna creatopus
Puffinus mauretanicus

Over the years some interaction (light and heavy contact) were observed with EU vessels targeting jack mackerel, though no by-catches of birds were found (Corten, A., 2015; Wojcik et al., 2017; Wójcik et al, 2018a; Wójcik et al, 2020). From Wójcik et al, 2018a: “The observations of seabirds in the net and around the vessel, initiated in 2014, were continued in 2015 - 2018. No by-catches of birds in the catch were observed. In 2017 no killed sea birds were observed, but six “light” and one “heavy” contact were observed. In the latter case, the bird (Grey-headed Albatross) sat on the water after the collision, but it was not possible to see whether any damage had occurred to this bird.”

In 2016, two collisions between birds and trawl warps were observed, one with a Black-browed Albatross and the other with a White-chinned Petrel. In both cases, the collision was classified as "light" (Wojcik et al., 2017).

In 2015, on two occasions, collisions between birds and trawl warps were observed. In both cases, this concerned Black-browed Albatrosses. One collision was classified as "light" since the bird continued to fly apparently unharmed. In the other case, the collision was classified as "heavy" since the bird sat on the water after the incident. The collisions occurred far behind the vessel where the scaring devices had no effect (Corten, A., 2015).

In 2019, no by-catch or encounters with seabirds were observed, and there was no EU fishery for jack mackerel in 2020 (Wójcik et al, 2020).

Table 5 Observations on birds around the "Annelies Ilena" in May - July 2015 (Corten, A., 2015)

English name	Latin name	Number of observations	Number sighted
Great Albatrosses	*Diomedea sp.*	14	22
Black-browed Albatross	*Thalassarche melanophrys*	43	1133
Salvin's Albatross	*Thalassarche salvini*	13	38
Chatham Albatross	*Thalassarche eremita*	1	1
Grey-headed Albatross	*Thalassarche chrysostoma*	24	83
Buller's Albatross	*Thalassarche bulleri*	2	3
Giant Petrels	*Macronectes sp.*	7	9
Cape Petrel	*Daption capense*	27	521
White-chinned Petrel	*Procellaria aequinoctialis*	34	84
Sooty Shearwater	*Puffinus griseus*	13	22
		Total	1937

More detailed results of the seabird observations in 2016 were presented in a separate document to the SC meeting in 2016 (Raczynski, et al., 2016). This report includes the observations on seabirds made in 2016, as well as a more detailed description of the birds that are present near the vessel.

Table 6. Results of bird observations in May - August 2016 (Table 1 in Raczynski, et al., 2016)

No°	English name	Latin name	IUCN Red List categories ver. 3.1	Populations trends	Number of observation	Number sighted
1	Great Albatrosses	Diomedea sp.	From Vulnerable till Critically Endangered	↓Decreasing One species →Stable	23	59
2	Black-browed Albatross	Thalassarche melanophrys	Near Threatened	↓Decreasing	37	9 714
3	Campbell Albatross	Thalassarche impavida	Vulnerable	↑ Increasing	9	13
4	Salvin's Albatross	Thalassarche salvini	Vulnerable	? Unknown	28	162
5	Chatham Islands Albatross	Thalassarche eremita	Vulnerable	↑ Increasing	10	13
6	Grey-headed Albatross	Thalassarche chrysostoma	Endangered	↓Decreasing	1	1
7	Buller's Albatross	Thalassarche bulleri	Near Threatened	→Stable	10	17
8	Giant Petrels	Macronectes sp.	Least Concern	↑ Increasing	17	29
9	Southern Fulmar	Fulmarus glacialoides	Least Concern	→Stable	1	1
10	Cape Petrel	Daption capense	Least Concern	→Stable	36	2 867
11	White-chinned Petrel	Procellaria aequinoctialis	Vulnerable	↓Decreasing	35	2 235
12	Grey Petrel	Procellaria cinerea	Near Threatened	↓Decreasing	4	11
13	Sooty Shearwater	Puffinus grisseus	Near Threatened	↓Decreasing	3	20
14	Blue Petrel and prions	Pachyptila sp. or Halobaena sp.			8	24
15	Wilson's Storm- petrel	Oceanites oceanicus	Least Concern	→Stable	23	1 397
					Total	16 563

During May - August 2016 period observations were made on a total of 37 days, 10 of which on the Polish "Janus", and 27 on the German "Maartje Theadora".

Based on Table 6 above, Figure 22 below shows the species composition. This composition looks similar to the numbers reported in 2015 (see Table 5), with mainly Black-browed albatrosses (*Thalassarche melanophrys),* Cape petrels *(Daption capense*) and White-chinned Petrels (*Procellaria aequinoctialis*) observed, though in 2015 the grey-headed albatross (*Thalassarche chrysostoma*) was observed more often (83 sightings in 2015 vs 1 in 2016).

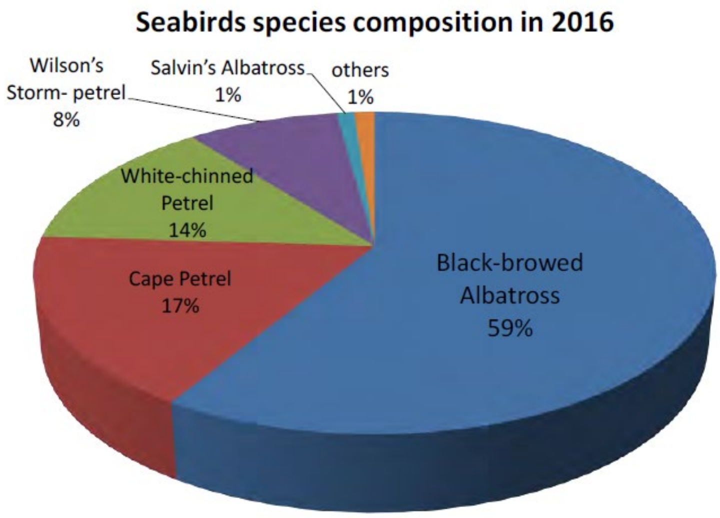

Figure 22. Species composition of all birds observed in 2016 (Figure 2 in Raczynski, et al., 2016)

The main conclusion from Raczynski, et al. (2016) was that pelagic trawlers, in contrast to long liners, do not inflict a significant observed mortality on seabirds.

The data from the EU vessels has been compared to the Chilean Purse Seine Jack Mackerel fishery, for which detailed data was available as part of their MSC-certification (Scarcella et al, 2019). The Chilean Purse Seine Jack Mackerel fishery operates between 26^0 S and 47^0 S, and thus is also further south than the proposed survey. However, the Chilean data can be used to triangulate data sources and provide a comparison to the EU fishery data.

Both the EU vessels, and vessels in the Chilean Purse seine fishery have interactions with the Black browed albatross (*Thallasarche melanophris*), Grey headed albatross (*Thallasarche chrysostoma*), and White chinned petrel (*Procellaria aequinoctialis*).

Many albatrosses and petrels can be observed near the vessel (see e.g. Table 2 and Table 3). Incidents with birds coming into contact with the vessel or the fishing gear were few between 2015-2019, and limited to a few individuals of Grey-headed Albatross, White-chinned Petrel and Black-browed Albatrosses, as detailed above. No mortalities were observed. This is similar for the Chilean Purse seine fishery.

Given the wide range in which albatrosses, petrels and shearwaters occur, the data from the jack mackerel fisheries as discussed above can be considered indicative of seabird interactions for the survey as well.

Serratosa et al (2020) looked into the seabird-at-sea distribution. Studies into seabird assemblages associated along the Humboldt Current show that there are four groups of daily transects with different species composition and distinct spatial distributions across the study area (Serratosa et al., 2020). Mapping these groups in geographic space revealed two spatial patterns. Two of the groups showed a clear segregation, only occurring closer to the Humboldt Current (farther east) or closer to Easter Island (farther west), indicative of a longitudinal structuring of the seabird assemblages. The other two groups, which correspond to sites located around the Juan Fernández and Desventuradas archipelagos, showed a less obvious spatial segregation.

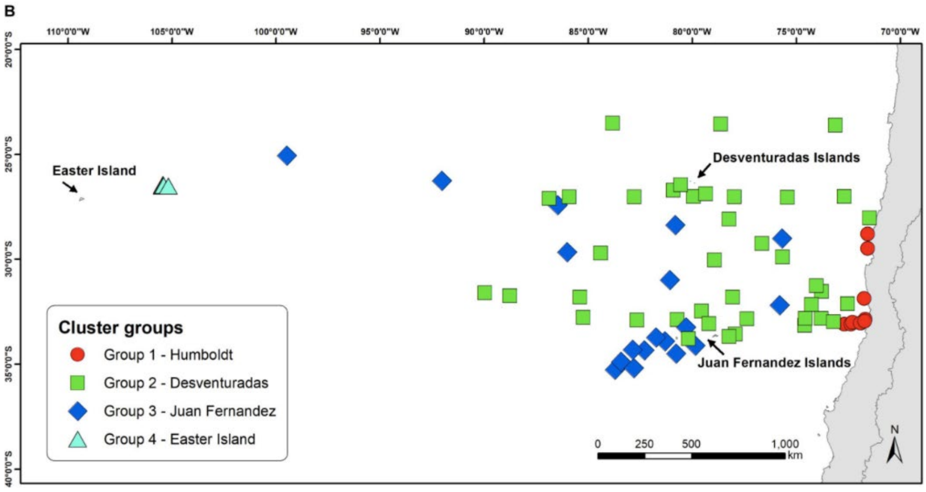

Figure 23. Geographical distribution of the samples sites and their belonging to the different cluster groups. Each symbol and color correspond to one group. Each group is named after the closest oceanographic system. (Figure 2b in Serratosa et al., 2020)

Figure 14 shows that especially the group seabirds that correspond to the Desventuradas Islands-group have a wide distribution going north of the Nazcar ridge at 25^0S and overlap with the proposed survey areas.

Data from Serratosa et al (2020) and an inventory of species from the Salas y Gómez and Nazca ridges that are listed on the IUCN red list by Walter et al. (2021) show that the Black-browed Albatross and Grey-headed Albatross, White chinned petrel, Chathams Island albatross, Grey petrel, and Buller's albatross have been observed in the proposed survey area. These species have also been observed in the jack mackerel fishery (see 5 and Table 6 above), further indicating that the data from this observed fishery can be used to infer possible risks to seabirds for the survey.

Risk assessment

Some bird species are more attracted to fishing boats than others, and this may also vary depending on time of year or region. Seabirds may interact with pelagic trawlers by striking the warps towing the net, or cables, leading to injury or death, or being entangled as the net is close to surface when they try to obtain fish, mostly when the net is hauled. The risk to birds is greatly enhanced when offal from processing the catch aboard is being discarded. At-risk seabirds are therefore those that normally feed on the species targeted in the fishery, or species and sizes that may be discarded, or both. Given that the survey is not expected to generate any discards or offal, the chance of bird interactions with the fishing gear reduces.

It is important to note the uncertainty regarding the sensitivity of specific species. It is well known that the feeding behaviour and thus the species' sensitivity to risk from pelagic trawling varies within bird families, among populations as well as regions, and also depends on the time of year.

Since the survey area overlaps with a great many seabirds, and the fact that seabirds are known to be attracted to fishing vessels, the spatial overlap is classified as 'medium'. For catchability, consideration was given to the fact that the gear-specific risk of midwater trawls to birds is considered as medium (in comparison with, e.g., drift gillnets or pelagic longline which are considered to pose high risk for birds, or pots and traps which are considered to pose low risk for birds) but due to the absence of offal or discard processing, the catchability is considered to be low. When seabirds come into contact with the fishing gear or the vessel, there is a low-medium risk of mortality: as discussed above, there is no significant observed mortality of seabirds, but survivability could be impaired if the bird e.g. damages it's wings, in which case death might not be observed but occur at a later time due to damage. Therefore, this risk has precautionary been classified as 'medium'.

Summary Risk

Spatial overlap	Catchability	Risk of mortality
Albatrosses, Storm-petrels, Petrels, Shearwaters - Medium	**Albatrosses, Storm-petrels, Petrels, Shearwaters - Low**	**Albatrosses, Storm-petrels, Petrels, Shearwaters - Medium**

6.4 Marine mammals

Distribution data

For marine mammals (e.g. sea lions, seals, dolphins and whales) interactions with the survey would be limited to wide-ranging species, occurring far off shore, like dolphins and whales. Most species of pinnipeds inhabit coastal areas, though some travel offshore and feed in deep waters off oceanic islands. The overlap in habitat with the proposed off shore survey is likely to be none to very limited, as there are no oceanic islands in the fishing area.

There are seven species of marine mammals identified for the proposed fishing area (Wagner et al., 2021) (see Table 7).

Table 7. 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). Data source IUCN (2020) (Supplementary table 1 in Wagner et al., 2021).

Balaenoptera bonaerensis	Southern minke whale	Balaenopteridae	NT
Physeter macrocephalus	Sperm whale	Physeteridae	VU
Balaenoptera borealis	Sei whale	Balaenopteridae	EN
Phocoena spinipinnis	Burmeister's porpoise	Phocoenidae	NT
Balaenoptera musculus	Blue whale	Balaenopteridae	EN
Pseudorca crassidens	False killer whale	Delphinidae	NT
Balaenoptera physalus	Fin whale	Balaenopteridae	VU

The high pelagic productivity indicated by the formation of Taylor caps and local upwelling processes observed over the Nazca Ridge may support blue whales (*Balaenoptera musculus*), for which it is considered to be a likely reproductive zone and stepping stone during their extensive migrations (Hucke-Gaete and Mate, 2005).

Risk assessment

Since the fishing area generally overlaps with marine mammals, but there is no specific attraction of the marine mammals listed in Table 7 to fishing vessels (as opposed to e.g. sea lions in coastal areas), the spatial overlap is precautionary classified as 'medium'.

There is limited data available on larger cetaceans with pelagic trawl gear, most studies appear to focus on porpoise and dolphin interactions with the gear or of pelagic longline with larger whales. Whales are likely to be at risk at or near the surface, the highest danger being susceptibility to collision when the whales may be rafting at the surface, e.g., after deep dives. Catchability of whales from midwater trawling itself is thought to be extremely low, and so is the risk of mortality (Perez, 2006). Marine mammals having a risk of mortality from trawling classified as 'medium' are porpoises (in this case the Burmeister's porpoise). If these are swimming close to the fishing gear, it is easier for them to get entangled just as they are turning away from the net.

There are no interactions between the EU South Pacific midwater otter trawl fishery and marine mammals (based on observer reports and self-sampling data, e.g. Wójcik et al, 2020). A summary of current SPRFMO bycatch records (Including species of concern) (SPRFMO, 2021c) encompassing all SPRFMO-fisheries, shows that only in the Chilean fisheries that occur within the Chilean EEZ and thus closer to shore, bycatch of marine mammals has been reported (mainly smaller marine mammals like dolphins, seals and sea lions). This, combined with the information above leads to an assessment of an overall low risk of the alfonsino and redbaits survey to marine mammals, especially given low tow duration when taking biological samples and the option not to trawl when there are sightings of marine mammals.

Regarding marine mammals, as for seabirds, it is important to note the uncertainty regarding the sensitivity of specific species. Feeding strategies of marine mammals and their movements may vary among populations as well as regions, and also depend on the time of year.

Summary Risk

Spatial overlap	Catchability	Risk
Porpoises - High	Porpoises - Medium	Porpoises - Medium
Sperm whales and Rorquals - High	Sperm whales and Rorquals - Low	Sperm whales and Rorquals - Low

6.5 VME encounters

The proposed survey is confined to the "epipelagic habitat" – the uppermost 200 m of the water column, often called the "sunlit zone", where most of the ocean's primary production takes place. The EU survey with midwater otter trawl does not fish near seamounts or reefs, although there are seamounts in the proposed survey area. 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 a deep trench (Parin et al., 1997). The ridge area beyond the Chilean EEZ contains about 110 seamounts with summits at depths down to 2000 m. There are at least 40 seamounts with a summit depth of less than 1000 m but the ridges have not been thoroughly explored. Most of the ridges are below 500 m, with some ridges in the proposed fishing area rising to -300 m.

Because sampling hauls takes place in deep water (>200 m) and targeted species are caught near the ocean surface (between 20-200 m depth), the gear does not interact with bottom habitats.

A number of Ecologically or Biologically Significant Marine Areas (EBSAs) have been identified within the SPRFMO Convention Area by the Secretariat of the United Nations'

Convention on Biological Diversity (CBD), as ratified by the United Nations in 1992 (http://www.cbd.int/ebsa/ebsas). The areas that have been designated as EBSAs in the Eastern Tropical and Temperate Pacific, include the Salas y Gómez and Nazca Ridges.

Based on the EBSAs within the SPRFMO convention area, the SPRFMO SC notes the need for the Commission to implement appropriate and precautionary measures to protect vulnerable elements of the ecosystem, though no formal VMEs have yet been identified for the proposed fishing area.

There are Vulnerable Marine Ecosystems (VMEs) identified in CMM 03-2021 (SPRFMO, 2021b). These VMEs only apply to gear that can be in contact with the seafloor such as bottom trawl, midwater trawl (defined as fishing for bentho-pelagic species using a trawl net that is designed to be pulled through the water near the seabed), and bottom lines (fishing line using a hook or hooks). With regards to the proposed fishery, outside the 200 nautical mile (nm) EEZs, there are no VMEs identified.

Summary Risk

Spatial overlap	Catchability	Risk
VME species	**VME species**	**VME species**
VME habitats	**VME habitats**	**VME habitats**

7 Analysis

The analysis of the acoustic recordings will be carried out by Wageningen Marine Research, IJmuiden, The Netherlands to obtain absolute biomass estimates from the survey area. The processing of the biological and genetic samples will be carried out by a scientific laboratory in either Chile, Peru or Poland.

8 Reporting

The report of the 2022 industry acoustic survey on alfonsinos and redbait is expected to be ready for the SPRFMO SC 2022.

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