By-catch risk assessment for experimental ~~Patagonian~~ toothfish demersal longline fishery: South Tasman Rise, South Pacific Regional Fisheries Management Organisation (SPRFMO) Convention Area

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BACKGROUND

This risk assessment is prepared for the support of a South Tasman Rise ~~Patagonian~~ toothfish exploratory fishing program, and to detail a mitigation strategy for minimising bycatch and overall impact on the South Tasman Rise (STR) ecosystem. Data collection is aimed at providing the SPRFMO Scientific Committee (SC) sufficient data to make informed recommendations to the Commission, as required under **paragraph 8 of CMM 13-16.**

Response by the SC to the first-round proposal noted that bycatch across taxa might be higher in the STR compared to more southern regions due to closer proximity to land (Southern Tasmania). On the basis of recommendation by the SC, focus in this report is given to deep-water chondrichthyans, seabirds, marine mammals, reptiles, and VME species. The SC also specifically requested an examination of Orange Roughy as a bycatch species; this will be done in addition to other fish species.

METHODS

Significant adverse impacts (SAI) are assessed according to Figure 1. The aim is to make qualitative assessments that will incorporate key characteristics of the species aiding the evaluation of 'likeliness' and 'consequence' of bycatch interactions in the case of demersal longline fishing for toothfish on the South Tasman Rise (STR).

Data on spatial overlap and catchability is evaluated and given qualitative assignments of 'Low', 'Low-Med', 'Med', 'Med-high', 'High' and combined to form overall risk. Mitigation is applied, and residual risk is assessed. Species' IUCN status is used to inform decisions on triggers and actions to be taken for managing risk. Finally, there is a feed-back process for using new knowledge gained to reduce risk through enhanced mitigation.

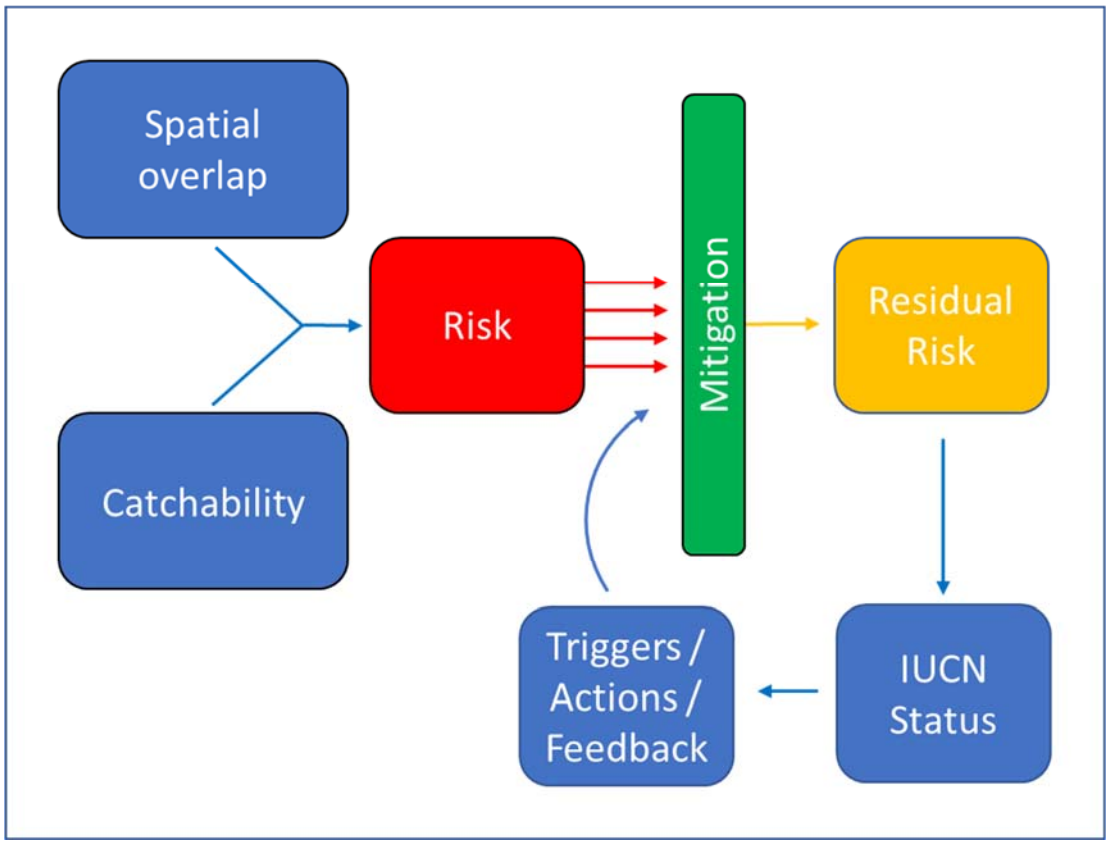


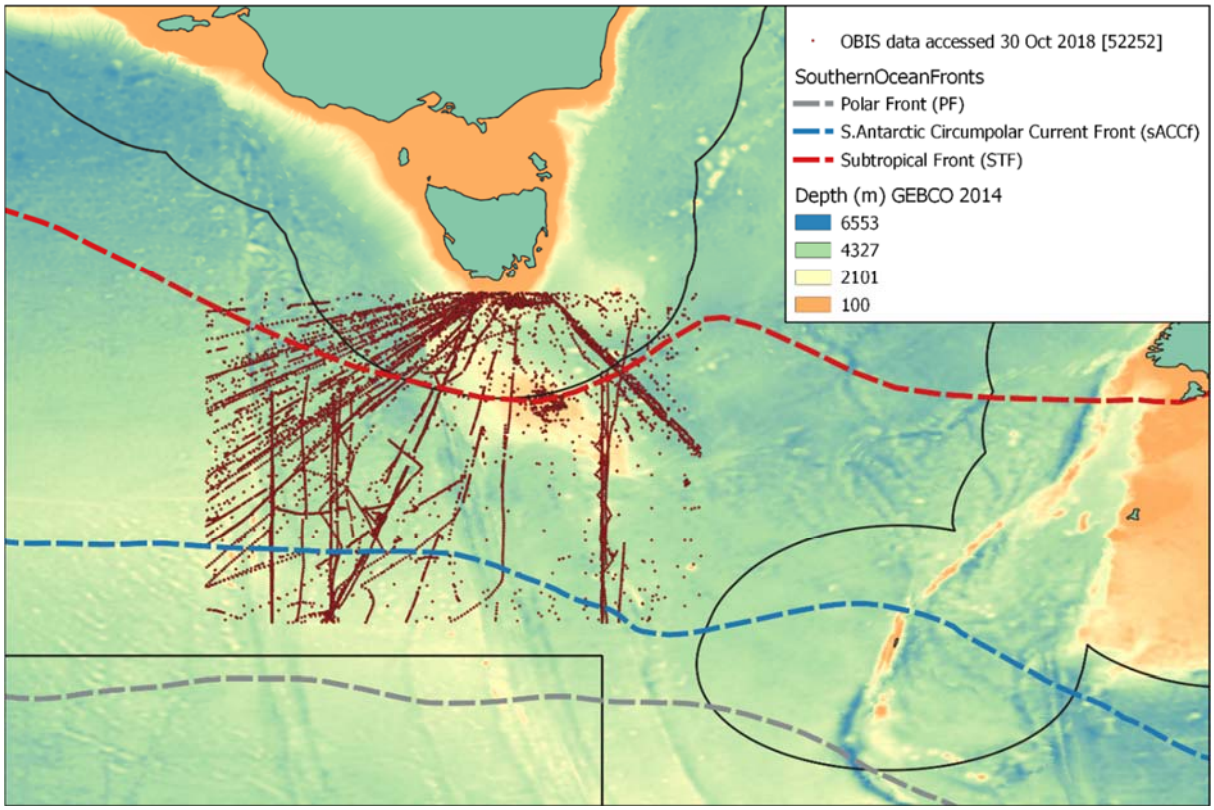
Figure 1. Risk assessment processes.

Spatial overlap

The **SPRFMO Bottom Fishery Impact Assessment Standard (BFIAS)** recommends the in areas where information is lacking on likelihood of occurrence [of VEMs] other information that is relevant to inferring the likely presence of vulnerable populations, communities and habitats should be used. This approach is taken for all species groups potentially impacted by fishing. Data on species observations and predicted occurrences were gathered from multiple validated online and published sources. Data for taxonomic groups and species were cross-validated between multiple sources. Online data were accessed on (30 Oct 2018).

- OBIS (Ocean Biogeographic Information Database). OBIS is an open-access web-distributed global atlas of marine biodiversity and biogeographic database, containing georeferenced species occurrence and associated metadata (Grassle, 2000). OBIS data positions for combined seabirds, fish, reptiles, mammals, invertebrates, and chondrichthyans are shown in Figure 2.
- IUCN (www.iucnredlist.org) was used to gather species distribution data using published mapped spatial data (downloaded shape files) and online Threatened Species lists.
- BirdLife International (www.birdlife.org) holds the IUCN distribution shape files and Threatened Species lists for birds.
- *Biogeographic Atlas of the Southern Ocean* (De Broyer and Koubbi (eds), 2014). A published atlas of Southern Ocean marine species.
- Department of Environment and Energy, Australian Government (www.environment.gov.au). Online species Profile and Threats Database.
- Atlas of Living Australia (www.ala.org.au). An online open-source atlas to the biodiversity of Australia.
- Fishes of Australia (www.fishesofaustralia.net.au) An online open-source atlas to the fish biodiversity of Australia.
- FishBase (www.fishbase.org). A global species database of fish species and mapped predicted distributions via www.aquamaps.org
- *Rays of the World* (Last PR et al 2016)
- *Sharks and Rays of Australia* (Last PR and Stevens JD 2009)
- *Fishes of the Southern Ocean* (Gon O & Heemstra PC 1990)
- Expert opinion from various institutions (SAERI, JNCC, University of St Andrews, Falkland Island Government Fisheries Department)

Species distributions were compared to the expected fishing area of the STR, and a qualitative assessment of likely occurrence overlap was assigned. Qualitative assessment was made on the basis of 1) species observed occurrence in the STR region (OBIS data), 2) the assumed distribution (e.g. IUCN) over the STR region or if it is at the edge of the assumed range 3) prediction in adjacent areas of similar depth if not observed in the STR.



Figures 2. Extent and distribution of OBIS data used in the analysis. Data include 52,252 records spanning all species. Also shown are the major oceanic fronts in the region, and national EEZs.

Catchability

Assuming no mitigation, we assess if the species is susceptible to being caught during demersal longline fishing operations. For seabirds, size, diving behaviour, and other characteristics were considered as gathered from various sources. For non-seabirds, vertical distribution of the species in the water column (either benthic or pelagic) is considered in a relative way; for example, given that the longline is associated with benthic/demersal habitats for long periods (12-16hrs soak time) compared to time spent in the water column during setting and hauling (~6 hrs), higher catchability scores were given to be benthic/demersal species compared to pelagic species based on longer or shorter exposure times to hooks/gear.

Conservation status IUCN

The species IUCN conservation status is considered in the assessment, acting as a modifier to the above. A more conservative approach to species risk with critical conservation status is taken.

Seasonality

Although seasonality may affect the actual species occurrence at the time of expected fishing in the STR area, an assumption was made that likelihood of impact would be the same in the region despite seasonality, thereby applying the most precautionary assessment.

Proposed mitigation and residual risk

Measures for reducing the occurrence of bycatch will be given, and residual impact after mitigation measures will be assessed. The related data collection activities for each bycatch group will be summarised.

ECOLOGICAL SETTING

The South Tasman Rise is a large submerged continental block that abuts southern Tasmania (Hill and Moore 2001). The summit area of the STR is a broad dome rising to about 750 m and is separated from Tasmania to the north by a 3000m deep saddle. The STR forms part of the Australian South-east Marine Region (Hill et al. 2001, cited in Hill and Moore 2001.)

Herraiz-Borreguero and Rintoul (2011) summarise the circulation around the STR. The key oceanic fronts in the region are Subtropical Front (STF) and the South Antarctic Circumpolar Current Front (sACCf) (Figure 1).

The STF straddles the central area of the STR, representing the boundary between warm, salty subtropical waters and cold, fresh Subantarctic waters, where the 11°C and 34.8 psu isotherms run at 150m depth. There is a deep-reaching anticyclonic recirculation cell in the west of the STR, creating a north-westward flow with little apparent flow to the east across the STR. This suggests strong zonal and meridional oceanographic gradients spanning the STR.

Sea surface productivity patterns support gradients across the STR. East of Tasmania there is generally relatively high surface phytoplankton biomass and productivity, whilst in contrast with the lower surface biomass west of the STR. Such biological and physical oceanographic gradients are likely to constrain at least some benthic, pelagic and air-borne species distributions.

The South Tasman Rise has two associated marine reserves lying within the Australian EEZ; the South Tasman Rise Commonwealth Marine Reserve encompassing the northern region of the STR and adjacent seamounts, and the Tasman Fracture Commonwealth Marine reserve lying to the north-west of the STR. In addition, there is a candidate Marine Important Bird Area to the north of the STR within the Australian EEZ ("Indian Ocean, Eastern 14") proposed for protection of Wandering albatross and Short-tailed shearwaters. There is a confirmed M-IBA to the east of the STR ("Pacific, Southwest 15") designated for the protection of Buller's Albatross (www.Birdlife.org).

RISK ASSESSMENT - SEABIRDS

Summary Risk

Spatial overlap	Catchability	Risk of mortality
Medium	Albatrosses and Fulmars - High	Albatrosses and Fulmars - High
	Petrels - Medium	Petrels - High
	Penguins and Prions - Low	Penguins and Prions - Low
Mitigation		
Meets CMM-09-17 **Exceed CMM-09-17; 2 x tory lines** **Meets paragraphs 18 and 19 of CMM 14b-2018** **Vessel light management at night**		
Residual risk after mitigation		
Low		

General assessment

A total of 51 seabirds were identified as overlapping with the STR to varying degrees (Appendix I). Seabirds interact with deep-set longline vessels in a number of ways. At the surface, birds are attracted to baited hooks during line setting at the stern of the vessel, where some species may be caught at the surface only (e.g. most albatrosses) or underwater if the species is able to dive and chase baited hooks while descending (e.g. white chinned petrels). During line hauling, birds are attracted to the starboard side of the vessel nearest the hauling bay with the risk again being caught by hooks while attempting to feed on bait. At-risk seabirds are therefore those larger seabirds that are able to feed on large squid and mackerel bait.

Birds striking the vessel itself, so called light-strike, may cause risk particularly at night when vessel lights can attract seabirds from a great distance. This would be a risk primarily to smaller birds or juveniles rather than larger adult albatross species, such as storm petrels and prions. Although this is not necessarily bycatch, it is related to ship fishing operations.

Specific at-risk species

Without mitigation, many seabirds are at risk of incidental mortalities as result of fishing operations. Some species are known to be particularly at high-risk, such as white chinned petrels, sooty shearwaters, black-browed albatrosses, and fulmars. Penguins are least at-risk.

Albatrosses have an IUCN list rating of “VU – Vulnerable”, “NT – Near Threatened”, or “EN – Endangered”. These rankings are due to their generally declining population sizes as reported from survey data. Petrels and Prions are rated mostly “LC – Lease Concern”.

Mitigation

- Minimum seabird bycatch mitigation commensurate with **SPRFMO CMM 09-17**
    - Sufficiently weight line
    - Use of 2 tory lines
    - Use of bird exclusion devices (BED) around hauling bay
    - Line setting and hauling restricted to hours of darkness
    - Strategic batch discard management
- Management of light emission from vessel at night to avoid light-strike

Trigger / Action

CMM 09-17 sets a trigger level of 0.01 birds/ 1000 hooks before additional mitigation measures must be made. In the instance of exceeding this limit, an evaluation of mitigation measures will be made, including ensuring correct deployment of mitigation, and strengthening mitigation where possible (e.g. further reducing night hours of setting, increasing line sink rate)

Data collection

Data collection requirements under **Annex 7, Section G of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**. Additionally;

- Daily seabird observations by Scientific Observer
- All incidental mortalities will be stored for necropsies
- Daily monitoring and recording of seabird light-strike

RISK ASSESSMENT – MARINE MAMMALS

Summary Risk

Spatial overlap	Catchability	Risk
High	**Whales/Dolphins - Low**	**Whales/Dolphins - Low**
	Otariids - Low	**Otariids - Low**
	Phocids - Medium	**Phocids - Medium**
Mitigation		
Meets paragraph 19 of CMM 14b-2018 **Avoidance of areas of visible mammal activity** **Elephant seals may have limited distribution in the STR** **Fishing planned for November - likely low Elephant seal encounters**		
Residual risk after mitigation		
Low		

General assessment

A total of 34 marine mammals were identified as overlapping with the STR to varying degrees (Appendix II)

The majority of whale species have a high degree of potential overlap with the STR region. Whales are likely to be at risk at or near the surface during setting or hauling, where entanglement would likely result in injury or drowning. Catchability of whales is thought to be very low and varies with species (Werner et al 2015). Orcas and Sperm whales have a very high degree of association with toothfish longline vessels, where interactions are more damaging economically to the vessel in terms of lost or damaged gear and depredation of catch off the line. Damage to individuals may occur, with mortalities relatively low. Similarly, dolphin mortalities are thought to be very rare among toothfish longline vessels.

Otariiid seals have been associated with toothfish longline vessels and have been observed to depredate on catch. Fur seal and sea lion toothfish fishing related mortalities appear to be very rare.

Specific at-risk species

Southern Elephant (*Mirounga leonina*) seals may be at risk to incidental mortality, as has been found in other regions. Van den Hoff et al (2017) summarise recent and historic reports of Elephant seal bycatch. These reports include video evidence of interactions with caught toothfish on the seabed as well as reports made by Scientific Observers of Elephant seal mortalities by drowning related to longline fishing.

Elephant seals can dive for up to 2h to depths over 1500m and bottom times of up to 15mins at deep-depths. Males tend to dive deeper (down to ~ 2000m) compared to females (~ 800m) (Prof. Mike Fedak pers com). Elephant seals are known to travel thousands of kilometres on 10-month long foraging trips (Hindell et al 2016). The closest colony to the STR is on Macquarie Island. IUCN distribution data suggest significant overlap with the STR. However, elephant seal tracking data (Fabien et al 2018) suggest that elephant seals may primarily travel south from Macquarie Island and rarely travel north across the STR.

IUCN listing for all seals are “LC – Least Concern”. Among whale species Fin, Sei, and Blue whales are listed as “EN – Endangered”. Sperm whales are listed as “VU – Vulnerable”, 5 species listed as “LC – Least Concern” or

less, and 12 species listed as "DD – Data Deficient". Dolphins are listed as either "LC- Least Concern" (4), or "DD- Data deficient" (3).

Mitigation

Few mitigation measures have been recommended to avoid marine mammal bycatch. In the case of Orcas and Sperm whales, the vessel will naturally aim to avoid interactions due to depredation behaviour of toothfish, characteristic these species. Seasonal avoidance has been recommended for depredation mitigation and may also be effective for reducing bycatch among other species. Pre-setting and hauling assessments of mammal abundance in the vicinity will be done, and judgement will be made on a case by case basis as to whether vessel avoidance is necessary.

In the case of Elephant seals, there have been no effective mitigation measures recommended for avoiding elephant seal bycatch due in part, to their deep and long-duration diving capabilities. Seasonal avoidance is suggested, where fishing could be conducted in September-November when adult seals are primarily ashore (Van den Hoff et al 2017).

Trigger / Action

Any seal or whale bycatch will trigger a re-evaluation of fishing strategy.

Data collection

Data collection requirements under **Annex 7, Section G of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**. Additionally;

- Cameras on longlines will be deployed – detection of potential Elephant seal interactions
- If caught, and possible to bring on board, gather species identification, sex, length, photographs.
- Sample, when possible to bring on board, whiskers (seals), DNA, stomach contents, length, sex, teeth sample for ageing.

RISK ASSESSMENT - REPTILES

Summary Risk

Spatial overlap	Catchability	Risk
Low	Low	Low
Mitigation		
Meets paragraph 19 of CMM 14b-2018 **Avoidance of areas of visible turtle activity** **Avoid periods of motionless line while suspended in the water column** **Fishing will take place south of known range. Vessel will move further south if turtles are encountered**		
Residual risk after mitigation		
Low		

General assessment

There are three species of turtle with possible overlapping distributions in the region of the STR (Appendix III). Hawksbill turtle (*Eretmochelys imbricate*) and Loggerhead turtle (*Caretta caretta*) range to the northern flanks of the STR, where the Subtropical Front appears to limit a more southerly distribution. The Leatherback turtle (*Dermochelys coriacea*) is limited to the southern coast of Tasmania, and is therefore unlikely to reach as far south as the STR.

Bycatch of turtles is a particularly prevalent in pelagic longline fisheries such as tunas and swordfishes (Lewison and Crowder 2007). Turtles are attracted to bait as well as the lightsticks used is some fisheries, such that both hooking and entanglement can occur leading to drowning. Whilst Hawksbill and Loggerhead turtles are distributed in shallow waters (down to a few hundred meters), Leatherback turtles feed in much deeper water, diving down to 1000m depth (Lutcavage et al 1992).

Interaction of turtles with demersal toothfish longline fishing would likely occur during setting and hauling while the line is suspended in the water column. During setting and hauling the line will travel through the water column at speeds that would reduce the likelihood of turtle bycatch. During line setting, the average sink rates on the *Tronio* are 0.44 ms^{-1} (~ 1 knot) and hauling speeds are approximately 1 ms^{-1} (~ 2 knots) (Joost Pompert, pers com).

Specific at-risk species

The Hawksbill turtle has an IUCN listing of 'Critical'. Loggerhead and Leatherback turtles are rated "Vulnerable".

Mitigation

There are few options for mitigation against turtle bycatch. There is likely to be a natural mitigation given line sink rates during setting, and speed of the line during hauling. During line soak time on the seabed, the line will be out of depth range for Hawksbill and Loggerhead turtles, and will be nears the depth limits for Leatherback turtles. Additional mitigation will be the use of avoidance strategies if turtles are seen in a fishing area, such as avoiding long periods of where the line is left motionless in the water column during setting and hauling.

Trigger / Action

If two turtles are caught in any Research Block, then more southern locations on the STR will be chosen in order to move further away from known areas of turtle distribution.

Data collection

Data collection requirements under **Annex 7, Section G of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**. Additionally**;**

- If a turtle is caught and alive when hauled to the surface, every effort will be made to cut it free and returned alive. The toothfish tagging basket will used to raise the animal from the water to the hauling bay so as not to cause further stress and damage to the animal. The crew will remove the hook cutting through the hook shank, or untangle animal from the line, and lower it back to the surface for release.
- Animals will be checked for tags and photographed.

RISK ASSESSMENT – NON-TARGET FINFISH

Summary Risk

Spatial overlap	Catchability	Risk
Medium	Grenadiers, Morids, Cusk eels - High	High
	Others - Low or unknown	Low
Mitigation		
Precautionary bycatch limit **Low number of lines proposed** **Lines will be set at least 3nm apart from each other, and not set at previous locations.**		
Residual risk after mitigation		
Low		

General assessment

An inventory of fish species observed on the STR was produced from OBIS data (Figure 1). The inventory was filtered to remove those groups that were highly unlikely to be bycaught using deep demersal longline fishing gear (e.g. smaller mesopelagic fishes). Interestingly, Orange Roughy (*Hoplostethus atlanticus*) was not in the OBIS inventory for this region, while other sources suggest that it should be present. After filtering and reviewing other data sources, a total of 163 fish species spanning 57 Families were identified as overlapping with the STR to varying degrees (Appendix IV).

Catchability for many fish families were assessed as 'unknown'; although size and diet of the group could be estimated, there is uncertainty as to whether they would be attracted to baited hooks on the seabed or in the water column. On the basis of other toothfish fisheries, Grenadiers and Morids are highly likely to be caught. Cusk eels are also likely to be caught given that many cusk eel fisheries use deep-set demersal longline systems. Most Perciform fishes are the most diverse group listed for the STR, but are assessed as "low" catchability given their reported smaller size range and diet.

Specific at-risk species

No potential fish bycatch species are particularly at risk. However, some concern was suggested about the potential for Orange Roughy catch as this is a recovering stock. Expert opinion from within the SC suggested that Orange Roughy catch on demersal toothfish longline gear would be highly unlikely.

Mitigation

Section 4.5 of this document prescribes a precautionary total fish bycatch limit. Given the low numbers of lines sets proposed per research block, it is highly unlikely that removals of bycaught species will have an impact on population integrity. However, there may be a cumulative effect of fishing on bycatch populations if fishing on the STR were to continue in future.

Trigger / Action

Section 4.5.1 outlines the bycatch limits and actions for non-target finfish.

Data collection

Data collection requirements under **Annex 7, Sections E and F of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**. Additionally**;**

- Samples will be retained for specialist identification and museum curation
- Samples for DNA analyses will be collected.

RISK ASSESSMENT – CHONDRICHTHYANS

SPRFMO SC6-DW08 Risk Assessment for Chondrichthyans

In this assessment for sharks and rays, the recent risk assessment completed in SC6-DW08 is also considered here in a comparative way. That is to say, the qualitative assessments assigned in this study use some similar concepts as the quantitatively scored, integrated assessment in SC6-DW08 using the PSA and SAFE methods, and therefore any direct use of that assessment here might be confounding.

SC6-DW08 notes that there are both "false positives" and "false negatives" that result in part, from lack of real-world interaction with fishing gears and lack of overall vessel reporting of interactions, respectively. In this sense, the assessment for sharks and rays in this study (and indeed all groups assessed here) is made in consideration of possible interactions using a specific gear type (demersal longline) with known bycatch profiles based on other toothfish fisheries, but from a region (STR) where there is no available historic longline fishing knowledge.

Summary Risk

Spatial overlap	**Catchability**	**Risk**
Skates - Medium	**Skates - High**	**Skates - Medium-High**
Sharks - Medium	**Sharks- High**	**Sharks - Medium-High**
Mitigation		
Precautionary bycatch limit		
Able to release at least some species alive		
Caveat - Risk assessments are possibly over-precautionary due to poor data (*SC6-DW08*)		
Residual risk after mitigation		
Medium		

General assessment

A total of 12 skate species were identified as potentially overlapping with the STR proposed fishing area, with varying degrees of likelihood (Appendix V). Given that skate species are demersal, all skate species are assessed as having a 'high catchability. However, overall risk is reduced due to total bycatch limits prescribed in the Fishing Operation Plan (Section 4.5). The SC6-DW08 assessment (where the species was assessed) also indicates 'low' risk for these species.

A total of 37 shark species and seven species of chimeras, spanning 16 Families, were found to have possible distributions over the proposed fished area of the STR (Appendix V). A mix of demersal and pelagic species are

identified with a few bentho-pelagic species. Catchability of demersal species were considered to be 'high' whilst pelagic species were considered 'medium' catchability given the shorter time the line is suspended in the water column compared to time on the seabed. In terms of over-all risk (before mitigation), 23 species were assessed to be of 'medium-high'risk, and 6 species 'high' risk, given spatial overlap and catchability. Assessments made here were comparable to assessments made for the same species in SC6-DW08, with assessments made in this study somewhat more precautionary. Similarly 'high' risk assessments were made for *Deania calcea* (Brier shark), *Zameus squamulosus* (Velvet dogfish), *Oxynotus bruniensis* (Prickly dogfish), and *Dalatias licha* (Black shark). 'High' risk assessments were made for *Centroscymnus coelolepis* (Portugese dogfish), and *Cetorhinus maximus* (Basking Shark), whilst in the SC6-DW08 assessment these were assessed to be at lower risk. The 'high' risk assessment for the Genus *Centroscymnus* is supported by the particularly high catches of *Centroscymnus viator* (Lantern shark) in the Kerguelen toothfish longline fishery (CCAMLR WG-FSA-18/25).

Specific at-risk species

Of the skate species, the Grey skate (*Dipturus canutus*) has an IUCN listing of 'Endangered'. The Bight skate (*Dipturus gudgeri*) is listed as 'NT – Near Threatened'. Six skate species are listed as 'LC – Least Concern', two species are 'DD – Data Deficient', and two species were not assessed.

Of the 37 shark species identified, eight are listed as 'VU – Vulnerable', nine species as 'NT – Near Threatened', 20 as 'LC – Least Concern', six as 'DD – Data Deficient', and one was not assessed.

Included in the compiled list of species potentially encountered on the STR are three **CMM 02-2018 (Data standards) Annex 14** species; *Carcharodon carcharias* (Great white shark), *Cetorhinus maximus*, (Basking shark), *Lamna nasus* (Porbeagle shark).

Mitigation

Skates can often be recovered from the line and released alive, and this will be done in all cases where skates are likely to survive release. In the case of sharks, it is not likely that any will be in such condition to be released alive, particularly the larger species (e.g. Somniosidae, Lamnidae, Cetorhinidae).

Primary mitigation for reducing risk to chondrichthyans is through precautionary bycatch limits (Section 4.5). It is also likely that risk assessments here are over-precautionary, given paucity of available data for most chondrichthyans in SPRFMO and, particularly for demersal longline fishing in the STR.

Trigger

Section 4.5 outlines catch limits for bycatch species.

Data collection

Data collection requirements under **Annex 7, Sections E and F of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**. Additionally**;**

- Data collection on all chondrichthyan bycatch will be aimed at filling two main data gaps identified in SC6-DW08, namely;
    - **Note** that the assessment has highlighted that additional work on post capture mortality and gear selectivity of deepwater chondrichthyans would aid future analyses and inform potential future mitigation strategies that would minimise risk associated with susceptibility.

- **Recommend** to the SPRFMO Commission that identification protocols and biological data collection for deepwater chondrichthyans is strengthened for SPRFMO demersal fisheries.

This will be done through;

- Where possible, retention of whole animal or diagnostic features (e.g. jaws) with good quality photographs
- An assessment of morbidity and post-release observations of animal if returned.

RISK ASSESSMENT - VME

Summary Risk

Spatial overlap	Catchability	Risk
VME species	VME species	VME species
VME habitats	VME habitats	VME habitats
Mitigation		
Limited impact footprint		
4nm separation between lines		
No spatial overlap of consecutive line setting, eliminating cumulative effects		
Residual risk after mitigation		
Low		

General assessment

OBIS data were used to compile an inventory of possible VME species that will be encountered on the STR. 247 species (and putative species) were identified. These were aggregated into VME groupings as recommended in SC6-DW09 for VME species and habitat indicators, where 9 out of the 10 groupings were identified on the STR (Appendix VI). The Porifera (PRF) were further split into the Demospongiae (DMO) and Hexactinellida (HXY) as recommended in CCAMLR (CCAMLR VME taxa Classification Guide 2009). Not found on the STR inventory were the Gorgonacea (GGW).

Recently, a great deal of recent work has been done developing methods for estimating impact of fishing on VMEs in the SPRFMO area (e.g. SPRFMO SC6-Report). This work has focused primarily on impact of trawl fisheries on VMEs, using historical data to help guide the setting of thresholds, triggers, move-on rules, etc. Challenges in prescribing similar VME management tools for demersal longline fisheries have been identified, primarily related to lack comparative longline-derived VME catch and effort data, and the likely low detection rate of VME species when using demersal longline fishing gear.

Given the lack of demersal longline fishing on the STR, it is difficult to estimate what the actual impact might be. However, OBIS records show that VMEs exist on the STR, and so it can me assumed that demersal longline fishing will likely have an impact typical of demersal longline fishing elsewhere (impact from anchors, weights, hooks, and the line). It is acknowledged in SPRFMO SC6-Report and references therein, that the footprint of demersal longline fishing is orders of magnitude lower than trawl fishing. This suggests that although proposed fishing on the STR will highly likely overlap with VMEs, and that catchability will also be high (assuming that any interaction of the longline will result in VEM damage), the risk of the longline significantly damaging VMEs will be spatially limited as a consequence of longline design. Nevertheless, there is concern over impact of demersal longline fishing on VMEs particularly as it relates to cumulative impacts.

Specific at-risk species

Many studies (e.g. Parker et al 2009) have identified certain invertebrate groups (Orders, Families) that are either sensitive to demersal longline fishing or are indicators of sensitive habitats. Specific species have not been identified as being particularly at-risk.

Mitigation

The footprint of a demersal longline is thought to be relatively low (**BFIA SWG-10-DW-01A**). This combined with the low number of lines being set across a large spatial extent will ensure low local impact as well as ensure short-term recoverability of impacted habitat. In addition, it is proposed that each line set will be at least 4nm apart (measured from the mid-point of each line), and that no lines will be set on previously fished ground in this campaign. This will ensure that there are no risks of cumulative impacts on VME habitats, satisfying paragraph **12 of CMM 03-18**.

Trigger / Action

In the absence of a SPRFMO VME trigger, the CCAMLR VME Risk Area assessment method will be used. Under CCAMRL CM 22-07 (2013) paragraph 2(iii), a 'VME indicator unit' is defined as either one litre of those VME indicator organisms that can be placed in a 10-litre container, or one kilogram of those VME indicator organisms that do not fit into a 10-litre container.'

'Risk areas' (CM 22-07 paragraph 2(iv)) for VMEs will be delineated where 10 of more VME units are detected in any 'line segment' (1000-hook section, CM 22-07 paragraph 2(iv)).

No move-on rule is required because all lines will be set at minimum 4nm apart (measured from the mid-point of the line) as part of the Fisheries Operation Plan (Section 4).

Data collection

Data collection requirements under **Annex 7, Sections H of CMM 02-2018** (Data Standards) will be met. Sufficient data will be collected with the aim of establishing baselines to build future monitoring and mitigation, as required under **paragraphs 10 and 24 of CMM 13-16**, and to assist the SC in providing recommendations to the Commission under paragraph **5 of CMM 03-18** and **Annex 1 of CMM 03-18**. Additionally**;**

- Data will be collected to fill knowledge gaps as identified in **Section 6 of SC6-DW09**, specifically "Note that insufficient data from bottom longline fisheries exists to develop a data-informed move-on rule for that method".
- VME data collection will help to develop VME maps for the SPRFMO area as required under **paragraph 5(F)(g) of CMM 03-18.**
- Provide data to develop alternative VME threshold methods for demersal longlines such as the incorporation of a biodiversity component, as described in **Section 2.6 of SC6-DW09.**
- A deep-water video camera will be used to examine species occurrence, density and species / habitat relationships, **as recommended by the BFIAS**. In addition, the real-world impact of demersal longline fishing on VME species and habitats will assessed.

- Environmental data will be collected (Conductivity, Temperature, Depth, Chlorophyll) for predictive modelling purposed (e.g. Maxent), **as recommended by the BFIAS**.

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Appendix I – Seabirds

Group	Species	common name	IUCN status	Spatial Overlap	Hooked during setting	Hooked during hauling	Light strike	Risk	Residual Risk
Penguins	*Eudyptes chrysocome*	Southern Rockhopper Penguin	VU	Low	Low	Low	Low	Low	Low
	Eudyptes filholi	Eastern Rockhopper Penguin	-	Low	Low	Low	Low	Low	Low
	Eudyptes chrysolophus	Macaroni Penguins	VU	Low	Low	Low	Low	Low	Low
	Eudyptes schlegeli	Royal Penguins	NT	Low	Low	Low	Low	Low	Low
Albatross	*Diomedea exulans*	Wandering Albatross	VU	High	Med	High	Med	Med-High	Low
	Diomedea epomophora	Southern Royal	VU	High	Med	High	Med	Med-High	Low
	Diomedea sanfordi	Northern Royal Albatross	EN	High	Med	High	Med	Med-High	Low
	Thalassarche melanophris	Black-browed Albatross	LC	High	High	High	Med	Med-High	Low
	Thalassarche chrysostoma	Grey-headed Albatross	EN	High	High	High	Med	Med-High	Low
	Thalassarche carteri	Indian Albatross	EN	Med-High	High	High	Med	Med-High	Low
	Thalassarche chlororhynchos	Atlantic Yellow-nosed Albatross	EN	Low	High	High	Med	Med-High	Low
	Thalassarche salvini	Salvin's Albatross	VU	High	High	High	Med	Med-High	Low
	Thalassarche cauta	Shy Albatross	NT	High	High	High	Med	Med-High	Low
	Thalassarche bulleri	Buller's Albatross	NT	High	High	High	Med	Med-High	Low
	Phoebetria palpebrata	Light-mantled Albatross	NT	High	Med	Med	Med	Med-High	Low
	Phoebetria fusca	Sooty Albatross	EN	Med-High	Med	Med	Med	Med-High	Low
	Macronectes giganteus	Southern Giant Petrel	LC	High	High	High	Med	Med-High	Low
	Macronectes halli	Northern Giant Petre	LC	High	High	High	Med	Med-High	Low
Fulmar	*Fulmarus glacialoides*	Southern fulmar	LC	High	Med	High	Med	Med-High	Low
Petrel	*Daption capense*	Cape Petrel	LC	High	Med	High	Med	Med-High	Low
	Thalassoica antarctica	Antarctic Petrel	LC	Medium	Low	Low	High	Medium	Low
	Aphrodroma brevirostris	Kerguelen Petrel	LC	High	Low	Low	High	Medium	Low
	Pterodroma lessonii	White-headed Petrel	LC	High	Low	Low	High	Medium	Low
	Pterodroma macroptera	Great-winged Petrel	LC	Med-HIgh	Low	Low	High	Medium	Low
	Pterodroma mollis	Soft-plumaged Petrel	LC	Med-HIgh	Low	Low	High	Medium	Low

	Pterodroma solandri	Providence Petrel	VU	Med	Low	Low	High	Medium	Low
	Pterodroma leucoptera	White-winged Petrel	VU	High	Low	Low	High	Medium	Low
	Pterodroma inexpectata	Mottled Petrel	NT	High	Low	Low	High	Medium	Low
	Pterodroma cookii	Cook's Petrel	VU	High	Low	Low	High	Medium	Low
	Procellaria aequinoctialis	White-chinned Petrel	VU	High	High	High	Low	High	Low
	Procellaria parkinsoni	Black Petrel	VU	Low	High	High	Low	High	Low
	Procellaria cinerea	Grey Petrel	NT	Med-High	High	High	Low	High	Low
	Procellaria westlandica	Westland Petrel	EN	Low-Med	High	High	Low	High	Low
	Halobaena caerulea	Blue Petrel	LC	Med-High	Low	Low	High	High	Medium
	Oceanites oceanicus	Wilson's Storm Petrel	LC	High	Low	Low	High	Low	Medium
	Fregetta grallaria	White-bellied Storm Petrel	LC	Low	Low	Low	High	Low	Medium
	Fregetta tropica	Black-bellied Storm Petrel	LC	Medium	Low	Low	High	Low	Medium
	Garrodia nereis	Grey-backed Storm Petrel	LC	Med-High	Low	Low	High	Low	Medium
	Pelagodroma marina	White-faced Storm Petrel	LC	Med-High	Low	Low	High	Low	Medium
	Pelecanoides georgicus	South Georgia Diving-petrel	LC	Low	Low	Low	High	Low	Medium
	Pelecanoides urinatrix	Common Diving -petrel	LC	Med-High	Low	Low	High	Low	Medium
Shearwaters	*Ardenna tenuirostris*	Short-tailed Shearwater	LC	Med-High	High	Med	Med	Low	Medium
	Ardenna grisea	Sooty Shearwater	NT	Med-High	High	Med	Med	Low	Medium
Prions	*Pachyptila belcheri*	Slender-billed Prion	LC	Med-High	Low	Low	High	Low	Medium
	Pachyptila desolata	Antarctic Prion	LC	Med-High	Low	Low	High	Low	Medium
	Pachyptila salvini	Salvin's Prion	LC	Med-High	Low	Low	High	Low	Medium
	Pachyptila turtur	Fairy Prion	LC	High	Low	Low	High	Low	Medium
	Pachyptila vittata	Broad-billed Prion	LC	Med-High	Low	Low	High	Low	Medium
	Pachyptila crassirostris	Fulmar Prion	LC	Low	Low	Low	High	Low	Medium
Terns	*Sterna paradisaea*	Arctic Tern	LC	Low	Low	Low	Low	Low	Medium
Skuas	*Stercorarius spp*	Skuas	LC	Med	Low	Med	Low	Low	Medium

Appendix II – Marine Mammals

Group	Species	Common name	IUCN status	Spatial Overlap	Catchability	Risk	Residual Risk
Seals	*Arctocephalus gazella*	Antarctic Fur Seal	LC	Low - Medium	Low	Low	Low
	Arctocephalus tropicalis	Sub-Antarctic Fur Seal	LC	Low	Low	Low	Low
	Arctocephalus forsteri	New Zealand fur seal	LC	High	Low	Low	Low
	Arctocephalus pusillus	Afro-Australian Fur Seal	LC	Low	Low	Low	Low
	Mirounga leonina	Southern Elephant Seal	LC	High	Medium	Medium	Medium
Whales	*Balaenoptera acutorostrata*	Common Minke Whales	LC	High	Low	Low	Low
	Balaenoptera physalus	Fin Whales	EN	High	Low	Low	Low
	Balaenoptera borealis	Sei Whales	EN	High	Low	Low	Low
	Balaenoptera bonaerensis	Antarctic Minke Whale	NT	High	Low	Low	Low
	Balaenoptera musculus	Blue Whale	EN	High	Low	Low	Low
	Berardius arnuxii	Arnoux's Beaked Whale	DD	High	Low	Low	Low
	Megaptera novaeangliae	Humpback Whales	LC	High	Low	Low	Low
	Eubalaena australis	Southern Right Whales	LC	High	Low	Low	Low
	Physeter macrocephalus	Sperm Whales	VU	HIgh	Low	Low	Low
	Orcinus orca	Killer Whale	DD	High	Low	Low	Low
	Globicephala melas edwardii	Southern Longfinned Pilot Whale	DD	High	Low	Low	Low
	Mesoplodon grayi	Gray's Beaked Whale	DD	High	Low	Low	Low
	Mesoplodon layardii	Strap-toothed Whale	DD	High	Low	Low	Low
	Mesoplodon bowdoini	Andrew's Beaked Whale	DD	High	Low	Low	Low
	Mesoplodon hectori	Hector's Beaked Whale	DD	High	Low	Low	Low
	Mesoplodon mirus	True's Beaked Whale	DD	Low	Low	Low	Low
	Caperea marginata	Pygmy Right Whale	DD	High	Low	Low	Low
	Hyperoodon planifrons	Southern Bottlenose Whale	LC	High	Low	Low	Low
	Kogia brevicep	Pygmy Sperm Whale	DD	Low	Low	Low	Low
	Pseudorca crassidens	False Killer Whale	DD	Low	Low	Low	Low

	Tasmacetus shepherdi	Shepherd's Beaked Whale	DD	High	Low	Low	Low
Dolphins	*Tursiops truncatus*	Common Bottlenose Dolphin	LC	Low	Low	Low	Low
	Lagenorhynchus obscurus	Dusky dolphins	DD	Low	Low	Low	Low
	Lagenorhynchus cruciger	Hourglass dolphins	LC	High	Low	Low	Low
	Lissodelphis peronii	Southern Right Whale Dolphin	DD	High	Low	Low	Low
	Delphinus delphis	Short-beaked Common Dolphin	LC	Low	Low	Low	Low
	Phocoena dioptrica	Spectacled Porpoise	DD	High	Low	Low	Low
	Stenella coeruleoalba	Striped Dolphin	LC	Low	Low	Low	Low

Appendix III – Reptiles

Group	Species	Common name	IUCN status	Spatial Overlap	Catchability	Risk	Residual Risk
Turtles	*Caretta caretta*	Loggerhead Turtle	VU	Medium	Low	Low	Low
	Dermochelys coriacea	Leatherback	VU	Low	Low	Low	Low
	Eretmochelys imbricata	Hawksbill Turtle	CR	Low	Low	Low	Low

Appendix IV – Non-Target Finfish

Group	Family	Common name	Spatial Overlap	Catchability	Risk	Residual Risk
Aulopiformes	Alepisauridae	Lancetfishes	Low	Unkonwn	Low	Low
	Ipnopidae	Tripod fishes	Low	Unkonwn	Low	Low
	Notosudidae	Waryfishes	Med	Unkonwn	Low	Low
	Paralepididae	Barracudinas	High	Unkonwn	Low	Low
	Scopelarchidae	Pearleyes	Med	Low	Low	Low
Cetomimiformes	Barbourisiidae	Velvet whalefish	High	Unkonwn	Low	Low
	Cetomimidae	Flabby whalefish	Low	Low	Low	Low
	Rondeletiidae	Redmouth whalefishes	Med	Low	Low	Low
Gadiformes	Macrouridae	Grenadiers	High	High	High	Low
	Moridae	Cods	HIgh	High	High	Low
Lampriformes	Lampridae	Opahs	Low	Low	Low	Low
	Regalecidae	Oarfish	Low	Unkonwn	Low	Low
	Trachipteridae	Ribbonfish	High	Unkonwn	Low	Low
Notacanthiformes	Halosauridae	Halosaurs	Med	Unkonwn	Low	Low
	Notacanthidae	Deep-sea spiny eels	Med	Unkonwn	Low	Low
Ophidiiformes	Aphyonidae	-	Low	Low	Low	Low
	Bythitidae	Viviparous brotula	High	Unkonwn	Low	Low
	Ophidiidae	Cusk-eel	Low	High	Medium	Low
Perciformes	Arripidae	Australian salmon	High	Low	Low	Low
	Bathydraconidae	Antarctic dragonfishes	Low	Unkonwn	Low	Low
	Blenniidae	Combtooth blennies	High	Low	Low	Low
	Bovichtidae	Thornfishes	High	Low	Low	Low
	Bramidae	Pomfrets	Med	Low	Low	Low
	Carangidae	Jack mackerels, runners, pompanos	Low	Low	Low	Low
	Caristiidae	Manefishes	High	Low	Low	Low
	Centrolophidae	Medusafishes	High	Low	Low	Low
	Cheilodactylidae	Morwong	High	Low	Low	Low
	Chiasmodontidae	Snaketooth fishes	Med	Low	Low	Low

	Clinidae	Blennioids	Med	Low	Low	Low
	Epigonidae	Deepwater cardinalfishes	High	Low	Low	Low
	Gempylidae	Snake mackerels	High	Unkonwn	Low	Low
	Gobiidae	Gobies	High	Low	Low	Low
	Howellidae	Oceanic basslets	Low	Unkonwn	Low	Low
	Latridae	Trumpeters	High	Low	Low	Low
	Mugilidae	Mullets	High	Low	Low	Low
	Nomeidae	Driftfishes	Low	Unkonwn	Low	Low
	Opistognathidae	Jawfishes	Low	Low	Low	Low
	Pentacerotidae	Armorheads	High	Low	Low	Low
	Polyprionidae	Wreckfish	Med	Unkonwn	Low	Low
	Rachycentridae	Cobia	Low	Low	Low	Low
	Scombridae	Tunas	Med	Low	Low	Low
	Tetragonuridae	Squaretails	High	Low	Low	Low
	Trichiuridae	Cutlassfishes	High	Low	Low	Low
	Uranoscopidae	Stargazers	High	Unkonwn	Low	Low
	Zoarcidae	Eelpouts	Med	Low	Low	Low
Pleuronectiformes	Achiropsettidae	Southern flounders	High	Low	Low	Low
	Pleuronectidae	Righteye flounders	High	Low	Low	Low
Scorpaeniformes	Liparidae	Snailfish	Med	Low	Low	Low
	Platycephalidae	Flatheads	Med	Unkonwn	Low	Low
	Scorpaenidae	Scorpionfish	High	Unkonwn	Low	Low
	Sebastidae	Rockfishes	Med	Unkonwn	Low	Low
	Tetrarogidae	Waspfishes	Low	Low	Low	Low
Trachichthyiformes	Trachichthyidae	slimehead	High	Low	Low	Low
Zeiformes	Cyttidae	-	Med	Unkonwn	Low	Low
	Oreosomatidae	Oreos	High	Unkonwn	Low	Low
	Zeidae	Dories	Med	Unkonwn	Low	Low

Appendix V – Chondrichthyans

Group	Species	common name	IUCN status	Habitat	Spatial Overlap	Catchability	Risk	Residual Risk	SC6-DW08 assessment (PSA / SAFE)
Rays	*Tetronarce nobiliana*	Great torpedo	DD	Pelagic / Demersal	Low	High	Medium	Low	Low / Low
	Amblyraja hyperborea	Boreal / Arctic Skate	LC	Demersal	Med-High	High	High	Medium	Low / Low
	Dipturus acrobelus	Australian deepwater skate	LC	Demersal	Medium	High	Med-High	Low-Med	Low / Low
	Dipturus canutus	Grey skate	EN	Demersal	Low	High	Medium	Low	Not Assessed
	Dipturus gudgeri	Bight skate	NT	Demersal	Low	High	Medium	Low	Not Assessed
	Dipturus wengi	Weng's skate	LC	Demersal	Medium	High	Med-High	Low-Med	Not Assessed
	Rajella challenger	Challenger Skate	-	Demersal	High	High	High	Medium	Low / Low
	Bathyraja ishiharai	Abyssal skate	DD	Demersal	Low	High	Medium	Low	Not Assessed
	Notoraja azurea	Blue skate	LC	Demersal	Low	High	Medium	Low	Not Assessed
	Bathyraja richardsoni	Richardson's skate	LC	Demersal	High	High	High	Medium	Low / Low
	Pavoraja nitida	Peacock skate	LC	Demersal	Low	High	Medium	Low	Not Assessed
	Bathytoshia lata	*Brown stingray*	-	Demersal	Low	High	Medium	Low	Med-Low
Sharks									
Hexanchidae (Cowsharks)	*Hexanchus griseus*	Bluntnose sixgill shark	NT	Pelagic / Demersal	Medium	High	Med-High	Low-Med	Med / Low
	Heptranchias perlo	Sharpnose sevengill shark	NT	Pelagic / Demersal	Medium	High	Med-High	Low-Med	Med / Extreme
Squalidae (Dogfishes)	*Squalus acanthias*	Whitespotted spurdog	VU	demersal	Medium	High	Med-High	Low-Med	Med / Extreme
	Squalus chloroculus	Greeneye spurdog	NT	?	Low	High	Medium	Low	Not Assessed
Centrophoridae (Gulper sharks)	*Centrophorus squamosus*	Leafscale gulper shark	VU	Pelagic / Demersal	Low-Med	High	Med-High	Low-Med	Med / Extreme
	Centrophorus zeehaani	Southern dogfish	NT	demersal	Low	High	Medium	Low	Not Assessed
	Deania calcea	Brier shark	LC	demersal	Med-High	High	High	Medium	High / Extreme
	Deania quadrispinosa	Longsnout dogfish	NT	demersal	Low-Med	High	Med-High	Low-Med	High / Extreme
Etmoptreridae (Lantern sharks)	*Etmopterus baxteri*	Southern lanternshark	-	demersal	Medium	High	Med-High	Low-Med	Not Assessed
	Etmopterus lucifer	Blackbelly Lanternshark	LC	demersal	Low-Med	High	Med-High	Low-Med	Med / Extreme

	Etmopterus pusillus	Smooth Lanternshark	LC	demersal	Med-High	High	Med-High	Low-Med	Low / Low
	Etmopterus unicolor	Bristled Lantersharik	DD	demersal	Low	High	Medium	Low	Med / Low
Somniosidae (Sleeper sharks)	*Centroscymnus coelolepis*	Portugese dogfish	NT	demersal	High	High	High	Medium	Med / Low
	Centroscymnus owstonii	Owston's dogfish	LC	demersal	Low	High	Medium	Low	Med / Low
	Centroselachus crepidater	Longnose Velvet Dogfish	LC	demersal	Med-High	High	Med-High	Low-Med	Med / Low
	Centroselachus crepidater	Golden dogfish	LC	demersal	Med-High	High	Med-High	Low-Med	Med / High
	Proscymnodon plunketi	Plunket's dogfish	NT	demersal	Med-High	High	Med-High	Low-Med	Not Assessed
	Scymnodalatias albicauda	Whitetail dogfish	DD	pelagic	Med-High	Med	Med	Low	Med / Low
	Somniosus antarcticus	Southern sleeper shark	DD	pelagic	Med-High	Med	Med	Low	Med / High
	Zameus squamulosus	Velvet dogfish	DD	pelagic/demersal	High	High	High	Medium	Med / High
Oxynotidae (Prickly dogfishes)	*Oxynotus bruniensis*	Prickly dogfish	DD	demersal	Med-High	High	High	Medium	High / Extreme
Dalatiidae (Kitefin sharks)	*Dalatias licha*	Black shark	NT	demersal	Medium	High	High	Medium	Med / High
	Euprotomicrus bispinatus	Pygmy shark	LC	pelagic	High	Medium	Med-High	Low-Med	Med / Low
	Isistius brasiliensis	Cookie-cutter shark	LC	pelagic	Medium	Medium	Medium	Low	Low / Low
Mitsukurinidae (Goblin sharks)	*Mitsukurina owstoni*	Goblin shark	LC	demersal	Medium	High	Med-High	Low-Med	High / Extreme
Alopiidae (Thresher sharks)	*Alopias vulpinus*	Thresher shark	VU	pelagic	High	Medium	Med-High	Low-Med	Low / Med
Cetorhinidae (Basking sharks)	Cetorhinus maximus	Basking Shark	VU	pelagic	Med-High	Medium	High	Medium	Med / Low
Lamnidae (Mackerel sharks)	*Carcharodon carcharias*	White shark	VU	pelagic	High	Medium	Med-High	Low-Med	Med / Low
	Isurus oxyrinchus	Shortfin mako	VU	pelagic	High	Medium	Med-High	Low-Med	Med / Low
	Lamna nasus	Porbeagle	VU	pelagic	High	Medium	Med-High	Low-Med	Med / Low
Scyliorhinidae (Catsharks)	*Apristurus ampliceps*	Roughskin catshark	LC	demersal	Medium	High	Medium	Low	Extreme / Med
	Apristurus australis	Pinocchio catshark	LC	demersal	Medium	High	Med-High	Low-Med	Med / Low
	Apristurus melanoasper	Fleshynose catshark	LC	demersal	Low-Med	High	Med-High	Low-Med	Med / Low
	Apristurus pinguis	Bulldog catshark	LC	demersal	Low	High	Medium	Low	Med / Low
	Apristurus sinensis	Freckled catshark	DD	demersal	Low	High	Medium	Low	Med / Low
Triakidae (Houndsharks)	*Galeorhinus galeus*	School shark	VU	pelagic	Low	Med	Medium	Low	Med / Low
Carcharhinidae (Whaler sharks)	*Prionace glauca*	Blue shark	NT	pelagic	Low-Med	Med	Medium	Low	Low / Low
Chimaeridae (Shortnose Chimeras)	*Chimaera fulva*	Southern chimera	LC	demersal	Medium	High	Med-High	Low-Med	Low / Low

	Chimaera lignaria	Giant Chimera	LC	demersal	Medium	High	Medium	Low	Low / Low
	Hydrolagus homonycteris	Black ghostshark	LC	demersal	Low-Med	High	Med-High	Low-Med	Low / Low
	Hydrolagus lemures	Blackfisn ghostshark	LC	demersal	Low	High	Medium	Low	Med / Low
Rhinochimaeridae (Spookfishes)	*Harriotta haeckeli*	Smallspine spookfish	LC	demersal	Low	High	Medium	Low	Low / Low
	Harriotta raleighana	Bigspine spookfish	LC	demersal	Medium	High	Med-High	Low-Med	Low / Low
	Rhinochimaera pacifica	Pacific spookfish	LC	demersal	Med-High	High	Med-High	Low-Med	Med / Low

Appendix VI – VMEs

Phylum	Class	Order	Family	Phylum	Class	Order	Family
Annelida	Polychaeta	Sabellida	**Serpulidae (SZS)**	Porifera	**Demospongiae (DMO)**	Agelasida	Agelasidae
Brachiopoda (BRQ)	Rhynchonellata	Terebratulida	Dallinidae			Axinellida	Axinellidae
Chordata	**Ascidiacea (SSX)**	Aplousobranchia	Didemnidae				Raspailiidae
			Holozoidae			Biemnida	Biemnidae
			Polycitoridae			Bubarida	Desmanthidae
			Polyclinidae				Dictyonellidae
		Phlebobranchia	Ascidiidae			Dendroceratida	Darwinellidae
			Molgulidae			Desmacellida	Desmacellidae
			Pyuridae			Dictyoceratida	Irciniidae
Cnidaria	Anthozoa	**Actiniaria (ATX)**	Actinernidae				Spongiidae
			Actinoscyphiidae			Haplosclerida	Chalinidae
			Hormathiidae				Niphatidae
			Liponematidae				Petrosiidae
		Alcyonacea (AJZ)	Acanthogorgiidae				Phloeodictyidae
			Alcyoniidae			Merliida	Hamacanthidae
			Anthothelidae			Poecilosclerida	Chondropsidae
			Chrysogorgiidae				Cladorhizidae

			Coralliidae			Coelosphaeridae
			Isididae			Crambeidae
			Nephtheidae			Crellidae
			Plexauridae			Hymedesmiidae
			Primnoidae			Latrunculiidae
			Spongiodermidae			Microcionidae
			Victorgorgiidae			Mycalidae
		Antipatharia (AQZ)	Antipathidae			Myxillidae
			Cladopathidae			Tedaniidae
			Leiopathidae		Polymastiida	Polymastiidae
			Schizopathidae		Scopalinida	Scopalinidae
			Stylopathidae		Spirophorida	Tetillidae
		Pennatulacea (NTW)	Anthoptilidae		Suberitida	Halichondriidae
			Halipteridae			Suberitidae
			Pennatulidae		Tethyida	Hemiasterellidae
			Protoptilidae			Tethyidae
			Stachyptilidae		Tetractinellida	Ancorinidae
		Scleractinia (CSS)	Anthemiphylliidae			Ancorinidae
			Caryophylliidae			Calthropellidae
			Dendrophylliidae			Geodiidae
			Flabellidae			Pachastrellidae
			Fungiacyathidae			Phymatellidae
		Zoantharia (ZOT)	Epizoanthidae			Vulcanellidae
			Stylasteridae		Verongiida	Aplysinidae
Echinodermata	**Crinoidea (CWD)**	Comatulida	Antedonidae	**Hexactinellida (HXY)**	Amphidiscosida	Hyalonematidae
			Charitometridae		Lyssacinosida	Euplectellidae
			Comatulidae			Rossellidae
			Himerometridae		Sceptrulophora	Euretidae

			Phrynocrinidae		Farreidae
			Thalassometridae		Sceptrulophora incertae sedis
			Zenometridae		
		Hyocrinida	Hyocrinidae		
		Isocrinida	Isselicrinidae		
			Pentacrinitidae		
Echinodermata	**Echinoidea (CVD)**	Cidaroida	Cidaridae		
			Ctenocidaridae		
			Histocidaridae		
Echinodermata	Ophiuroidea	**Euryalida (OEQ)**	Asteronychidae		
			Euryalidae		
			Gorgonocephalidae		