3rd Meeting of the Scientific Committee

Port Vila, Vanuatu
28 September - 3 October 2015

SC-03-DW-01_revн

Proposal for exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017: Description of proposed activities and impact assessment

New Zealand, Ministry for Primary Industries

Proposal for exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017: description of proposed activities and impact assessment

Prepared by the New Zealand Ministry for Primary Industries for the consideration of the Scientific Committee of the South Pacific Regional Fisheries Management Organization

14 August 2015

Contents

1. Purpose of paper

This paper forms the first stage of an application for New Zealand vessels to fish by the method of bottom longline outside New Zealand's bottom longline footprint and to catch toothfish in excess of catch in the reference years. The proposed incremental, exploratory fishing is for a demersal species that has not been fished for more than 10 years, and this constitutes a new or exploratory fishery in terms of the Convention. This proposal is, therefore, drafted to conform to Article 22 of the Convention, paragraphs 16–18 of CMM 2.03 and the Bottom Fishery Impact Assessment Standard (BFIAS). This assessment is provided for the consideration of the Scientific Committee meeting in September-October 2015 such that it can advise the Commission meeting in early 2016.

2. Requirements for a proposal

2.1. Requirements of Article 22 of the Convention

Article 22 in relation to NEW OR EXPLORATORY FISHERIES states that:

1. A fishery that has not been subject to fishing or has not been subject to fishing with a particular gear type or technique for ten years or more shall be opened as a fishery or opened to fishing with such gear type or technique only when the Commission has adopted cautious preliminary conservation and management measures in respect of that fishery, and, as appropriate, non-target and associated or dependent species, and appropriate measures to protect the marine ecosystem in which that fishery occurs from adverse impacts of fishing activities.

2. Such preliminary conservation and management measures, which may include requirements regarding notification of intention to fish, the establishment of a development plan, mitigation measures to prevent adverse impacts on marine ecosystems, use of particular fishing gear, the presence of observers, the collection of data, and the conduct of research or exploratory fishing, shall be consistent with the objective and the conservation and management principles and approaches of this Convention. The measures shall ensure that the new fishery resource is developed on a precautionary and gradual basis until sufficient information is acquired to enable the Commission to adopt appropriately detailed conservation and management measures.

3. The Commission may, from time to time, adopt standard minimum conservation and management measures that are to apply in respect of some or all new fisheries prior to the commencement of fishing for such new fisheries.

2.2. Relevant sections of Conservation and Management Measure CMM 2.03

2.2.1. Assessment of bottom fishing

10. No Member or CNCP shall authorize their flagged vessels to engage in any bottom fishing within the Convention Area unless they have undertaken an assessment of the impact of their flagged vessels' bottom fishing. Any assessment carried out after 2011 must be done in accordance with the FAO Deep-sea Fisheries Guidelines, and taking into account the SPRFMO BFIAS and areas identified where VMEs are known or suspected to occur in the area to be fished. When preparing assessments, Members and CNCPs will take into account the information provided pursuant to paragraph 23 of this CMM.

11. Assessments by Members or CNCPs shall also address whether the proposed activities achieve the objectives described in paragraph 1 of this CMM and Article 2 of the Convention.

12. The Scientific Committee shall:

    (a) assess, on the basis of the best available scientific information, whether the proposed bottom fishing would have significant adverse impacts on VMEs and if it is assessed that these activities would have significant adverse impacts, recommend measures to prevent such impacts, or recommend that the proposed bottom fishing should not proceed.

    (b) assess, taking into account, inter alia, the cumulative impacts of other fishing occurring in the region where such information is available, whether the proposed activities are consistent with paragraph 1 of this CMM and Article 2 of the Convention.

    (c) provide recommendations and advice to the Commission on the assessment.

13. The Commission shall:

    a. on the basis of these assessments and taking into account the recommendations and advice of the Scientific Committee, consider whether, and if applicable, the extent to which, bottom fishing in the region of the Convention Area for which the assessment was conducted, can be authorised and which, if any, measures are required, to prevent significant adverse impacts on VMEs.

    b. Make their determinations and any Scientific Committee evaluations publicly available.

14. Members and CNCPs shall ensure that assessments are updated when a substantial change in the fishery has occurred, such that it is likely that the risk or impacts of the fishery may have changed.

15. These assessments shall be made publicly available on the SPRFMO website.

2.2.2. Fishing outside the footprint or above reference period catch levels

16. Notwithstanding paragraphs 8(c) and (d), a Member or CNCP may apply to the Commission to either:

    a. undertake bottom fishing in the Convention Area where they do not have a bottom fishing footprint;

b. undertake bottom fishing in the Convention Area but outside their footprint established in accordance with paragraph 8(a); or

c. exceed the average level of catch for bottom fishing established in accordance with paragraph 8(c).

17. The Member or CNCP shall prepare and submit to the Secretariat for consideration by the Scientific Committee 60 days in advance of a Scientific Committee meeting, an application outlining their proposal to commence bottom fishing or their proposal to fish outside their footprint or above reference year catch levels, in accordance with paragraphs 10 and 11. Such an application will take into account the results of any public consultation conducted by that Member or CNCP.

18. Assessments by Members or CNCPs shall be submitted to the Scientific Committee for review. The Scientific Committee will consider the assessments in accordance with paragraph 12.

19. The Commission shall consider the assessments in accordance with paragraph 13. These assessments shall be made publicly available on the SPRFMO website.

20. Members and CNCPs shall not permit bottom fishing to occur until it has been authorised in accordance with paragraphs 16 to 19.

21. The requirements in paragraphs 16 to 20 are in addition to the requirements in any other measures adopted under Article 22 of the Convention with respect to new and exploratory fisheries.

2.2.3. Vulnerable Marine Ecosystems

22. Subject to paragraph 8(h) of this CMM, in respect of areas where VMEs are known to occur or are likely to occur based on the best available scientific information, the Commission shall close such areas to bottom fishing by a particular gear type or types, drawing on advice from the Scientific Committee provided under paragraph 5, unless, based on an assessment undertaken in accordance with either paragraphs 10 to 15 or paragraphs 16 to 19 above, the Commission determines that such bottom fishing will not have significant adverse impacts on VMEs.

23. Members and CNCPs shall cooperate to identify, on the basis of the best available scientific information, areas where VMEs are known or likely to occur in the Convention Area and to map these sites, and provide such data and information to the SPRFMO Secretariat for circulation to all Members and CNCPs.

2.3. Bottom Fishery Impact Assessment Standard

The purpose of the Bottom Fishery Impact Assessment Standard (BFIAS) is to provide a minimum standard for assessing the potential impacts of proposed bottom fishing activities on VMEs and deep sea fish stocks. This standard is intended to guide SPRFMO participants in preparing the required bottom fishery impact assessments, and to guide the SWG when reviewing these assessments. It is intended to constitute the standardized approach to be taken by all participants when preparing risk and impact assessments for high seas bottom fishing activities in the SPRFMO area.

The BFIAS specifies that assessments should include the following sections:

2.3.1. Description of the Proposed Fishing Activities

(The BFIAS notes that, for exploratory fisheries, estimates of total catch and discard quantities may not be available given the nature of the fisheries and so estimates of the other factors, such as fishing duration, number of tows and potential catch rates should be provided. Once information is available from the new or exploratory fishery the impact assessment would be updated using this data.)

2.3.2. Mapping and Description of Proposed Fishing Areas

2.3.3. Impact Assessment

(The BFIAS notes that, for exploratory fisheries, little information may be available, and predictive approaches should be used to evaluate the likelihood of interaction with, and potential impact on, VMEs. All assumptions used in the impact assessment should be clearly stated. This section should include a trigger for when a new assessment should be completed.)

2.3.4. Information on Status of the Deepwater Stocks to be Fished

(The BFIAS notes that, for exploratory fisheries, predictive approaches and information from other fisheries should be used to inform the assessment of impact on deepwater stocks to be fished.)

2.3.5. Monitoring, Management and Mitigation Measures

(The BFIAS notes that, in situations where new or exploratory fisheries are being undertaken monitoring and precautionary measures are critical. As outlined in the FAO Guidelines:

> *65. Precautionary conservation and management measures, including catch and effort controls, are essential during the exploratory phase of a DSF, and should be a major component of the management of an established DSF. They should include measures to manage the impact of the fishery on low-productivity species, non-target species and sensitive habitat features. Implementation of a precautionary approach to sustainable exploitation of DSFs should include the following measures:*
>
> *i. precautionary effort limits, particularly where reliable assessments of sustainable exploitation rates of target and main by-catch species are not available;*
>
> *ii. precautionary measures, including precautionary spatial catch limits where appropriate, to prevent serial depletion of low-productivity stocks;*
>
> *iii. regular review of appropriate indices of stock status and revision downwards of the limits listed above when significant declines are detected;*
>
> *iv. measures to prevent significant adverse impacts on vulnerable marine ecosystems; and*

v. comprehensive monitoring of all fishing effort, capture of all species and interactions with VMEs (FAO 2008).

Based on this, the BFIAS goes on to state that assessments for new or exploratory fisheries must include a description of the monitoring, mitigation and precautionary management measures that will be in place, as outlined above. Details regarding the reporting of evidence of a VME to the SPRFMO Secretariat should be included.)

The remainder of this paper includes the sections specified in the BFIAS, bearing in mind the requirements of Article 22 and CMM2.03, for the consideration of the Scientific Committee.

3. Proposal

3.1. General approach to incremental, experimental fishing

It is proposed that a precautionary and gradual exploratory fishing programme be undertaken for toothfish in the southern part of the SPRFMO area. It is not known whether Patagonian toothfish, *Dissostichus eleginoides*, or Antarctic toothfish, *Dissostichus mawsoni*, is more likely to be dominant. There will be a stepwise process of ground location, ground observation for fishing feasibility, structured test fishing, and if a successful result is achieved then ultimately fishing in accordance with annual precautionary catch limits will be proposed. It is envisaged that the first three steps would take place opportunistically when occasions permitted but, contingent on the approval of the Scientific Committee and the SPRFMO Commission, the first trip will take place between July and September 2016 with a precautionary retention limit of 30 tonnes greenweight.

The structured approach will start with acoustic observation of bathymetry across the more promising parts of two exploratory fishing boxes. This will be followed by stratified or systematic fishing using relatively short demersal longlines.

Full details of the design are being developed (and will be provided to the Secretariat on or before 28 August 2015) but fishing, data collection, and tagging will be structured to:

- map the bathymetry of the fishable area,
- characterise the local toothfish populations, including life-cycle information
- documenting relative abundance of Patagonian and Antarctic toothfish,
- understand the stock structure and movement patterns of toothfish in the SPRFMO area and between SPRFMO, CCAMLR and other management areas,
- tag toothfish for stock linkage studies, and, potentially, for biomass estimation,
- collect information on distribution, relative abundance, and life history of bycatch species.

Effort will be spread throughout apparently suitable areas of the two exploratory boxes, probably using a design concept similar to those used in survey fishing in CCAMLR (CCAMLR document WG-FSA-14/61).

Total effort, effort at a given location, and retained catch (limited to 30 tonnes greenweight of toothfish) will be limited during the first exploratory fishing visit and any results will be used to develop proposals for the consideration of New Zealand's domestic technical working group or (depending on timing) the Scientific Committee on the design of subsequent trips and fishing.

3.2. Details of the vessels to be used

New Zealand nominates the vessel *San Aspiring*, owned and operated by Sanford Ltd, to conduct the first exploratory fishing trip. This section includes all vessel data required in terms of the SPRFMO Data Standards for vessel data, and confirmation that they appear on the list of approved SPRFMO vessels submitted by flag states to the SPRFMO Secretariat.

Details of the vessel to be used:

(i)	Name of fishing vessel Previous names (if known) Registration number IMO number (if issued) External markings Port of registry	*San Aspiring* *Gudni Olafsson* 900522 9226528 Blue hull with a white stripe, white upper works with blue around top of bridge and top of funnel, the vessel call sign ZMGO under bridge in large black letters. Sanford trademark on funnel, vessel name on bow both sides in blue over the white, vessel name and port of registry (Auckland) centre-stern. Auckland
(iii)	Previous flag (if any)	Icelandic until late 2002
(iv)	International Radio Call Sign	ZMGO
(v)	Name of vessel's owner(s) Address of vessel owner(s) Beneficial owner(s) if known	Sanford Limited 22 Jellicoe Street Freemans Bay Auckland Sanford Limited
(vi)	Name of licence owner Address of licence owner (operator)	As above
(vii)	Type of vessel	Demersal long line
(viii)	Where was vessel built When was vessel built	Huangpu Shipyard, Guangzhou province, China 2001
(ix)	Vessel length overall LOA (m)	51.2m
(x)	12 x 7 cm colour photographs - 1 x starboard side of the vessel - 1 x port side of the vessel - 1 x stern view	See attached
(xi)	Details of the implementation of the tamper-proof requirements of the VMS device installed	ALC 1. Sailor 6150 Mini C IMN# 451200644 Serial number: 13130251 MPI Seal Number: 048425 ALC 2. TT-3022D IMN# 451202712 Serial number: 2217707 MPI Seal Number: 048429 ALC3: Trimble Galaxy 7005 IMN#451202710 Serial number: 0200014534 MPI Seal Number: 019059
(i)	Name of operator Address of operator	As for (v)

(ii)	Names and nationality of master	Carl Fry or John Bennett, New Zealand
(iii)	Type of fishing method(s)	Demersal autoline
(iv)	Vessel beam (m)	12.21
(v)	Vessel gross registered tonnage	1508
(vi)	Vessel communication types and numbers (INMARSAT A, B and C)	Inmarsat C: Telex system (451200644) primary Fleet Broadband: +870773247108
(vii)	Normal crew complement	25
(viii)	Power of main engine(s) (kW)	1730 kW
(ix)	Carrying capacity (tonne) Number of fish holds Capacity of all holds (m^3)	Approx 380 MT 2 740 m3 (including bait hold 60 m3)
(x)	Any other information in respect of the vessel considered appropriate (e.g. ice classification).	DNV 1A1 Ice-C class vessel, built for operation in regions where ice floes of thickness 0.4m are anticipated. .

3.3. Detailed description of fishing methods

New Zealand deep-water demersal autoliners, including *San Aspiring*, carry 20–30 magazines of longline. Each magazine holds about 1000 to 1200 hooks, depending on hook size and magazine length. The hooks and snoods are normally spaced at 1.4 m intervals (Figure 1) and connected to rotors and swivels that are permanently attached to the backbone (Figure 2). Snoods are usually 300–400 mm long. The average length of backbone on each magazine is 1.4–1.5 km (0.76–0.81 nautical miles (nm)).

New Zealand autoline vessels use Integrated Weighted Line (IWL) which has lead embedded in the core to assist sinking as a seabird mortality mitigation measure. This weighting is about 50 g per metre of backbone.

During setting, the line is pulled off the magazine, through the baiting machine, and over the stern. As each magazine is emptied a new magazine is slid into place, connected to the line being set and made ready for setting. The average set has about seven magazines connected together to make a line of about 5.7 nm in length. A typical setting operation from float to float takes about 1 to 1½ hours. Hauling the same line from 500 m depth would take approximately 6 hours, or 8 hours when hauling from a depth of about 1500 m.

Between three and six lines are usually set in the chosen fishing area depending on line length. These lines are normally left to fish for between 12 and 36 hours depending on the fishing operation, presence (or absence) of sea-lice, weather and ice conditions, and the number of lines already fishing in the area although a 48 hour soak time is not uncommon.

Tethered camera observations by the UK (UK 2010) suggest that the frequency of lateral longline movement in contact with the ocean floor is likely to be negatively correlated with depth. In three deployments in shallow water (531–541 m; mean = 537 m) lateral movement was observed during hauling immediately prior to lift-off from the sea floor, whereas in two observed deployments in deeper water (1528 and 1390 m) the line was seen to lift vertically from the sea floor without any lateral movement. A negative correlation with depth is to be expected due to trigonometric considerations (Sharp 2010). The limited bathymetry information that we have on the areas to be fished indicate that fishing depths are likely to be greater than 900 m and potentially in the range 1200 to 1500 m. Australian work in the Heard and McDonald Islands fishery (Welsford et al. 2014) suggested somewhat greater lateral movement of longlines (median ~3 m, mean ~6 m) and some indication (not statistically significant) that lateral movement decreased with depth.

Additional detail on the benthic longline setup and operation can be found in Fenaughty (2008). http://www.ccamlr.org/en/document/publications/wg-fsa-08/60

Table 1: Description of main bottom long line gear items.

Item	Description
Backbone	11.5 mm lead-core internally weighted polypropylene/nylon line at 50g/m (Fiskevegn AS)
Grapnels	40 or 50 kg - two or four used per line depending on sea, bottom, and tidal conditions
Weights	About 5 kg - rarely used, tied to the line occasionally when setting in loose sea ice or when turning while setting
Hook type	15mm straight shank 15/O hooks (Fiskevegn AS)
Chain	Lengths of heavy chain generally 20 or 40 kg used for additional weighting at the line ends.
Floats	Only surface floats, either inflatable or pressure floats depending on ice conditions
Snoods	45-50cm blue Capron™ snoods spaced at 1400 mm

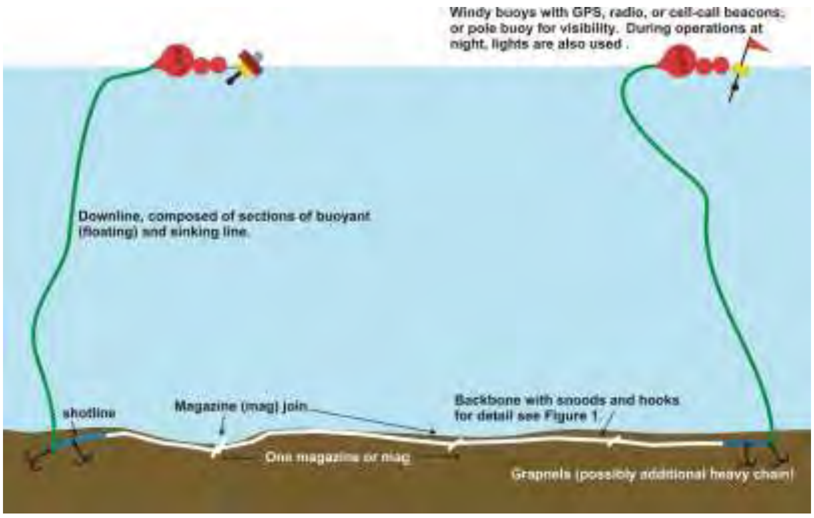


Figure 1: General arrangement for bottom longlining using an autoline system

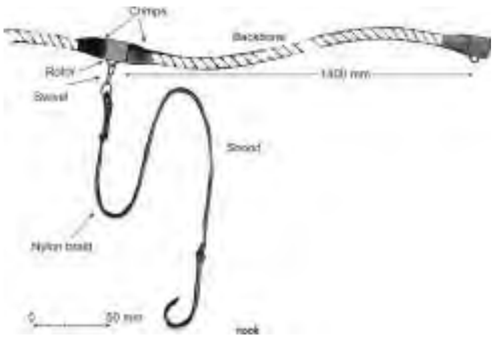


Figure 2: Generic arrangement of backbone and snood

3.4. Seabed depth range to be fished

Although bathymetric information for the target areas is limited, any areas selected to be fished are highly likely to be in the range of 800 to 2500 m.

3.5. Target species, and likely or potential by-catch species.

The main target species is toothfish, *Dissostichus* spp. It is not known whether Patagonian toothfish, *Dissostichus eleginoides*, or Antarctic toothfish, *Dissostichus mawsoni*, are likely to dominate in this area. Antarctic toothfish generally has a more southerly distribution than Patagonian toothfish, but the nearest known spawning concentration of Patagonian toothfish is around the Macquarie Islands well to the west. Fine-scale data from the CCAMLR convention area (Hanchet et al in press, see also Figure 3) show that the fishing areas closest to the proposed exploratory fishing boxes yield predominantly Antarctic toothfish, but, in some areas, Patagonian toothfish dominate at more southerly latitudes than the proposed exploratory fishing areas. An overall retention limit of 30 tonnes (greenweight) of toothfish, regardless of species, is proposed for the first exploratory trip.

Given a general circumpolar distribution of most fish species at this latitude, and experience in other fisheries such as those at Macquarie Island, Heard & McDonald Islands, and in the CCAMLR Northern Hills, it is expected that bycatch will not exceed 10% of the total catch. Bycatch species are likely to include macrourids (*Macrourus whitsoni*, *M. caml*, with probably lesser amounts of *M. holotrachus* and *M. carinatus*); violet cod *Antimora rostrate*; other morid cods, and low numbers of skates, typically *Amblyraja georgiana*. Very few deep-sea sharks are expected based on experience in these other fisheries.

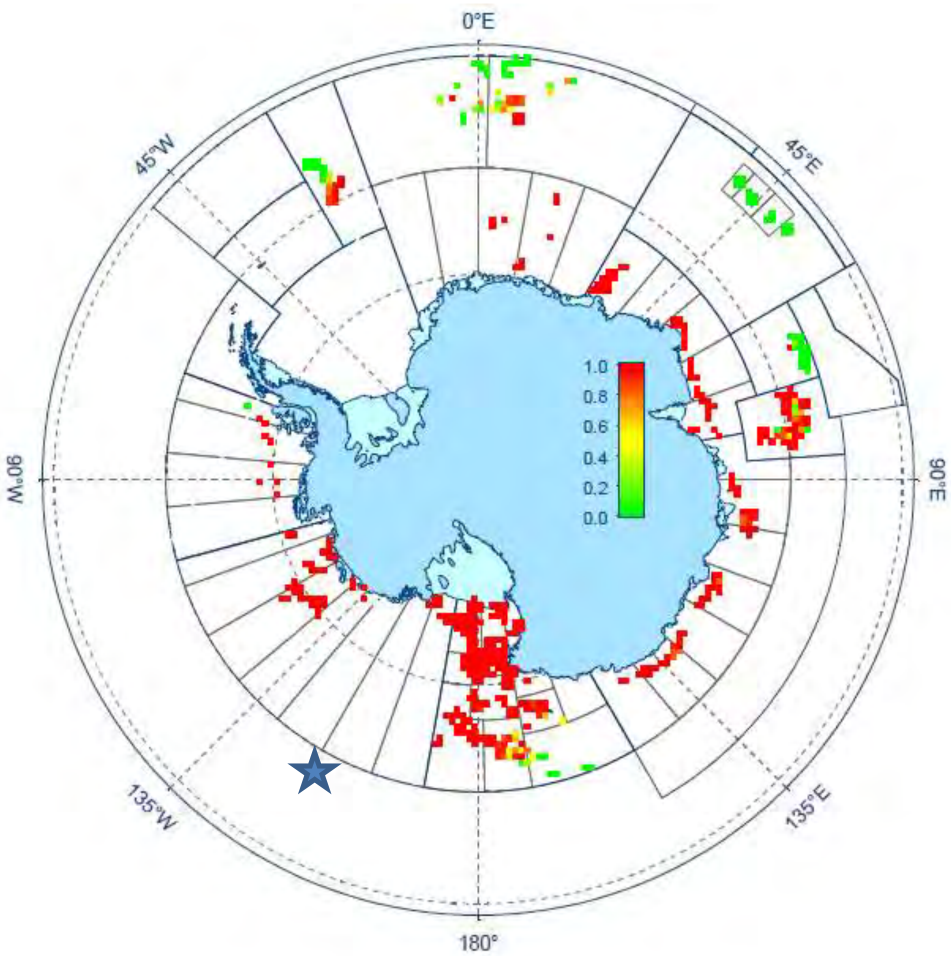


Figure 3 (from Hanchet et al. in press): Proportion of *D. mawsoni* of the total *Dissostichus* spp. catch by number in longline catches by 0.5º longitude*0.5º latitude cells from CCAMLR fine scale catch and effort data. Solid lines denote CCAMLR Subareas and Divisions, and lighter grey lines indicate CCAMLR SSRUs. The blue star indicates the general location of the proposed exploratory fishing areas.

Longlines are known to capture seabirds in many fisheries worldwide, including at similar latitudes (e.g., Anderson et al. 2011, Baird et al. 2015) and this risk will be mitigated using integrated weight line (to facilitate fast sinking of the lines), tori lines (to deter birds from approaching the lines), night-setting, and offal management (to reduce the attractive effect of discarded material). This is a highly effective combination (e.g., Løkkeborg 2011) that is likely to reduce the risk to seabirds to very low levels. Robertson et al. (2006) recorded that integrated weight lines (50 g.m^{-1} beaded lead core, sink rate: 0.24 m.s^{-1}) yielded a 94 to 99% reduction in the capture of white-chinned petrels and a 61% reduction for sooty shearwaters compared with unweighted conventional lines (sink rate: 0.11 m.s^{-1}) in the New Zealand ling (*Genypterus blacodes*) fishery. The observed sink rate of lines set by the vessel *San Aspiring* during operational fishing in the CCAMLR area between 2011 and 2014 was faster still at 0.34 m.s^{-1} and ranged from 0.19 to 0.56 m.s^{-1} (Figure 4).

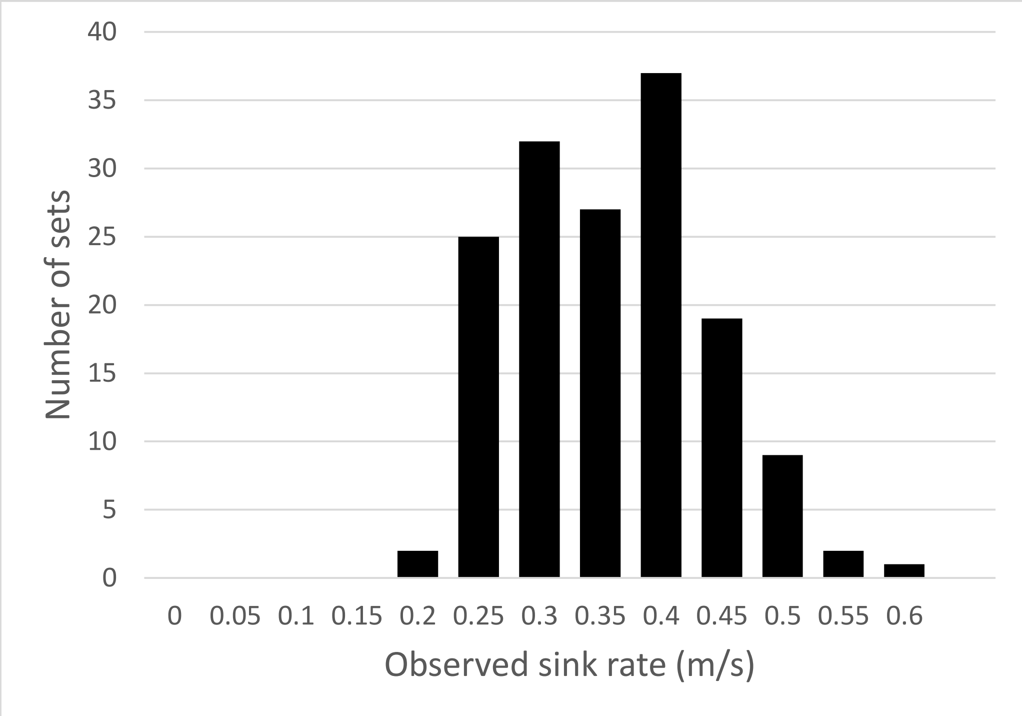


Figure 4: Observed sink rates for integrated weight line sets from the vessel San Aspiring in CCAMLR fisheries, 2011 to 2014.

Interactions with orca and other marine mammals and turtles are considered unlikely based on experience in the northern parts of the CCAMLR area. Observers will record all sightings and interactions.

3.6. Intended period and duration of fishing

As this is an exploratory fishing exercise there will be a stepwise process of ground location, ground observation for fishing feasibility, test fishing, and if a successful result is achieved then ultimately fishing will take place according to a formalized design and subject to effort and catch limits. It is envisaged that the first three steps would take place opportunistically when occasions permitted, such as:

- Late February or early March following the Ross Sea fishing season within the CCAMLR Convention area - typically this fishery closes in February/March
- In early March in transit to the CCAMLR subarea 48.3fishery
- Some time between July and September in transit from the CCAMLR subarea 48.3 fishery to New Zealand

The first exploratory trip is proposed for the winter period between July and September 2016 (contingent on the approval of the Scientific Committee and, ultimately, the SPRFMO Commission in early 2016). During this first trip, fishing operations would take place over no more than a 7–10 day period. In optimal conditions approximately five lines a day could be set and hauled. This would be an upper bound and given the requirement to search for appropriate fishing grounds.

The full design of exploratory fishing operations and data collection has not yet been determined but it has been agreed that a structured approach similar in concept to the toothfish survey in CCAMLR 88.2 A & B North will be employed. A full design proposal will be provided to the SPRFMO Secretariat for transmission to the Scientific Committee no later than 28 August 2015, together with a formal risk assessment. The design, including any catch, effort or bycatch limits for any subsequent exploratory or fishing trips will be contingent on analysis of the results of the first trip; these analyses will be presented to New Zealand's technical working group and to the Scientific Committee for approval.

New Zealand nominates one vessel, the *San Aspiring*, undertakes this exploratory fishing. Table 2 shows the ranges of line links and hook numbers from *San Aspiring* records in the neighboring CCAMLR subarea 88.2 as a guide. Based on this, and the CCAMLR 48.3 fishery in which *San Aspiring* also takes part, it is suggested that maximum number of hooks set per day in the two exploratory fishing areas would be similar to CCAMLR survey in 88.2 A & B North.

Table 2. Ranges of line lengths and hook numbers from San Aspiring records averaged over the past three completed fishing seasons in Subarea 88.1 and 88.2.

	Minimum	Average	Maximum
Line length	3,600 m	7,509 m	11,998 m
Number of hooks	2,571	5,364	8,570

3.7. SPRFMO Data Standards and data to be collected

The following is the SPRFMO standard for bottom longline fishing activity data:

1. Data are to be collected on an un-aggregated (set by set) basis.

2. The following fields of data are to be collected:

(a) Vessel flag

(b) Vessel name

(c) Vessel call sign

(d) Registration number of vessel

(e) Set start date and time (UTC format)

(f) Set end date and time (UTC format)

(g) Set start position (1/10th degree resolution – decimal format)

(h) Set end position (1/10th degree resolution – decimal format)

(i) Intended target species (FAO species code)

(j) Number of hooks

(k) Bottom depth at start of set

(l) Estimated catch retained on board by species (FAO species code) in live weight

(m) An estimation of the amount of living marine resources discarded by species if possible

(n) Were any marine mammals, sea-birds, reptiles or other species of concern caught (yes/no/unknown-Y, N, U)

Contingent on the final design, more data will be collected, potentially based on the data requirements specified for CCAMLR surveys. The nominated vessel is capable of reporting and electronically transmitting this information on a daily basis if necessary. Very similar information is regularly reported on a daily basis when the vessel is working within the CCAMLR Convention Area.

3.8. Maps of the proposed fishing areas in relation to VMEs and seabed bathymetry

New Zealand’s bottom lining footprint within the Southwest Pacific Basin (where the proposed exploratory fishing will occur) is shown in Figure 5 and the combined trawl-longline footprint on the southwestern portion of the SPRFMO area is shown in Figure 6. It can be seen from these figures that there has been no previous fishing in the proposed exploratory fishing areas. As previously noted this will be a stepwise research programme firstly identifying any potential areas that are suitable for fishing and, if these are found, structured design-based fishing using bottom longline gear.

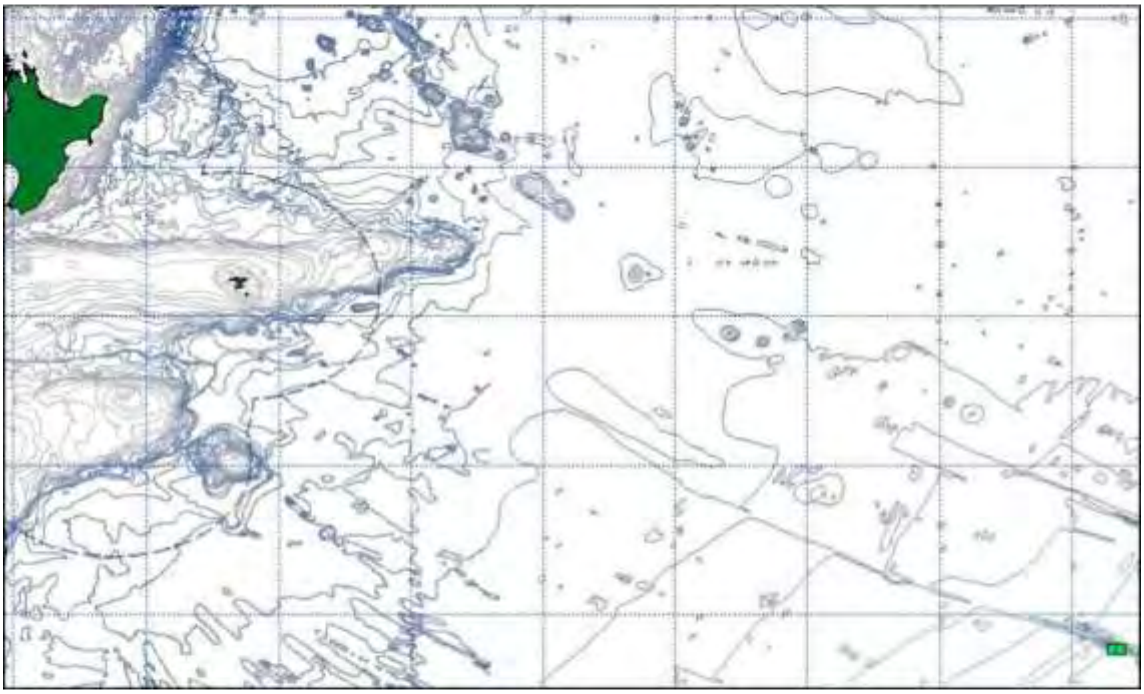


Figure 5: New Zealand bottom line footprint map for the Southwest Pacific Basin fishing area, showing the two blocks fished over the 2002 - 2006 reference period (from New Zealand SPRFMO Area Bottom Fishery Impact Assessment Draft 1.0).

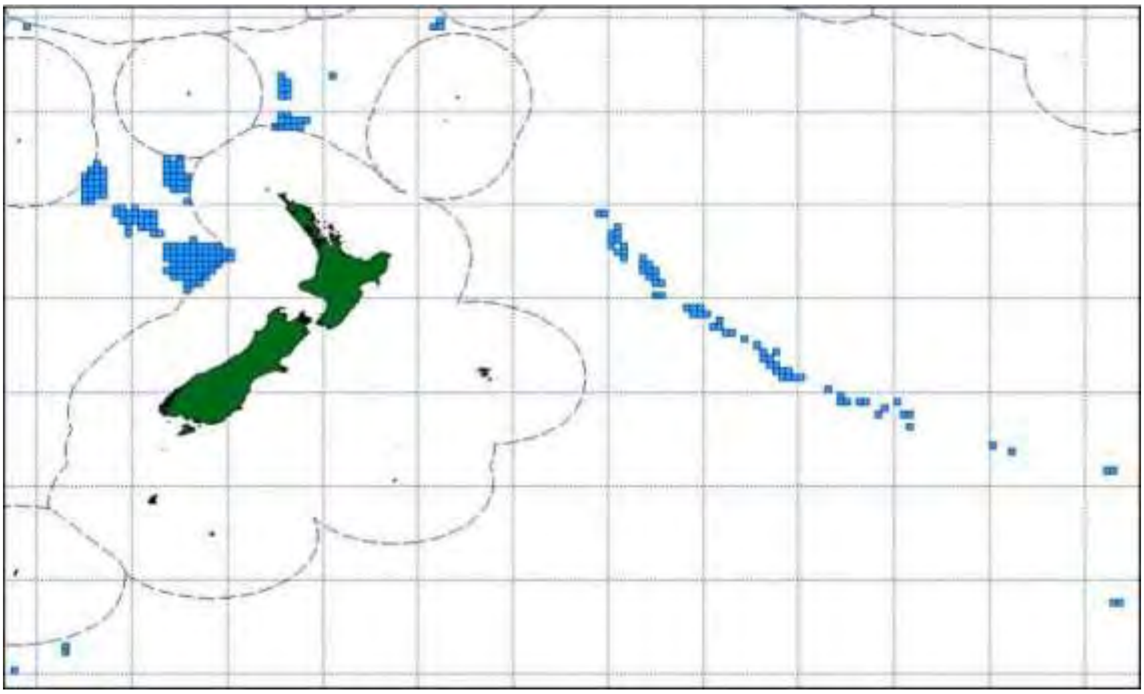


Figure 6: New Zealand all methods, all areas, combined bottom fishing footprint map, showing the total 218 blocks fished by any method over the 2002 - 2006 reference period (from New Zealand SPRFMO Area Bottom Fishery Impact Assessment Draft 1.0).

The two proposed exploratory fishing blocks (A and B) are shown in Figures 7 and 8. These represent the areas in which the vessel will search for suitable fishing ground. New Zealand fishing companies' knowledge of similar areas in the Southern Ocean and Antarctica suggest it is unlikely that much of this area (estimated less than 5%) will be within the depth ranges suitable for fishing.

The maps shown here below are based on the Global Multi-Resolution Topography (GMRT) synthesis which is a publicly available continuously-updated compilation of seafloor swath bathymetry integrated with global land topography. Swath bathymetry data acquired with ships throughout the global oceans are cleaned, quality assured and curated by data managers at the Marine Geoscience Data System (MGDS) for inclusion in GMRT.

The Global Multi-Resolution Topography (GMRT) synthesis is a multi-resolutional compilation of edited multibeam sonar data collected by scientists and institutions worldwide, processed and merged into a single continuously updated compilation of global elevation data. GMRT v3.0 on which these maps are based was released in June 2015 and includes 2,719,144 miles of data from 844 cruises.

Where sonar data is not available (in the area proposed there is very little - Figure 7) the map is based upon bathymetry data from the GEBCO_08 Grid, version 20100927, a global bathymetric grid with 30 arc-second spacing. The grid is based on a database of ship-track soundings but, where data are sparse, as in this case, the grid is based on ship-track soundings with interpolation between soundings guided by satellite-derived gravity data.

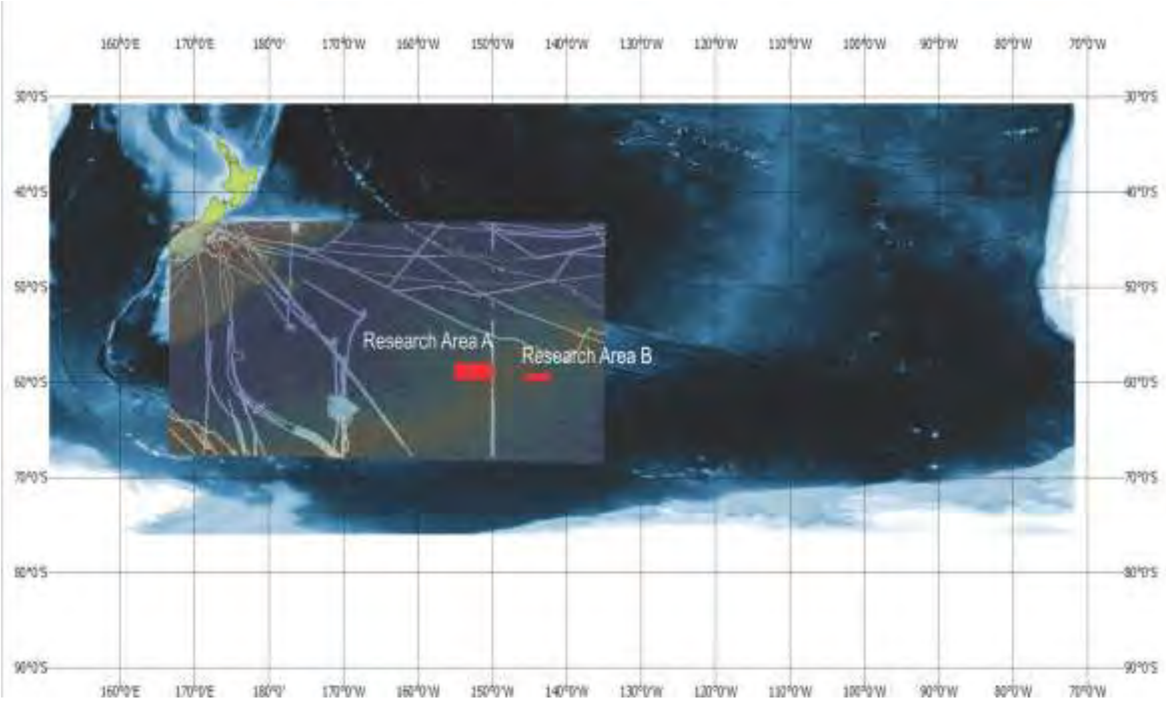


Figure 7: Map showing the general location of proposed Southern Ocean research areas. The internal box indicates positions of swath bathymetry tracks.

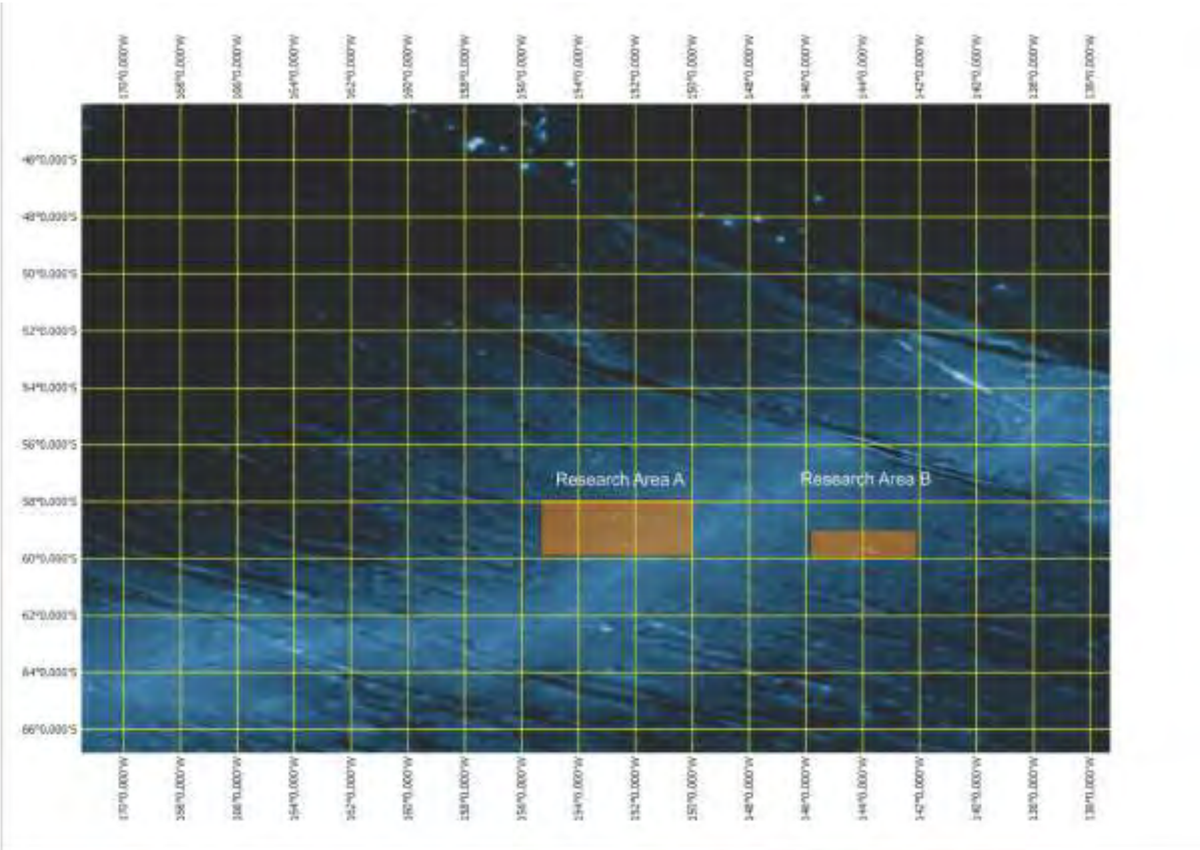


Figure 8: Map showing the proposed research areas at a higher resolution.

Table 3: Corner positions for the two proposed exploratory fishing boxes.

Exploratory fishing area	Box corners	
A	57 54.0S	155 20.0W
	59 54.0S	155 20.0W
	59 54.0S	150W
	57 54.0S	150W
B	59S	142 10.0W
	60S	142 10.0W
	60S	145 50.0W
	59S	145 50.0W

3.9. Predictive habitat models for VME indicator taxa or features in the SPRFMO Area

Relatively little information is available on topographic features likely to support VMEs in the proposed exploratory fishing areas. However, models that predict the likelihood of VME habitat or features (i.e. seamounts) and VME indicator taxa which include the SPRFMO area have been built (e.g., seamounts - Kitchingman & Lai 2004; Allain et al 2008; Yesson et al. 2011; VME indicator taxa Tittensor et al. 2009, Davies & Guinotte 2011, Yesson et al. 2012).

Penney (2010) showed several maps predicting habitat suitability for scleractinian corals based on broad-scale data (e.g., Figure 9 for the depth range 750–1000 m). These predictions suggests that, at a very broad scale, there is low-moderate likelihood of stony corals (a key VME indicator taxon) occurring in the general vicinity of the proposed exploratory fishing areas.

Recently, Boosted Regression Tree (BRT) and Maximum Entropy (MaxEnt) habitat suitability models were constructed specifically for the SPRFMO area and for the New Zealand EEZ. Details of these models and the results of a field validation exercise are contained within a manuscript submitted for publication (Anderson et al. submitted). That validation exercise showed that models predicting a suite of four stony coral VME indicator taxa (combined) did not perform very well, primarily because many of the environmental predicator variables used were scaled to 1 km resolution using a global bathymetry data set that was found to be very imprecise in the validation area (sometimes biased by many 100s of metres depth). However, the authors consider that the models predict the likelihood of suitable habitat for coral VME indicator taxa at a coarse-scale (i.e., at the scale of a large topographic feature such as a seamount or ridge, but not at within-feature scale.

Noting the general imprecision of the models, predictions of the likelihood of four key VME indicator stony coral taxa (*Solenosmilia variabilis*, *Goniocorella dumosa*, *Enallopsammia rostrata* and *Madrepora oculata*) were generated and mapped (Figure 10) to give a broad indication of the likelihood of encountering VMEs in the proposed exploratory fishing areas.

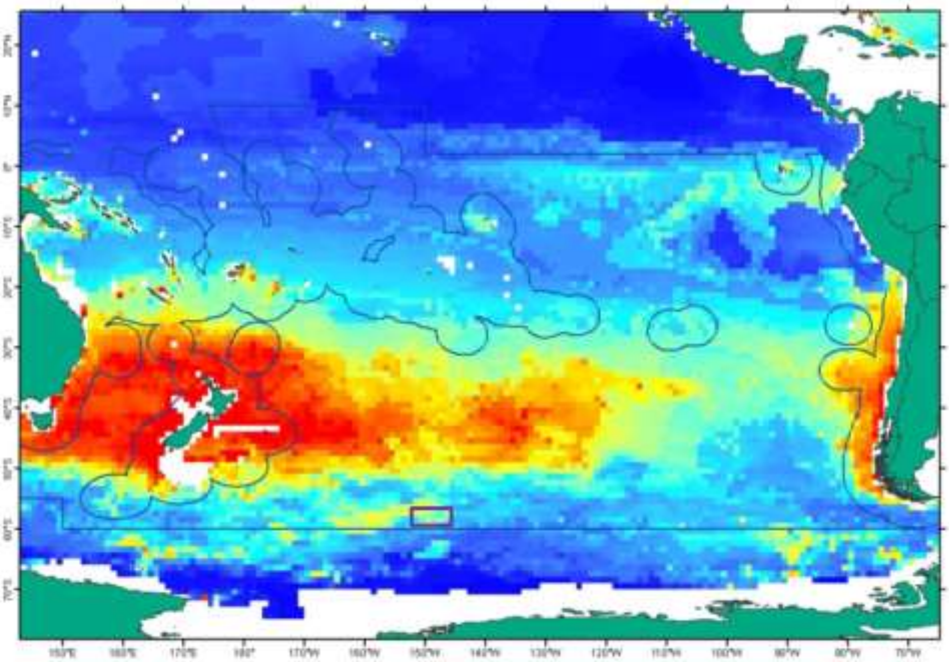


Figure 9 (after Penney 2010): Predicted 1° global scleractinian coral habitat suitability (dark blue=0 to dark red=1) in the 750m to 1,000m depth range, from Tittensor et al. (2009). The general location of the proposed exploratory fishing areas is outlined in purple and the SPRFMO Area is outlined in blue.

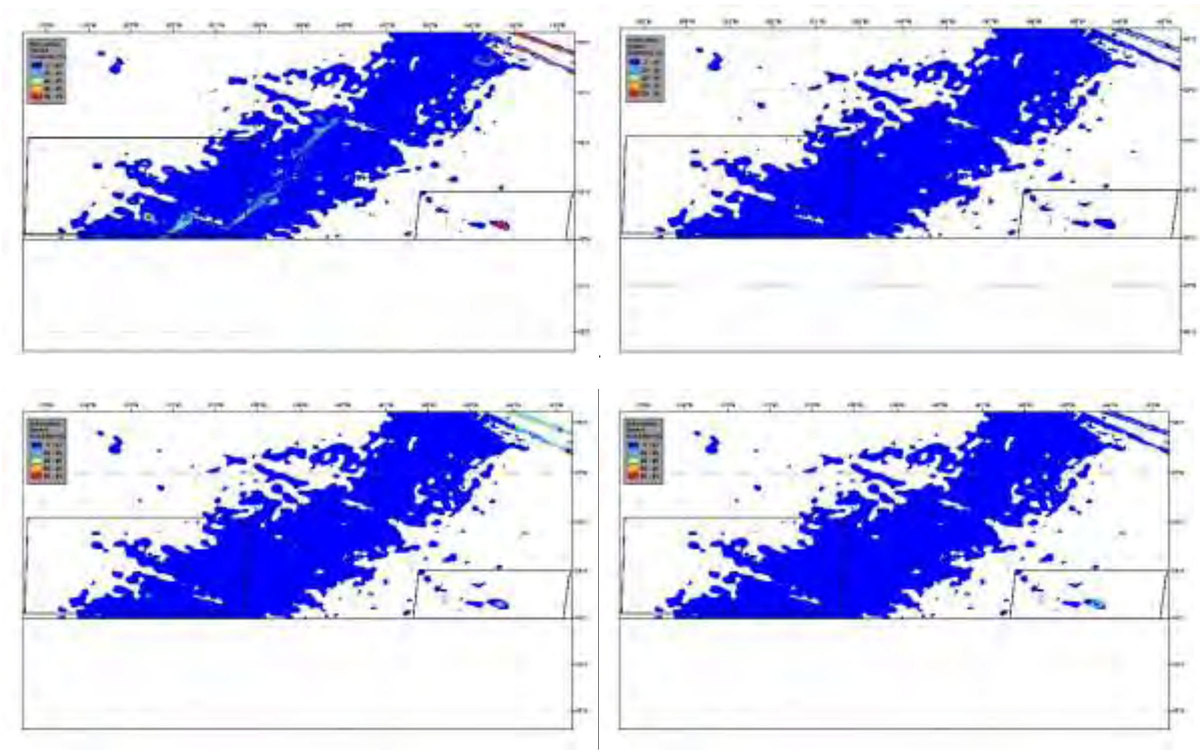


Figure 10: Indicative maps of model-predicted VME likelihood for the two proposed exploratory fishing boxes. The top two panels show predictions for four key species of scleractinian (stony) corals (combined) using BRT model on the left and a MaxEnt model on the right. The two lower panels show predictions for two individual species using MaxEnt model, *Goniocorella dumosa* on the left and *Solenosmilia variabilis* on the right. Areas plotted white are either outside the SPRFMO area or deeper than 2000 m.

BRT and MaxEnt models perform differently and make different predictions for the level of habitat suitability; in this case, BRT models generally predict higher habitat suitability for the suite of four stony coral species than MaxEnt models, especially on two features, one in each of the proposed exploratory fishing areas. It is important that the uncertainty in this model predictions is borne in mind but, taken together, these outputs suggest that there are two large topographic features (one in each proposed exploratory fishing area) that may provide suitable habitat for coral species that could indicate the presence of a VME.

No other information on the presence or likelihood of VMEs was available from the SPRFMO secretariat.

3.10. Other information that might be useful in assessing the potential impacts of fishing.

There is no other information that might be useful in assessing the potential impacts of the proposed fishing, but collection of this information will be a major objective of the programme. During exploratory fishing trips, the vessel will collect continuous bathymetry information as it maps and works the grounds and MPI observers will collect comprehensive shot-by-shot information on VME indicator taxa and other benthic bycatch. Both will assist in future VME characterisation and prediction.

4. Impact assessment.

4.1. Scoping of Issues of concern

The proposed fishing activity entails the use of demersal bottom longline (see section 3). New Zealand's Bottom Fishery Impact Assessment for bottom fishing activities by New Zealand vessels fishing in the SPRFMO Area during 2008 and 2009 (for bluenose and hapuku, not for toothfish) noted the following potential impacts:

- direct impact of bottom lines on VMEs
- over-exploitation of bottom lined species
- loss of bottom line fishing gear

The 2008–09 risk assessment is not considered to be an appropriate risk assessment for the proposed fishing activity, given the different gear to be employed, but it is considered that the same three potential impacts exist for the proposed bottom line fishing for toothfish during the proposed exploratory fishing phase.

4.2. Risk assessment.

4.2.1. Previous similar risk assessments

Two risk assessments for demersal longlining have been conducted that are relevant context for this proposal, but neither constitutes an acceptable risk assessment for the proposed exploratory fishing:

- The results of a qualitative risk assessment in the Bottom Fishery Impact Assessment by New Zealand vessels fishing in the SPRFMO Area during 2008 and 2009 (using gear suitable for bluenose and hapuku) are summarised in Table 4 and reproduced in full in Appendix 1 (NZ Ministry of Fisheries 2008). That risk assessment is not considered appropriate for the proposed exploratory fishing because the gear and target species are both different.
- The results of a quantitative risk assessment employed more recently in the CCAMLR area are described below (after Sharp 2010). That risk assessment is not considered appropriate for the proposed exploratory fishing because the fishing area is different.

For context, these two risk assessments are summarised in the following two sections.

4.2.2. New Zealand's qualitative 2008–09 risk assessment for bottom longlining

Each of the three potential impacts was assessed, based on the FAO Deepwater Guidelines (FAO 2008), using specific definitions for the various rating criteria. To the extent possible, allocation to ranks was based on quantifiable criteria. Elements of risk specifically evaluated were:

- Description of Impact - Provides a brief description of the expected impacts, answering the question, "What will be affected and how?"
- Extent - Indicates whether the impact will be: Site Specific (limited to within one kilometre of the fished site); Local (limited to within one fished 20' block, or 50km of the fished site); Regional (limited to the fishing area ~200-500 km radius); or Oceanic (extending across a significant proportion of an ocean basin, or of the SPRFMO Area).
- Duration - Gives the expected duration of the effects of the impact, being: Short (months, <1 year); Medium (years, 5-20); or Long (> 20 years, decades to centuries).
- Intensity - Provides an expert evaluation of whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as: None (no impact); Low (where environmental processes are slightly affected); Medium (where environmental processes continue to function but in a noticeably modified manner); or High (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed established standards / requirements).
- Cumulative Impact - An assessment of whether the impact is cumulative over time or space or not, and is expressed as being: Unlikely (the event is either a low-impact rare event, or recovery is rapid, such that effects will not accumulate over time or area); Possible (depending on extent, severity, natural disturbance levels and recovery rates); or Definite (at

the intensities occurring, effects will endure such that, over time or space, impacts from a number of separate operations will accumulate).

- Overall Significance - The overall significance of each impact is then evaluated from the combination of duration, extent, intensity and cumulative effects. Overall Significance is determined as follows:
    - Low: Where the impact will have a negligible influence on the environment and no active management or mitigation is required. This would be allocated to impacts of low intensity and duration, but could be allocated to impacts of any intensity, if they occur at a local scale and are of temporary duration.
    - Medium: Where the impact could have an influence on the environment, which will require active modification of the management approach and / or mitigation. This would be allocated to short to medium-term impacts of moderate intensity, locally to regionally, with possibility of cumulative impact.
    - High: Where the impact could have a significant negative impact on the environment, such that the activity causing the impact should not be permitted to proceed without active management and mitigation to reduce risks and impacts to acceptable levels. This would be allocated to impacts of high intensity that are local, but last for longer than 5-20 years, and/or impacts which extend regionally and beyond, with high likelihood of cumulative impact.

The separate assessments against these criteria for New Zealand's bottom longlining activities for bluenose and hapuku in 2008/09 are summarised in Table 4, and the activity was assessed as having low or low-medium risk.

Table 4: Summary of risk assessment for New Zealand bottom longlining (primarily for bluenose and hapuku) in 2008/09.

	Extent	Duration	Intensity	Cumulative	Overall
Direct impact of bottom lines on VMEs	Site-specific	Medium	Low	Possible	Low / medium
Over-exploitation of bottom lined species	Regional	Medium	Low	Likely	Low / medium
Loss of bottom line fishing gear	Site-specific	Medium	Low	Unlikely / possible	Low

4.2.3. Quantitative CCAMLR risk assessments

The proposed demersal longline fishing method is used in the CCAMLR area and its impact was extensively reviewed by Sharp (2010) to estimate the likely impacts of bottom longline fishing on vulnerable benthic invertebrate taxa and, generically, Vulnerable Marine Ecosystems (VMEs). This work was consistent with the requirements of CCAMLR Conservation Measure 22-06 (Bottom fishing in the Convention area).

Intensity. Sharp noted that effort densities associated with the New Zealand fishing effort as represented by fished pixels within the Ross Sea region was overall very low. Even within fished areas over his 12 year time series it is clear that fishing effort is highly concentrated in preferred locations; i.e. 94% of the fished pixels had effort densities less than 1.5 km of line / km^2, and only 13 individual pixels (0.7%) had effort densities in excess of 4 km of line per km^2. Applying the mean lognormal-input impact index estimate (1.84×10^{-3}) as calculated in the paper to the effort density distribution (Figure 11) implies that VME taxa in 94% of historically fished locations have experienced lethal impacts less than 0.28%, and in only 0.7% of fished locations have VME taxa experienced impacts of greater than 0.74%, to a maximum lethal impact (on VME organisms) of 1.8%.

Limited knowledge of the proposed bathymetry and fauna as being an extension of the Pacific Antarctic Ridge suggests that this is likely to be similar to the northern hills area of the Ross Sea. Mean and maximum lethal impacts could be estimated based on the expected fishing pattern.

Sharp's (2010) assessment of the impacts of this comparable area (88.1 northern hills) which are shown in Figure 12 as bioregional categories 16 and 17. Intensity is likely to be much less during this proposed exploratory project than would be common in an operational fishery such as The Ross Sea. Full monitoring of VME indicator and other benthic organisms will take place during all fishing operations.

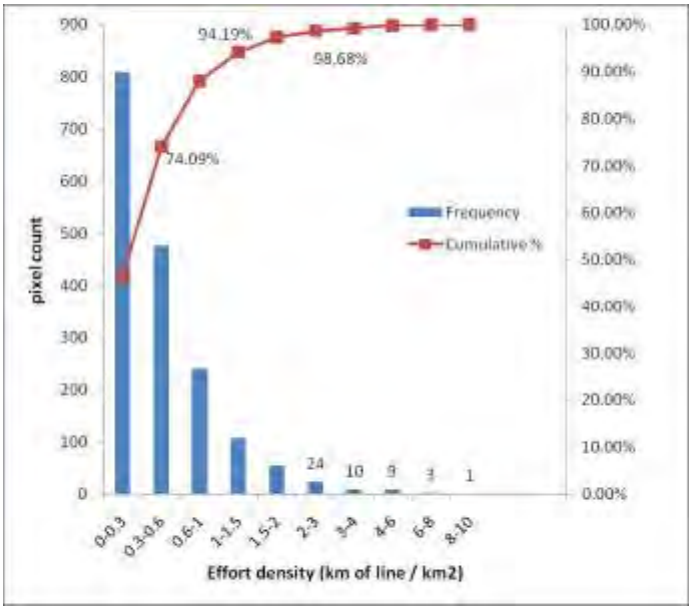
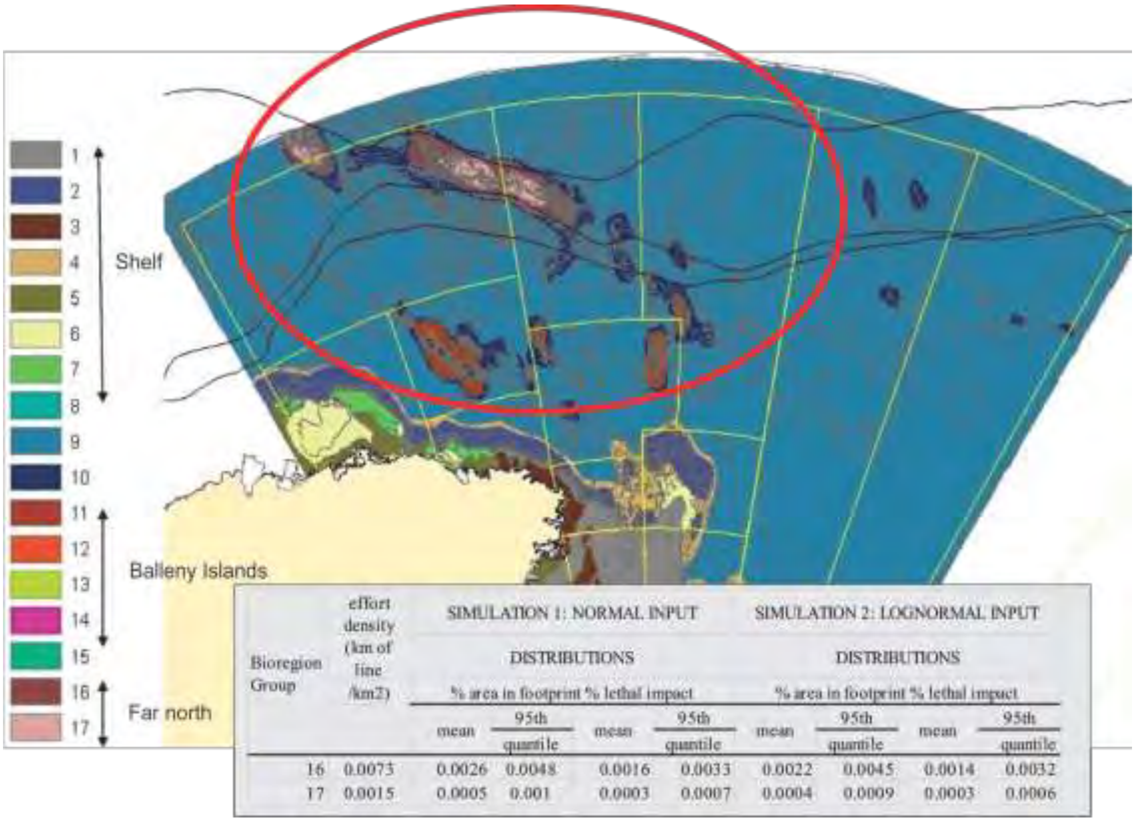


Figure 11 (after Sharp 2010): Spatial concentration of all historical New Zealand fishing effort in the Ross Sea. The histogram sorts 1737 non-zero-effort pixels (0.05° latitude x 0.177° longitude) as a function of cumulative effort density (in km of line per km^2). Note that the horizontal scale is not linear and that an additional 115 296 pixels in the Ross Sea with zero New Zealand effort (98.4% of the total) are not shown.



Bioregion Group	effort density (km of line /km2)	SIMULATION 1: NORMAL INPUT				SIMULATION 2: LOGNORMAL INPUT			
		DISTRIBUTIONS				DISTRIBUTIONS			
		% area in footprint		% lethal impact		% area in footprint		% lethal impact	
		mean	95th quantile	mean	95th quantile	mean	95th quantile	mean	95th quantile
16	0.0073	0.0026	0.0048	0.0016	0.0033	0.0022	0.0045	0.0014	0.0032
17	0.0015	0.0005	0.001	0.0003	0.0007	0.0004	0.0009	0.0003	0.0006

Figure 12: The benthic bioregionalisation of the Ross Sea region showing the analogous northern hills area (termed "far north" by Sharp) and the estimated cumulative footprints and impacts associated with all New Zealand effort in the history of the Ross Sea fishery (Areas 88.1 and 88.2, 1997-2009), within the northern hills bioregionalisation groups (16 and 17). Mean and upper bound confidence interval (95th quantile) values are shown. Modified from Sharp et al. (2010).

Duration *– how long the effects of the impact are likely to last.*

The duration of impact at the scale of individual organisms or communities is taxon-dependent. Some VME indicator taxa like stony and gorgonian corals are very long-lived and effects at particular sites where these are common or dominant can be expected to endure at least several years. Conversely, some other benthic taxa are more productive and mobile and effects where these are dominant will be more transient. Collection of samples taken by fishing gear to improve this information will be one of the priority objectives of the project.

Spatial extent *– The spatial impact relative to the extent of the VMEs (e.g. will fishing impact 5%, 30% or 80% of the VME distribution) and whether there may be offsite impacts (e.g. will reproduction be impacted at a broader spatial scale).*

The spatial risk assessment approach summarised here uses the CCAMLR approach as detailed in Sharp et al (2009) and Sharp (2010). In a preliminary assessment of known and anticipated impacts on proposed bottom fishing activities on VMEs in 2012/13 by the CCAMLR Secretariat (CCAMLR 2012) New Zealand reported that: *Consistent with the assumptions adopted by WG-FSA in 2010 and described in the Report on Bottom Fisheries and Vulnerable Marine Ecosystems (SC-CAMLR XXX, Annex 7, Appendix D), we apply an estimated footprint index of 6.67 x 10^{-3} km^2 of seabed area per km of longline deployed. This index is likely to over-estimate impact because it assumes a mean lateral* *movement frequency of 0.5 (i.e. lateral movement occurring in 50% of all deployments) irrespective of depth, whereas the only instances of lateral movement actually observed by the UK in tethered camera deployments in 2010 (WG-EMM-10/30) were shallower than fishable depths (observed deployments at typical fishable depths for longlines were observed to lift vertically from the seafloor with no lateral movement). Adopting the assumptions of WG-FSA in 2010 is therefore conservative (precautionary).* In the absence of any current accurate bathymetry data for the target research areas a precautionary estimate of impact could be estimated using the footprint index above of 6.67 x 10^{-3} km^2 of seabed area per km of longline deployed. A sensitivity analysis could be conducted using the slightly greater line movement cited by Welsford et al. (2014).

The indications from Sharp (2010) were that an area in the northern Ross Sea (suggested as being analogous) has had very low fishing footprints (a mean value of 0.00142% across the two identified bioregions) and mortality/lethal impact had a mean value of 0.0009%. Based on experience in similar areas, New Zealand fishing companies estimate that less than 5% of the proposed research areas identified for exploration in the SPRFMO area will be fished and may have a similarly low footprint. However, the distribution of VMEs and the association between toothfish and VMEs is poorly known so the proportion of VMEs potentially impacted is less predictable.

There are unlikely to be any offsite or far-field effects from bottom longlining because such gear disturbs only a small amount of sediment relative to a bottom trawl tow.

Cumulative impact: Given the small footprint of individual demersal longline sets, multiple fishing events in the same location are unlikely even in the most intensively fished areas. Sharp (2010) indicated that even at the scale of the most heavily fished areas and impacted bioregionalisation groups in the Ross Sea simulations showed that the impacted bioregionalisation groups had experienced approximately 0.013% lethal impact of the most vulnerable VME taxa, with an upper bound (95th quantile) estimate of 0.03% lethal impact.

Overall risk. At the level of fishing proposed and with the small footprint and impact of demersal longline gear, the overall risk is suggested to be low and the impact will probably have a negligible influence on the overall benthic environment. If toothfish and fishing effort are closely associated with VMEs (and these are predicted to take up only a very small fraction of the exploratory fishing boxes, see Figure 10), then additional analysis will be required to determine the area likely to be affected. Improving information on the bathymetry, benthic fauna, and likely distribution of VMEs are all objectives of this exploratory work.

4.2.4. Risk assessment for the proposed exploratory fishing

At the time of submitting this paper for the consideration of the Scientific Committee, it had not been possible to finalise a risk assessment specific to the proposed exploratory fishing activities and, indeed, risk is contingent on the actual design developed and on any effort and catch limits imposed. A qualitative, expert-based risk assessment of the staged exploratory fishing activity will be conducted by appropriate experts in New Zealand. That assessment will be modelled on the previous New Zealand qualitative risk assessment in Appendix 1, and will be provided to the

Secretariat for the consideration of the Scientific Committee by 28 August 2015. That risk assessment will be specific to the exploratory fishing programme only.

If a substantive fishery is subsequently proposed by New Zealand, that proposal will be underpinned by a more comprehensive and rigorous impact and risk assessment, potentially applying the quantitative method of Sharp (2010).

4.3. Interactions with VMEs

- *What impacts are likely to result from the fishing gears to be used? All impacts should be identified, characterised and quantified or ranked.*

New Zealand has carried out cumulative impact assessments on bottom longline gear in the CCAMLR area since 2008. Although a low risk factor, relative to other interactions the complete or partial loss of gear was identified as the most important consideration. A direct relationship between the amount of gear loss and the presence of, and operating within, sea-ice has been established. For example the same vessels working in the CCAMLR sub area 48.3 fishery where there is no sea ice have very little gear loss. Sea-ice should not be a factor in the proposed exploratory fishing areas, so one major contributing cause of gear loss is not present. There may be other risks, particularly rough bottom.

- *What will the probability, likely extent (% of habitat targeted) and intensity of the interaction between the proposed fishing gear / targeting practices on the VMEs in the proposed fishing areas be?*

In the absence of accurate bathymetry data for the proposed exploratory fishing areas, a precautionary estimate of the impacted area of seabed could be made using the footprint index of 6.67×10^{-3} km^2 of seabed area per kilometre of longline deployed. This would suggest the extent of interactions between fishing gear and benthic habitat is likely to be small. A number of other fisheries target toothfish but there is little evidence that such fishing focusses on VMEs. For instance, Parker and Smith (2011) compared indices of toothfish presence and abundance with the presence of VME organisms. They concluded that toothfish indices were not useful in predicting the occurrence of any of the six common VME indicator taxa captured on individual longline segments and toothfish catch never explained more than 4% of the null model deviance when forced into the model. Parker and Mormede (2009) explored the catch of VME indicator organisms collected during the 2008/09 Ross Sea longline fishery for any correlation with toothfish catch-rate. They also concluded that there was no evidence of a functional relationship. These studies suggest that CCAMLR fisheries for toothfish do not focus on VMEs.

- *What are the characteristics of the habitats and benthic communities which may be impacted? Are the fished seabed features likely to support VMEs?*
- *How diverse is the ecosystem in the proposed fishing areas, and will the fishing activity reduce this biodiversity? Do the proposed fishing areas contain rare species which do not occur elsewhere?*

No sampling has yet as taken place and very little precise bathymetric data is available to provide information on the characteristics of the habitats and benthic communities potentially impacted by this proposal. It may be possible by analogy to look at information available from the northern Ross Sea and Amundsen Sea (CCAMLR Subarea 88.2) regions. Figures 13 and 14 provide some information from the Ross sea toothfish fishery. Generally numbers of VME organisms recovered in the Northern Hills area - analogous to the proposed research areas A and B - are lower than observed further south. CCAMLR 5-day reports indicate that, of the 58 VME risk areas notified under conservation measure between 2009 and 2015, only one is north of the shelf break at 70 S. and lies at 65°'S 23' S.

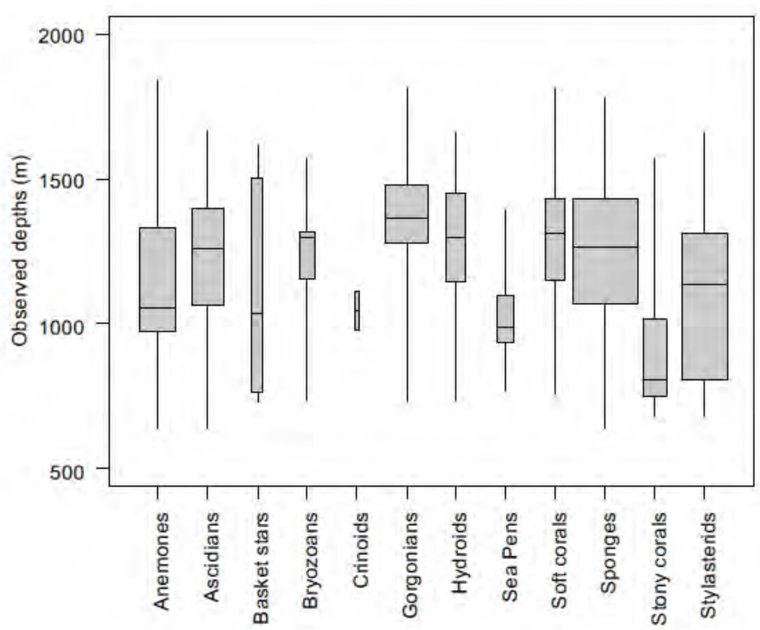


Figure 13: Scaled depth distribution of potentially vulnerable taxonomic groups from the 2009 Ross Sea longline fishery. Boxes show interquartile range, horizontal line indicates median and vertical lines indicate range. Box would is proportional to the number of observations. Note that fishing is not allowed shallower than 550 m in the CCAMLR Convention Area. From Parker and Bowden (2010).

- *What is the likely spatial scale and duration of the impacts? The overall scale of impact will be the product of spatial scale, duration and cumulative impact on VMEs and low productivity resources. To the extent possible, rates of recovery, regeneration and re-colonisation should be quantified or estimated.*

The current proposal is a stepwise research plan involving preliminary searching and investigation of potential bathymetric features that may constitute habitat for toothfish. This preliminary phase would be in the order of 7 to 10 days and would involve a maximum of up to five lines and about 17 500 total hooks per day set in a structured design of multiple lines (if fishable ground was located). It is highly unlikely that this entire period would be spent fishing. Note that the most current information indicates that any fishing is likely to be deep resulting in limited sideways movement of the line. In such cases the maximum impact width is likely to be in the order of 1 m (given a snood length of 0.5 m between the hook and the mainline).

Proposals for subsequent fishing trips would be similarly structured, depending on the results of the first trip.

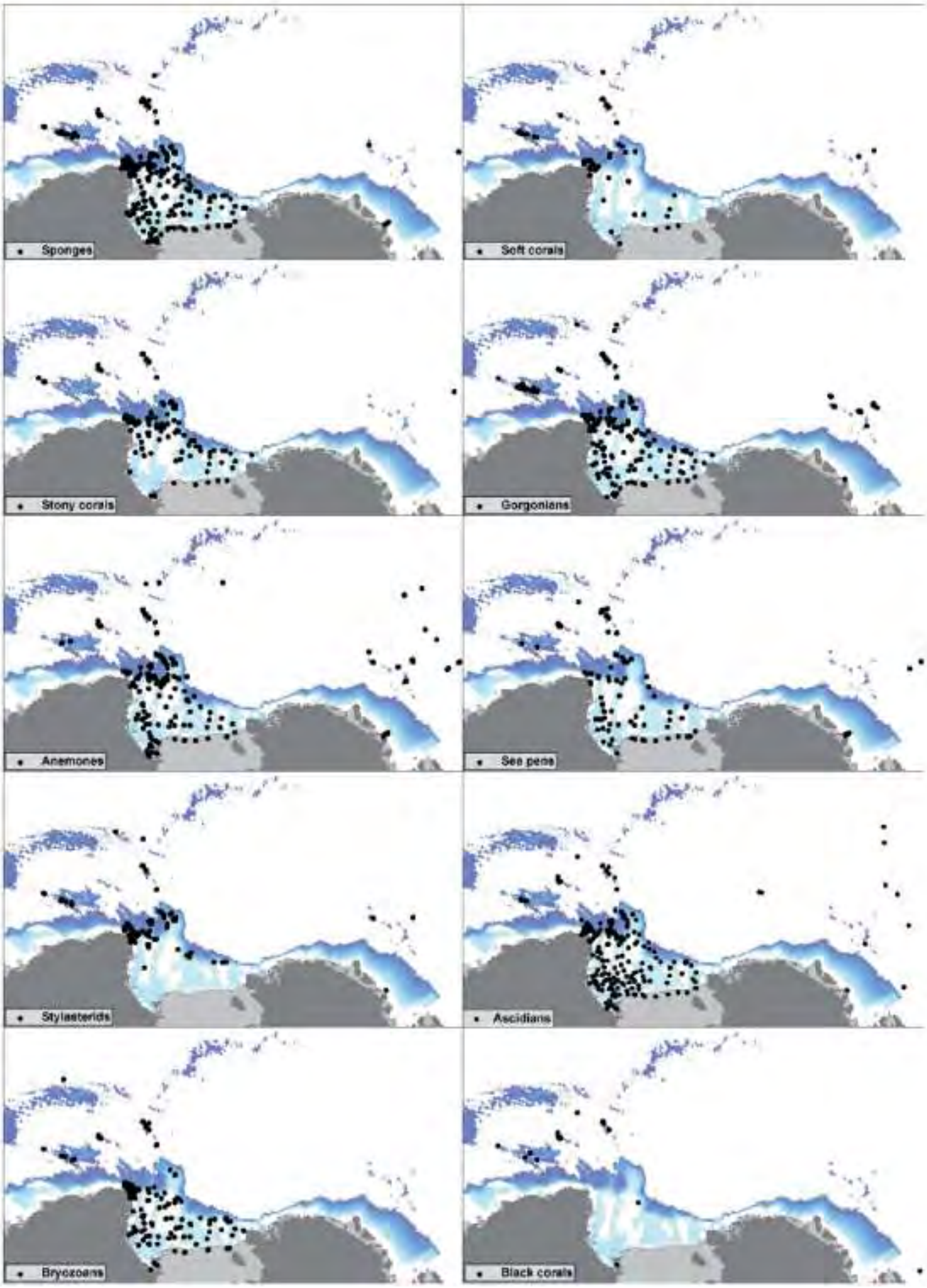


Figure 14: Distribution of selected Taxonomic Groups in the Ross Sea region based on samples from New Zealand's NIWA invertebrate collection, SCAR MARBIN and CCAMLR 2009 retained samples from New Zealand scientific observers collected on New Zealand fishing vessels. Bathymetry from 500 to 2500 m is shaded light to dark blue. From Parker and Bowden (2010).

- *Are there any other threats or issues of concern expected from the proposed fishing activities, such as gear loss and ghost fishing, incidental bycatch discards, protected or endangered species mortalities, effects on ecosystem functioning?*

The lack of sea ice greatly reduces the potential for gear loss. Rugged or sticky bottom and strong tides may still create some potential to lose gear however. Ghost fishing does not occur with longline gear as the bait decomposes or is eaten by marine amphipods within 24 to 36 hours.

Seabird mortality mitigation measures have been successfully developed by the demersal longline fleet catching toothfish. As an example in the Ross Sea toothfish fishery only two birds have been killed as a result of fishing operations in 16 years. There will probably be a higher rate of seabird interactions in the proposed exploratory fishing areas (and, therefore, higher risk of captures) than in CCAMLR areas 88.1 and 88.2. Encounters could include endangered petrels like Chatham petrel whose at-sea distribution is known to include the proposed exploratory fishing areas (Figure 15). However, mitigation measures applied in CCAMLR, Macquarie Island, and Heard & MacDonald Island fisheries using very similar gear have been found to be very effective. Such measures (including integrated weight line, tori lines, offal management, and night-setting) will be applied rigorously during exploratory fishing and both seabirds and mitigation will be monitored by observers.

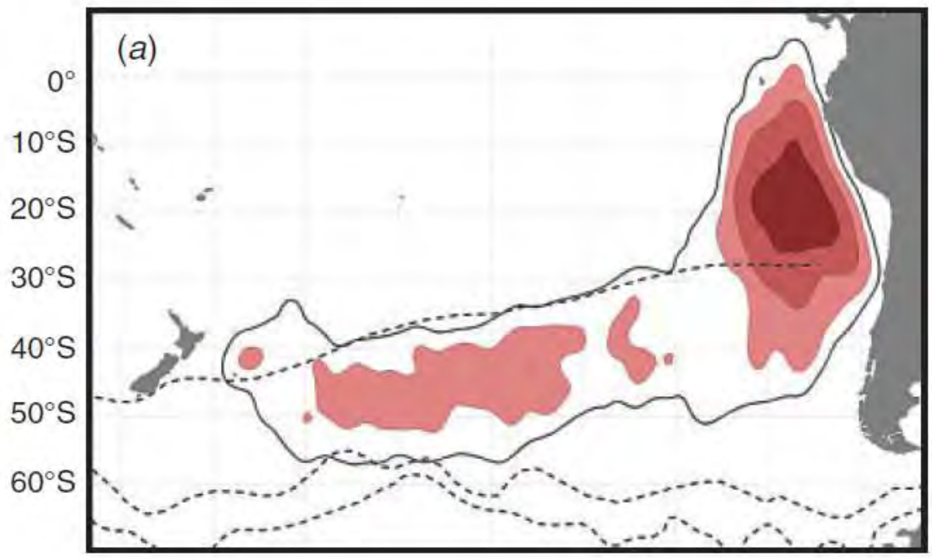


Figure 15 (after Rayner et al. 2012): Kernel density distributions for Chatham petrels tracked with geolocator-immersion loggers during the non-breeding period (May–October 2009). Coloured polygons represent the 25, 50 and75 %density contours, and the outer black line represents the 95% density contour. Approximate locations (north to south) of the Subtropical Front, Subantarctic Front and Polar Front are shown as dotted lines.

5. Information on Status of the Deepwater Stocks to be Fished.

- *A list of the intended target and likely by-catch species.*

The proposed target of this exploratory fishing, *Dissostichus* spp, comprises two species with broad circumpolar distributions. Stock structure for both species is poorly understood (Hanchet et al 2015 in press). It is therefore not possible to be definitive about the species or stock from which any fish caught, and the status of that stock will therefore be uncertain.

In the absence of any available information and the intended fishing areas and given the general homogeneity of circumpolar fish species in the Antarctic convergence area it is reasonable to use analogous catches from other CCAMLR and high latitude demersal longline fisheries. Typically, these fisheries take more than 90% toothfish, with about 5% rattails and smaller numbers of morid cods, skates and other species.

- *Tables of historic catches and catch trends of these species in the intended fishing area, if available.*
- *Results of any surveys conducted on the stocks to be fished.*
- *Results of the most recent stock assessments that have been conducted for the stocks to be fished.*
- *Any other information relevant to understanding the status and sustainability of target and by-catch species.*

There is no known historical fishing or catch from the proposed exploratory fishing areas and no surveys have been carried out on any stocks to be fished. However, information held by the SPRFMO secretariat indicates a history of fishing for Patagonia toothfish in the SPRFMO area, including both bottom trawl and bottom longline (Table 6).

This information comes largely from New Zealand's national data report in 2007 during the preparatory meetings for the formation of SPRFMO which indicated catches of 11 t of toothfish in 1995 and 1145 t in 1996 (Table 7, reproduced from NZ Ministry of Fisheries 2007).

Detailed examination of the reported fishing that led to this summary shows that the 1156 t of toothfish taken in 1995–96 was from the Australian EEZ near Macquarie Island by a single vessel (flag unrecorded in New Zealand records, but probably Australian, fishing for a New Zealand company). That trip entailed 280 bottom trawl tows within the Australian EEZ and two bottom trawl tows within what is now the SPRFMO area with no catch of toothfish.

Table 6: Information on catch history of Patagonian toothfish within the SPRFMO area held by the secretariat as at 7 August 2015.

Participant	Year	Area / 5x5 Degree Square	5x5 square	Fishing Method	Species / Group Name	Catch Weight (Kg)
New Zealand	1995	HS-SPRFMO-FAO81		(Bottom trawl)	Patagonian toothfish	11,000
New Zealand	1996	HS-SPRFMO-FAO81		(Bottom trawl)	Patagonian toothfish	1,145,000
New Zealand	2003	HS-SPRFMO-FAO81	-57.5/157.5	09.9.0 Hooks and Lines (not specified)	Patagonian toothfish	1,000
New Zealand	2004	HS-SPRFMO-FAO81	-57.5/162.5	09.9.0 Hooks and Lines (not specified)	Patagonian toothfish	3,173
New Zealand	2004	HS-SPRFMO-FAO81	-57.5/217.5	09.9.0 Hooks and Lines (not specified)	Patagonian toothfish	44

Table 7 (reproduced from NZ Ministry of Fisheries 2007): catch by species and year for New Zealand vessels operating in the reporting area specified during the negotiations (now the SPRFMO area).

Year	Hoplostethus atlanticus	Epigonus telescopus	Allocyttus niger	Hyperoglyphe antarctica	Dissostichus eleginoides	Pseudocyttus maculatus	Macruronus novaezelandiae	Beryx splendens, B. decadactylus	Others	Total
1990	561						510		262	1,333
1991	141		9	3		20	19		183	375
1992	757	10	1	51		8	111	23	132	1,093
1993	4,943	245	29	223		31	37	43	529	6,080
1994	3,191	1,058	25	136		32	74	86	603	5,205
1995	12,505	320	844	175	11	358	261	18	681	14,971
1996	9,492	265	113	82	1,146	161	73	70	697	12,098
1997	4,178	351	123	168		89	119	31	517	5,576
1998	2,432	182	171	140		195	32	464	388	4,004
1999	5,892	325	51	53		169	89	39	189	6,808
2000	1,886	151	84	19		90	2	29	89	2,330
2001	2,942	485	16	49		109		22	117	3,739
2002	3,335	159	126	1		51	7	18	277	3,974
2003	2,495	227	72	20		29	4	191	599	3,643
2004	2,170	87	102	132	3	120	1	167	222	3,004
2005	2,570	188	531	101		95	1	25	311	3,822
2006	1,681	21	61	277		9	1	28	246	2,324
Total	61,169	4,081	2,146	1,657	1,160	1,567	1,348	1,261	6,051	80,440

New Zealand holds records of about 1.5 t of Patagonian toothfish caught by bottom line in 1996 and 1999 and will explore why this is not included in the secretariat's records. Two NZ vessels lined for toothfish in the 2002–2006 reference period. The fishing occurred in 2003 and 2004 and targeted Patagonian toothfish (*Dissostichus eleginiodes*) in SPRFMO General Fishing areas now known as the Hjort Trench and the Southwest Pacific Basin. There were 29 fishing events involving the setting and hauling of 116 000 hooks. A total of 5.6 t of fish was caught including 3.9 t of *Dissostichus eleginiodes* and 0.1 t of Antarctic toothfish, *Dissostichus mawsoni*.

These data suggest that only a small amount of toothfish has been taken from the SPRFMO area since 1990. Mostly Patagonian toothfish, *Dissostichus eleginiodes* and a negligible amount of Antarctic toothfish, *Dissostichus mawsoni*. The average catch each year (almost entirely Patagonian toothfish) during the reference years (2002–2006) was 780 kg. It is proposed that greater annual catches and retention of toothfish are permitted during this exploratory fishing, including up to 30 tonnes (greenweight) of the two toothfish species combined from the first exploratory fishing trip and in the following year (subject to review).

The proposed exploratory fishing areas lie very close to the southern boundary of the SPRFMO area where it abuts the CCAMLR area. The methodology for carrying out stock assessments on toothfish stocks is well developed and widely used within CCAMLR. Should a fishery be found in the area to be researched, this methodology may be transferable. The interaction between toothfish in the SPRFMO and CCAMLR areas needs to be considered carefully and will benefit from information collected during structured exploratory fishing.

6. Proposed monitoring measures

The following SPRFMO CMMs apply to this exploratory fishing.

- **2.03** (effective 4/05/2014) Bottom fishing in the SPRFMO Convention Area
- **2.04** (effective 4/05/2014) Minimising Bycatch of Seabirds in the SPRFMO Convention Area
- **2.05** (effective 4/05/2014) Establishment of the Commission Record of Vessels Authorised to Fish in the SPRFMO Convention Area
- **2.06** (effective 4/05/2014) Establishment of the Vessel Monitoring System in the SPRFMO Convention Area
- **2.07** (effective 1/01/2015) Minimum Standards of Inspection in Port
- **3.02** (effective 13/05/2015) Standards for the Collection, Reporting, Verification and Exchange of Data
- **3.03** (effective 13/05/2015) Establishment of a Compliance and Monitoring Scheme in the SPRFMO Convention Area
- **3.04** (effective 13/05/2015) Boarding and Inspection Procedures in the SPRFMO Convention Area

The BFIAS notes that monitoring should be implemented to ensure the effectiveness of any management or mitigation measures and to detect any change in the degree of impact which would prompt the need for a re-assessment. The BFIAS included the following measures.

- *VMS positional information should be collected in accordance with the SPRFMO Data Standards. Provide details of VMS systems to be operated on vessels, including who these will report to, reporting frequency and reporting accuracy.*

Details of the implementation of the tamper-proof VMS devices installed on the candidate vessel *San Aspiring* are shown in Section 1. This vessel normally operates within the CCAMLR Convention area and reports as required by Conservation Measure (CM 10-04 (2013)). This requirement is for automatic communications at least every four hours to a land-based fisheries monitoring centre (FMC) of the flag State of the vessel. The following data are transmitted:

(i) Fishing vessel's identification code;
(ii) the current geographical position (latitude and longitude) of the vessel, with a position error which shall be less than 500 m, with a confidence interval of 99%; and
(iii) the date and time (expressed in UTC) of the fixing of the said position of the vessel.

The VMS ALC as required is tamperproof (of a type and configuration preventing the input and output of false positions and not capable of being overwritten manually, electronically, or otherwise). The ALC is located within the sealed unit and protected by official seals indicating whether a unit has been accessed or tampered with.

San Aspiring is fitted with several ALCs in case of a malfunction to enable continuous reporting. These units are capable of meeting SPRFMO standards for VMS reporting (once every 2 hours) and can respond to polling at any rate if required.

- *Details of catch and effort data collection systems to be used, including catch and effort reporting systems to the flag states concerned, and additional systems to be implemented specifically for the proposed activity. Report how these data collection systems comply with the SPRFMO data standards. These monitoring systems should specifically address how retained and discarded by-catches are to be monitored and reported. There should also be reporting systems in place to record whether a VME has been encountered during fishing.*

San Aspiring operates within the CCAMLR framework and reports catch effort information on a daily and monthly basis as required to the Flag State and to CCAMLR Secretariat. Target toothfish catches are recorded using an electronic computerised on-board inventory system on a set by set basis. Fish are generally weighed on accurate motion compensated scales. All bycatch species are recorded by weight and number and reported on an aggregated daily basis and on a set by set basis in a monthly report. This vessel is fully capable of complying with SPRFMO data standards and reporting or CCAMLR CM 22-07 (2013). Specifics will be contingent on the design but observers will record all benthic bycatch.

- *Details of any scientific observer coverage planned for the proposed fishing activity, including levels of coverage, how deployments will be designed to achieve statistically representative coverage of the proposed fishing activities, and what information observers will be collecting. Observer data should be collected in accordance with the SPRFMO Observer Data Standard.*

It is proposed that at least one flag state (NZ MPI) observer be carried for the proposed fishing activity. Observer data will be collected in accordance with the SPRFMO Observer data standard and will include gear deployment and retrieval data, catch and effort information, biological data collection, and information on marine mammals, seabirds, reptiles and other species of concern. The vessel has good facilities for biological data collection including provision of dedicated motion compensated scales for observer use. New Zealand and CCAMLR identification guides for CCAMLR 88.1 and 88.2 are available for observers to use. Operations will be designed such that an observer would always have at least 6 hours of uninterrupted sleep per 24 hours and make the necessary observations. In addition to human observer(s), a suitably-sited video camera will provide coverage of all lines and hooks hauled. Arrangements for the storage and review of footage will be considered as part of the final research design to be provided to the Secretariat by 28 August 2015.

- *Description of the data that will be provided to the SPRFMO Secretariat for the fishing activity including, as a minimum, data required in terms of the adopted SPRFMO data standards, but also describing other information (e.g. seabed bathymetry or mapping, VME identification and characterization) that will be provided. Details regarding the reporting of evidence of a VME to the SPRFMO Secretariat should be included.*

New Zealand will submit of all data at least to the standard required by the adopted SPRFMO data standard, noting that substantially more information is likely to be collected as outlined in the research plan and detailed in a research report to the SC (and, as appropriate, presented to CCAMLR). The *San Aspiring* and New Zealand observers are fully capable of supplying the information specified in SPRFMO data standard and additional data required by the design. Seabed bathymetry information within the target research areas will be provided to SPRFMO as well as any information on VME distribution and species composition. Vessel crews and observers are conversant with the CCAMLR and SPRFMO reporting requirements for VMEs. The CCAMLR system could be used in SPRFMO waters given the proximity of the target fishing grounds to the CCAMLR Convention area; alternatively any similar approach required by SPRFMO would be carried out. Given the generally poor understanding of toothfish distribution, movement and stock structure of toothfish and the reliance of CCAMLR's spatially-explicit toothfish stock assessments on tag returns, exploratory fishing will include structured quasi-random tagging at or above the CCAMLR rate of three fish per greenweight tonne captured. This is broadly similar to the rate of tagging in the Macquarie Island longline fishery for Patagonian toothfish (~ 3.1 tags per tonne up to 2011/12 and ~2.0 tags per tonne since, Day et al. 2015). The exact tagging rates and methodology are subject to the specific design developed, the size of any fish captured, and catch limits.

Catch and effort against imposed limits (30 tonnes of toothfish in total is proposed but effort and cluster catch limits are contingent on the specific design) will be monitored on a shot-by-shot basis. It is proposed that retention of toothfish from the experimental fishing areas will cease once the limit has been caught. There are several ways this might be achieved, but it is currently considered that the ratio of tagged fish per tonne captured should be progressively increased as the limit is approached. This will need careful monitoring by the crew and observer but it is thought to be feasible.

A specific move-on rule to further mitigate impacts on VMEs was explored, but is not considered necessary in addition to the clustered design anticipated because clusters of lines must be at least 10 miles apart. In effect, the design already incorporates a move-on component.

7. Recommendations

It is recommended that the Scientific Committee:

- **notes** New Zealand's proposal to conduct demersal longline fishing for toothfish outside its footprint and in excess of catches in the reference period (limited at 30 tonnes greenweight retained annually)
- **recognizes** the cautious, exploratory nature of the proposal
- **recognizes** the scientific benefits of the proposed data collection, especially for understanding the distribution, movement, and stock structure of toothfishes
- **agrees** that data and analyses from New Zealand's exploratory fishing be shared with CCAMLR
- contingent on the acceptability of the final design and risk assessment to be provided by 28 August 2015, **advises** the Commission that the proposal is acceptable in terms of Article 22, CMM 2.03, and the BFIAS.

8. References

Anderson O.F.; Guinotte J.; Rowden A.A.; Clark M.R.; Mormede S.; Bowden D.; Davies A.J. (submitted) Field validation of habitat suitability models for Vulnerable Marine Ecosystems in the South Pacific Ocean: implications for the use of broad-scale models in fisheries management. Submitted.

Anderson O. R.; Small C. J.; Croxall J. P.; Dunn E. K.; Sullivan B. J.; Yates O.; Black A. (2011). Global seabird bycatch in longline fisheries. *Endangered Species Research* **14**: 91-106.

Allain, V., Kerandel, J. A., Andrefouët, S., Magron, F., Clark, M., Kirby, D. S., & Muller-Karger, F. E. (2008). Enhanced seamount location database for the western and central Pacific Ocean: screening and cross-checking of 20 existing datasets. Deep Sea Research Part I: Oceanographic Research Papers, 55(8), 1035-1047.

Baird K.; Small C.; Bell E.; Walker K.; Elliot G.; Nicholls D.; Alderman R.; Scofield P.; Deppe L.; Thomas B.; Dias M.P. (2015). The overlap of threatened seabirds with reported bycatch areas between 25° and 30° South in the Western Central Pacific Fisheries Commission Area. WCPFC-SC11-2015/ EB-WP-09.

CCAMLR Secretariat (2012) Preliminary assessment of known and anticipated impacts of proposed bottom fishing activities on VMEs in 2012/13. CCAMLR-XXXI/14 Rev. 1

Clark, M.R.; Anderson, O.; Bowden, D.; Chin, C.; George, S.; Glasgow, D.; Guinotte, J.; Hererra, S.; Osterhage, D.; Pallentin, A.; Parker, S.; Rowden, A.; Rowley, S.; Stewart, R.; Tracey, D.; Wood, S.; Zeng, C. (2015). Vulnerable Marine Ecosystems of the Louisville Seamount Chain: voyage report of a survey to evaluate the efficacy of preliminary habitat suitability models. *New Zealand Aquatic Environment and Biodiversity Report No. 149*. 88 p.

Davies, A. J., & Guinotte, J. M. (2011). Global habitat suitability for framework-forming cold-water corals. PloS one, 6(4), e18483.

Day J, Haddon M and Hillary R (2015) Stock Assessment of the Macquarie Island fishery for Patagonian toothfish (*Dissostichus eleginoides*) using data up to and including August 2014. Report to SARAG 51, 24 February 2015. CSIRO, Australia.

Fenaughty J.M (2008). The autoline system – an updated descriptive review of the method with recommendations to clarify CCAMLR Conservation Measures regulating longline fisheries within the Convention Area. WG-FSA-08/60.

Kitchingman, A., & Lai, S. (2004). Inferences on potential seamount locations from mid-resolution bathymetric data. Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report, 12(5), 7-12.

Løkkeborg, S. (2011). Best practices to mitigate seabird bycatch in longline, trawl and gillnet fisheries—efficiency and practical applicability. *Marine Ecology Progress Series* **435**: 285–303.

New Zealand Ministry of Fisheries (2008). Bottom Fishery Impact Assessment: Bottom Fishing Activities by New Zealand Vessels Fishing in the High Seas in the SPRFMO Area during 2008 and 2009. Downloaded from http://www.sprfmo.int/conservation-measures/benthic-impact-assessments/ on 12 August 2015.

Parker, S.J., and M.H. Smith (2011). Can toothfish catches be used to predict the presence of vulnerable benthic invertebrate taxa? CCAMLR Science, Vol. 18 (2011): 87–96

Parker, S.J. and S. Mormede. 2009. Is the by-catch of vulnerable invertebrate taxa associated with high catch rates of fish in the Ross Sea longline fisheries? Document WS-VME-09/7. CCAMLR, Hobart: 11 pp.

Parker, S.J. and D.A. Bowden. 2010. Identifying taxonomic groups vulnerable to bottom longline fishing gear in the Ross Sea region. CCAMLR Science, 17: 105–127.

Parker, S.J., S. Mormede, D.M. Tracey and M. Carter. 2009. Evaluation of VME taxa monitoring by observers from five vessels in the Ross Sea region Antarctic toothfish longline fisheries during the 2008/09 season. Document TASO-09/8. CCAMLR, Hobart, Australia: 13 pp.

Penney A. (2010). Use of geospatial data and predictive habitat models to evaluate the likelihood of presence of vulnerable marine ecosystems in the SPRFMO Area. SPRFMO paper SWG-09-DW-03. 12 p.

Rayner, M. J., Taylor, G. A., Gummer, H. D., Phillips, R. A., Sagar, P. M., Shaffer, S. A., & Thompson, D. R. (2012). The breeding cycle, year-round distribution and activity patterns of the endangered Chatham Petrel (*Pterodroma axillaris*). *Emu* **112**: 107-116.

Robertson G, McNeill M, Smith N, Wienecke B, Candy S, Olivier F (2006) Fast sinking (integrated weight) longlines reduce the mortality of white-chinned petrels (*Procellaria aequinoctialis*) and sooty shearwaters (*Puffinus griseus*) in demersal longline fisheries. *Biological Conservation* **132**:458–471

Rowden A.A.; Clark M.R.; Lundquist C.J.; Guinotte J.M.; Anderson O.F.; Julian K.A.; Mackay K.A.; Tracey D.M.; Gerring P.K. (2015). Developing spatial management options for the protection of vulnerable marine ecosystems in the South Pacific Ocean region. *New Zealand Aquatic Environment and Biodiversity Report No. 155*. 76 p.

Rowden A.A.; J Guinotte; S. J. Baird; D. M. Tracey; K. A. Mackay; S. Wadhwa (2013) Predictive modelling of the distribution of vulnerable marine ecosystems in the South Pacific Ocean region. *New Zealand Aquatic Environment and Biodiversity Report No. 120*. 74 p.

Sharp, B., S.J. Parker and N. Smith. (2008): An impact assessment framework for bottom impacting fishing methods in the CCAMLR area. CCAMLR, WSA-08/53.

Sharp B.R. (2010). Updated impact assessment framework to estimate the cumulative footprint and impact on VME taxa of bottom longline fisheries in the CCAMLR Area. CCAMLR Science, 16 (2009): 195–210

Tittensor, D. P., Baco, A. R., Brewin, P. E., Clark, M. R., Consalvey, M., Hall-Spencer, J., ... & Rogers, A. D. (2009). Predicting global habitat suitability for stony corals on seamounts. Journal of Biogeography, 36(6), 1111-1128.

UK. (2010). Preliminary assessment of the potential for the proposed bottom fishing activities to have significant adverse impact on vulnerable marine ecosystems. WG-EMM 10/33. 16 p. CCAMLR.

Yesson, C., Clark, M.R., Taylor, M. L., Rogers, A.D. (2011). The global distribution of seamounts based on 30-arc seconds bathymetry data. *Deep-Sea Research* I 58, 442–453.

Yesson, C., Taylor, M. L., Tittensor, D. P., Davies, A. J., Guinotte, J., Baco, A., ... & Rogers, A. D. (2012). Global habitat suitability of cold-water octocorals. *Journal of Biogeography*, 39(7), 1278-1292.

9. Appendices

Appendix 1: Assessments of potential adverse impacts from New Zealand's bottom line fishing activity 2008–09 (from New Zealand's Bottom Fisheries Impact Assessment)

<table>
<tr><td colspan="6">Impact of bottom line fishing on VMEs
Description of Impact: Bottom line fishing operations make some catches of benthic organisms, including vulnerable hard corals, gorgonians and sponges.
• Bottom line operations can either catch benthic organisms directly on the fishing hooks, or may cause damage to benthic communities if lines are transversely pulled across the seabed by currents, or during hauling.</td></tr>
<tr><td colspan="2">Extent: Site specific</td><td colspan="2">Duration: Medium</td><td colspan="2">Intensity: Low</td></tr>
<tr><td colspan="3">Cumulative impact: Possible</td><td colspan="3">Overall significance: Low / Medium</td></tr>
<tr><td colspan="6">Extent – Seabed impacts will be limited to areas directly damaged by the fishing gear, including areas across which it may move during hauling. For the average of ~1000 hooks per bottom longline set over 2002 - 2006, with a hook spacing of 3m (for bluenose and hapuku targeted longlines) and assuming an impact of 1m either side of the line, even if the line was dragged its full length again, or double this width, during hauling, impacted area would be ~0.012 km2, two orders of magnitude less than maximum impacts of an average trawl tow.

Duration – Given the low growth rates of the benthic organisms which may be impacted, a duration of Medium must be assumed. However, at the current low fishing effort levels and spatial scales in the SPRFMO Area, duration of impacts, at an ecosystem level, may well be Low. For the limited areas expected to be damaged by bottom lining, re-colonisation from adjacent areas would be expected to be more rapid than for a larger impact area.

Intensity – Impact intensity is Low at current fishing effort levels and spatial scales.

Cumulative Nature – Possible, particularly in areas fished often enough that line damage may result in reduction in biodiversity.

Management & Mitigation – At current low levels and spatial scale of fishing effort, active management or mitigation measures are probably not necessary. However, fishing effort intensity and spatial scale, as well as benthic bycatch rates and composition, need to be monitored to ascertain whether effort or impacts rise to levels requiring active management. Should this occur, similar measures, including possible precautionary closures or move-on provisions, as implemented for bottom trawling, may be necessary.

Monitoring – New Zealand commercial catch and effort returns include start and end position for bottom longline operations, but end positions are not always provided. Start position only is probably adequate for dahn line fishing. However, both start and end positions are required for bottom longline and trot line fishing, to allow the spatial scale of fishing effort to be monitored and analysed. Current low levels of observer coverage on high seas bottom line fishing vessels would need to be increased to provide adequate information on benthic bycatches, using the new Benthic Materials form, to monitor and evaluate composition of benthic bycatches by bottom lines.</td></tr>
</table>

Over-Exploitation of Bottom Lined Species

Description of Impact: Bottom line fisheries primarily target hapuku / bass and bluenose, both of which are slow growing species:

- Hapuku are large, slow-growing and apparently fairly resident species that have been found to undergo moderately rapid localised depletions when targeted at moderate fishing effort levels.
- Bluenose have recently been found to be slow growing, although with somewhat higher productivity than species like orange roughy (Ministry of Fisheries 2008). Bluenose appear to be wider ranging than hapuku, but do form feeding or spawning aggregations on high profile seabed features as adults, which are targeted. There are indications that such aggregations may show CPUE hyper-stability, followed by sudden declines if heavily fished. All bluenose stocks within the New Zealand EEZ were recently assessed to have been over-exploited as a result.

Extent: Regional	*Duration*: **Medium**	*Intensity*: **Low**
Cumulative impact: **Likely**	Overall significance: **Low / Medium**	

Extent – Regional, as bottom line targeted species, particularly bluenose, appear to be wider ranging than species such as orange roughy. However, stocks are still likely to be largely confined to areas of the spatial scale of the fishing areas constituting the footprint, particularly for hapuku.

Duration – At current fishing effort and mortality levels, duration of impacts are likely to be Medium, despite the slow growth of these species. However, if exploitation rates increase to the level where fishing mortality exceeds sustainable levels and over-fishing occurs, duration of impacts may be Long.

Intensity – Low, at present, given the very low level of bottom line fishing effort in the SPRFMO Area. However, there are indications of increasing market demand, and resultant increasing fishing effort, for species such as bluenose

Cumulative Nature – Likely, considering the slow growth rates of these species, but this will depend on exploitation rates. Stock depletion will occur if fishing mortality exceeds long term sustainable levels.

Management & Mitigation – Current low effort and catch levels on the high seas probably do not require any active management or mitigation measures. Nonetheless, the FAO Deepwater Guidelines recommend the implementation of precautionary effort or catch limits for all low productivity deepwater species, set at levels likely to ensure long term sustainability. Current best estimate of natural mortality (M) for bluenose is ~0.8 (Ministry of Fisheries 2008), indicating that exploitation rates should not exceed 8%. Should high seas bottom line fishing effort levels continue to increase to the level where fishing mortality exceeds this natural mortality, precautionary effort or catch limits would need to be established for the primary target species, such as bluenose and hapuku, in the main targeted fishing areas.

Monitoring – Existing commercial catch return systems are already specifically designed to collect the necessary high-resolution catch and effort data for such species. Scientific observers on high seas bottom liners are also already required to monitor catch and effort for all target species, and to supplement this with length-frequency and biological sampling (gonad staging and otoliths). Observer coverage levels would need to be increased to ensure that adequate data are collected to monitor inter-annual trends in these fisheries, to allow for the implementation of a process to revise catch limits downwards when significant declines are detected, as recommended by FAO.

Loss of Bottom Line Fishing Gear

Description of Impact: Bottom line fishing operations targeting species such as bluenose and hapuku / bass intentionally target areas of steep, high profile, rocky seabed, usually also under conditions of current across these features. There is an inevitable risk of gear loss in such areas:

- Greatest risk is loss of weights and anchors, and gear may be rigged with weak links to such gear to prevent loss of fishing components and catch, should anchors stick fast. This would be particularly relevant to dahn line and trot line gear, where the fishing components are suspended above the seabed. Lost anchors pose little ongoing threat to the seabed.
- For bottom longline gear, particularly using bottom main lines with integrated weighted cores, there is a significant risk of sections of bottom line plus snoods being lost. This may be of concern, should such gear continue to ghost fish for any appreciable length of time.

Extent: Site-specific	*Duration*: **Medium**	*Intensity*: **Low**
Cumulative impact: **Unlikely / possible**	Overall significance: **Low**	

Extent – Usually Site Specific, as weighted lost gear will remain at the site at which it was lost. There is some risk of loss of floating components which may then drift away from the fished area. These pose no threat to the seabed, but may be of concern if they ghost fish for any appreciable length of time.

Duration –Medium: at the depths of these high seas fishing operations, growth and recovery of biogenic benthic communities is slow, and it is likely to take years to decades for lost gear to become covered with benthic growth, and integral with the seabed communities. However, such 'recovery' is likely to occur.

Intensity – Low, if there is little or no risk of ghost fishing by lost gear, but medium if gear may continue to fish for any length of time. Risk of ghost fishing may be low if the gear ceases to become effective once baits have been removed, or decayed away.

Cumulative Nature – Unlikely / Possible, but only if gear continues to ghost fish for any appreciable length of time, exceeding months. More information is required on the likelihood of ghost fishing by various bottom line fishing gears.

Management & Mitigation – Economic costs of gear loss in the bottom line fisheries are lower than in trawl fisheries and, while some incentive clearly remains, there is less economic incentive for industry to minimise gear loss. Industry should be consulted on the extent of gear loss and options for improving gear design and deployment to minimise gear loss (for example, by incorporating sacrificial components), and particularly for minimising the risk of ghost fishing by lost gear.

Monitoring – Scientific observers on high seas bottom lining vessels are not currently required to formally document type and quantity of gear loss, although some do record such events in daily logs. Observers should be required to document all significant (to be defined) gear losses in a way that permits GIS plotting of such positions, and analysis of gear losses. Options should also be investigated for industry to similarly record gear losses. Industry reports that most skippers already record such positions as areas to be avoided during future fishing operations. This would be particularly important for any exploratory fisheries in new fishing areas.

South Pacific Regional Fisheries Management Organisation

3rd Meeting of the Scientific Committee

Vanuatu 28 September-3 October 2015

Survey design for New Zealand's proposed exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017:

Martin Cryer

Ministry for Primary Industries

Purpose

This paper includes, for the consideration of the Scientific Committee, a detailed survey design for New Zealand's proposed exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017. It is closely modelled on the design adopted by CCAMLR for longline surveys for toothfish in the immediately adjacent CCAMLR subareas 88.2 A&B (northern parts). The design should be read in conjunction with the original proposal and the survey design and is drafted as Appendix 2 of the overall proposal.

Appendix 2 for New Zealand's proposal for exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017: survey design (modified after CM 41-10 2014, toothfish survey design for CCAMLR 88.2 A&B North).

Background: New Zealand has submitted a proposal for exploratory bottom long lining for toothfish within the SPRFMO Management area outside the bottom long lining footprint to be carried out during 2016 and 2017. The following research plan, drafted as Appendix 2 to the original proposal, outlines details of the research design, research data collection, and tagging procedures.

Objectives

The major objectives[1] for the exploratory project are as follows:

- map the bathymetry of the fishable area,
- characterise the local toothfish populations, including life-cycle information
- documenting relative abundance of Patagonian and Antarctic toothfish,
- contribute to the understanding of stock structure and movement patterns of toothfish in the SPRFMO area and between SPRFMO, CCAMLR and other management areas,
- tag toothfish as a contribution to stock linkage studies, and, potentially, for biomass estimation,
- collect information on distribution, relative abundance, and life history of bycatch species.

Overall research design

The identified research blocks (**Figure *1***) have been identified solely on the basis of GEBCO data[2] and are based on satellite derived gravity data (no ship track information is publicly available). Given this low-knowledge starting point, the main intent of the research design is to enable the vessel to carry out a "prospecting[3]" phase during the first year in order to identify potential fishable ground, collect relevant bathymetric detail, and if possible information on *Dissostichus* (toothfish) species and any associated fish and non-fish bycatch.

This will be an iterative procedure over two years with any results in forming a modified survey design for the following season. The existing information is sparse but indicates that actual fishable areas are likely to be small and there is no published information on species mix or catch rates in this area, but the retained catch is limited to 30 tonnes of *Dissostichus* species in the first year. The two research areas straddle some of the northern extent of the Pacific Antarctic Ridge and collectively comprise about 91,000 km² in area. Further south, this Ridge is characterised by small features such as seamounts, ridges and pinnacles. It is likely therefore that the fishable habitat in this area will be similar and that finding fishable ground may be time-consuming.

[1] These objectives have been slightly revised from those in the original proposal
[2] GEBCO_08 Grid, version 20100927
[3] CCAMLR distinguishes prospecting, biomass estimation, and stock assessment phases in the development of a longline fishery. See Report of the Working Group on Fish Stock Assessment (Hobart, Australia, 7 to 18 October 2013

Standardisation of fishing gear.

The fishing gear to be used for this work will be standardised and used very similar fishing gear to existing research surveys carried out within the CCAMLR Convention area as detailed in the original proposal (see the CCAMLR gear library, http://www.ccamlr.org/en/document/publications/wg-fsa-08/60). As is the case in other longline research surveys, integrated weight line (IWL) will be used and the target soak time will be 18 hours with a range of ±6 hours, environmental conditions and weather permitting. The gear has been the subject of substantial testing for use in CCAMLR surveys.

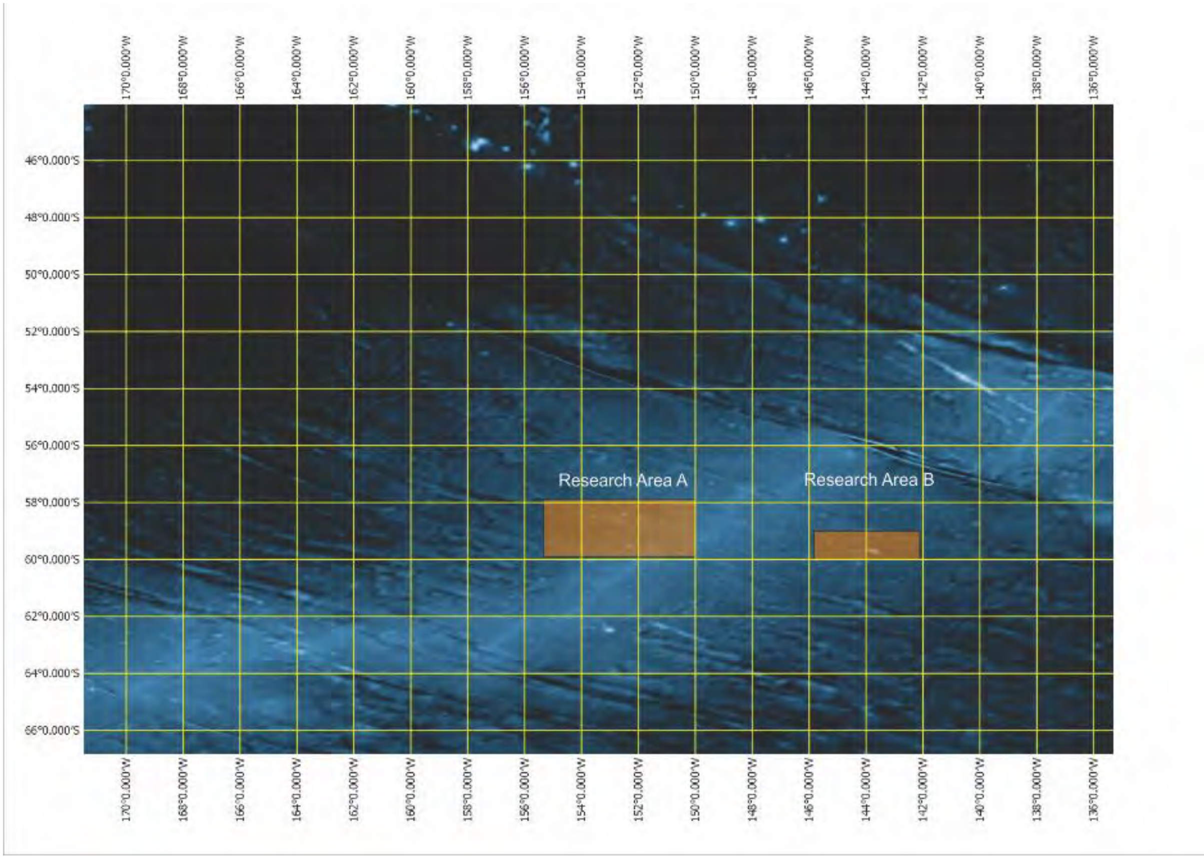


Figure 1. Location of proposed research showing as shaded boxes Research area A and research area B.

Proposed number and duration of stations/hauls

Because the depth and topography of the proposed exploratory fishing areas is poorly-known, it is not possible or appropriate to specify formal strata or randomised set locations.

CCAMLR has developed a protocol for research longline fishing on small, isolated features (see CM 41-10, 2014) to undertake research in the northern section of CCAMLR subarea 88.2 which lies immediately south of the proposed exploratory fishing areas. The design of surveys in the northern part of 88.2 is not typical of other longline survey designs within CCAMLR which use fixed longline lengths and minimum separation rules. CCAMLR's standard protocol would not be feasible as a research design in the feature-dominated environment expected in the proposed exploratory fishing areas. The presence of seamounts and other features requires the flexibility for vessels to deploy clusters of shorter sets closer together in order to fish small or steep-sided features. Spreading of effort is achieved through spatial separation of clusters rather than separation of individual lines.

Because the benthic environment in the proposed exploratory fishing areas is predicted to be similar to that in CCAMLR 88.2 A&B North, a similar survey design approach is proposed. For consistency with CCAMLR surveys, the following rules are proposed:

- clusters of IWL lines are allowed with no rules for minimum separation between lines
- no more than 6,900 hooks may be set in a line
- no more than 17,250 hooks may be set in a cluster
- clusters of lines may be no closer together than 10 nautical miles (measured from the proximate lines of each individual cluster).

Tagging rates

For consistency with the adjacent CCAMLR Management area, a minimum tagging rate of three fish of each *Dissostichus* species per greenweight tonne will be implemented. The rules applied by CCAMLR in the immediately adjacent 88.1 A&B North region where tagged fish were released in early 2015 will be used (CM 41-01 Annex C). These rules requires a minimum tag overlap statistic (that is a comparison between the observed length frequency from vessel biological information and the size composition of fish returned alive with tags) of 60% once 30 or more *Dissostichus* of each species have been successfully released with tags.

The company and crew of the proposed vessel, *San Aspiring*, has experience working to catch limits of 30 tonnes or less and uses intensive monitoring of catch retained. As the catch limit of 30 tonnes is approached, the following measures to constrain the retained catch within the limit will be considered:

- shorter lines will be set
- a seawater tank will be maintained on board such that live fish in good condition can be retained in case they need to be tagged and returned to meet the catch limit
- the tagging rate will be progressively increased

Biological information

- A suitable workstation for the observer will be supplied on board the vessel which will include provision of motion-compensating scales for gonad weighing.
- As the survey areas are immediately adjacent to the CCAMLR Convention area, all toothfish captured will be observed carefully for the presence of tags, and all previously-tagged fish will be retained.
- All fish and invertebrates will be identified to the lowest taxon possible. Photographs and/or specimens of taxa not identified to species level will be retained by the observer. New Zealand (MPI) and SPRFMO codes will be used.
- Up to 35 toothfish of each species per line will be measured for total length, weight, sex, and gonad stage. Stomachs will be examined and standardised qualitative measurements taken.

Sample numbers of each toothfish species will be in proportion to the number of hooks hauled in each line as detailed in paragraph 8.7 of the 2011 Report of the Working Group on Fish Stock Assessment which states that "*all fish of each Dissostichus species in a haul (at a rate of 7 fish per 1 000 hooks up to a maximum of 35 fish for each species) are to be measured and randomly sampled for biological studies*".

- Additional samples such as muscle tissue, stomach contents, bycatch species, and gonad histology for stable isotope analysis may be collected following discussions with New Zealand scientists and on-board feasibility.
- Contingent on the catch, 5 pairs of otoliths per 5 cm length class of toothfish between 100 and 150 cm will be collected for each sex. As it is likely that few toothfish shorter than 100 cm will be caught, otoliths will be collected from all retained fish shorter than 100 cm.
- Any macrourids, up to 10 of each species caught on a set, will be identified and sampled for length, weight, sex, and gonad weight.
- Catches (including weights to the nearest 0.1 kg) of benthic invertebrates and VME[4] indicator taxa will be recorded using standard SPRFMO protocols and codes.

Marine mammals, seabirds, turtles, and other species of concern

The following information will be collected for marine mammals, seabirds, turtles, and other species of concern:

- Standardised seabird and marine mammal abundance counts will be made at the rear of the vessel at the start, middle, end of each event (from set to haul)
- The observer will have a target of observing 10% of hooks hauled for marine mammal, seabird and turtle captures, and for comparison with a sample of recorded video observations
- At least 50% of hooks hauled will be viewed on recorded video after the voyage
- All marine mammals, seabirds, turtles, and other species of concern captured will be identified, and photographs will be taken of as many birds colliding with the ship as possible and all birds released alive
- All dead birds will be retained for formal identification and necropsy
- Opportunistic observations, photography and identification of marine mammals will be undertaken in collaboration with the crew
- Benthic species of concern are covered under benthic and VME section
- Fish species of concern are covered under the biological measurements section

Additional resources

Because the workload for a single observer will be high during the proposed exploratory fishing, the vessel will be equipped with a video monitoring and recording system to be located over the hauling position to ensure that all hauled lines and hooks are observed. All recorded footage will be provided to the NZ Ministry for Primary Industries at the end of the voyage for analysis. In addition, a dedicated assistant experienced in at-sea scientific data collection will assist the observer with any biological measurement and data collection. Sanford's toothfish longliners routinely carry Company Representatives with a science background who carry out reporting duties, assist scientific observers, and collect any additional information required by CCAMLR, government agencies, or Sanford Ltd.

[4] BFIAS: Annex 1 of the FAO Guidelines provides a list of examples of potentially vulnerable species groups, communities and habitats, as well as features that potentially support them and should be used as the basis for determining what constitutes VME taxa in the SPRFMO area

One of these two company representatives will be on board during the proposed exploratory fishing. Their background and work experience are summarised in the Annex to this design.

Recommendations

It is recommended that the Scientific Committee:

considers this survey design as part of New Zealand proposal for exploratory fishing for toothfish

Annex 1: Experience of Sanford Company Representatives relevant to the proposal

David Michael Bilton

David has worked in the fishing industry in New Zealand and Australia as well as having spent 6 years in the employ of the New Zealand Ministry of Fisheries as an at-sea observer and Observer Officer.

As a commercial fisher David has worked in New Zealand including: crayfish potting, scallop dredging, gillnetting and as trainee Company Rep while long lining in CCAMLR Subareas 48.3, 48.4 (2011), and as Company Rep while long lining in CCAMLR Subareas 48.3, 48.4 (2012 to 2013). David has also completed trips as Sanford Company Representative in CCAMLR Subarea 88.1 (2011/12 – 2014/15). The fisheries David has worked in Australia include: longlining, trawling as well as operating a charter vessel out of Darwin.

During David's time with the New Zealand Ministry of Fisheries he completed trips as an Observer on longline vessels (local waters and CCAMLR 88.1), gill net and trawl fisheries where the primary focus was collecting biological and environmental data as well as reporting on operational compliance aspects of each vessel that trips were completed on.

David was involved in the initial CCAMLR requested shelf survey of the Ross Sea Region from the 2012 survey. Since that time he has assisted in the survey during 2013 and 2015.

As an Observer Officer for the New Zealand Ministry of Fisheries for 4 ½ years, David's roles included planning, preparation and co-ordinating of Observer placements both within New Zealand and Internationally. Data/information and validation upon completion of observer placements were also key aspects of this role. Placement, training and briefing/debriefing of New Zealand National CCAMLR Observers was a main aspect of David's work while employed by The Ministry of Fisheries.

Dave has been trained in deployment and operation of the CPR (continuous plankton recorder) and has had experience in this from the 2011/12 season onwards.

Monique Mary Messina

Monique completed a BSc majoring in Marine Biology from Victoria University in Wellington in 2006 and spent 5 years employed by the New Zealand Ministry for Primary Industries as an at-sea Observer and then as an Observer officer.

During her time as an observer Monique completed trips on longline vessels (local waters and CCAMLR Subarea 88.1) and on inshore and deep sea trawl vessels where the primary focus was collection of biological/environmental data as well as reporting on operational compliance aspects of each vessel. As part of her work as an observer Monique regularly completed training trips with new observers.

Monique worked as an observer officer for 2 years coordinating observer placements on vessels fishing within the NZ EEZ and within CCAMLR Convention areas. Briefing and debriefing of Observers before and after placement on vessels along with the compiling and validation of data at completion of trips were key aspects of this position. The role also included recruitment and training of new observers.

Monique has completed two seasons in 48.3 and 88.1 aboard Sanford vessels *San Aspiring* and *San Aotea II* and took part in the CCAMLR 2014 shelf research survey. Monique has been trained in deployment and operation of the CPR (continuous plankton recorder) and has experience in this from the 2013/14 season.

South Pacific Regional Fisheries Management Organisation

3rd Meeting of the Scientific Committee

Vanuatu 28 September-3 October 2015

Assessment of potential adverse impacts of New Zealand's proposed exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017:

Martin Cryer

Ministry for Primary Industries

Purpose

This paper includes, for the consideration of the Scientific Committee, the assessments of impacts and risks required by SPRFMO's Bottom Fishery Impact Assessment Standard (BFIAS) for New Zealand's proposed exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017. It should be read in conjunction with the original proposal and the survey design and is drafted as Appendix 3 of the overall proposal.

Appendix 3 for New Zealand's proposal for exploratory bottom longlining for toothfish by New Zealand vessels outside the bottom lining footprint during 2016 and 2017: assessments of potential adverse impacts (modified after New Zealand's Bottom Fisheries Impact Assessment 2008/09).

Introduction

New Zealand has proposed to SPRFMO's Scientific Committee that exploratory bottom longlining for toothfish be permitted outside New Zealand's 2002-2006 bottom longlining footprint and in excess of average catches between 2002 and 2006. Such a proposal requires an impact and risk assessment as specified in SPRFMO's agreed Bottom Fishery Impact Assessment Standard, BFIAS. It is important to note that the qualitative impact and risk assessment presented here applies to the exploratory (prospecting) fishing trips only and not to any substantive fishery that might develop. In addition, the Scientific Committee is working toward a revised, comprehensive Conservation and Management Measure for bottom fisheries that will probably require a more quantitative impact and risk assessment.

Scoping of Issues of concern

The proposed fishing activity entails the use of demersal bottom longline. New Zealand's Bottom Fishery Impact Assessment for bottom fishing activities by New Zealand vessels fishing in the SPRFMO Area during 2008 and 2009 (for bluenose and hapuku, not for toothfish) noted the following potential impacts:

- direct impact of bottom lines on VMEs
- over-exploitation of bottom lined species
- loss of bottom line fishing gear
- incidental capture and mortality of seabirds[1]

The 2008–09 risk assessment is not considered to be an appropriate risk assessment for the proposed fishing activity, given the different gear to be employed, but it is considered that the same four potential impacts exist for the proposed bottom line fishing for toothfish during the proposed exploratory fishing phase.

Impact and risk assessment.

Each of the four potential impacts was assessed, based on the FAO Deepwater Guidelines (FAO 2008), using specific definitions for the various rating criteria taken from New Zealand's 2008/09 bottom fishery impact assessment. To the extent possible in what is largely a qualitative, expert-based assessment, allocation to ranks was based on quantifiable criteria. Elements of risk specifically evaluated were:

[1] The potential impact on seabirds was inadvertently omitted from the original proposal

- Description of Impact - Provides a brief description of the expected impacts, answering the question, “What will be affected and how?”
- Extent - Indicates whether the impact will be: Site Specific (limited to within one kilometre of the fished site); Local (limited to within one fished 20’ block, or 50km of the fished site); Regional (limited to the fishing area ~200-500 km radius); or Oceanic (extending across a significant proportion of an ocean basin, or of the SPRFMO Area).
- Duration - Gives the expected duration of the effects of the impact, being: Short (months, <1 year); Medium (years, 5-20); or Long (> 20 years, decades to centuries).
- Intensity - Provides an expert evaluation of whether the magnitude of the impact is destructive or innocuous and whether or not it exceeds set standards, and is described as: None (no impact); Low (where environmental processes are slightly affected); Medium (where environmental processes continue to function but in a noticeably modified manner); or High (where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed established standards / requirements).
- Cumulative Impact - An assessment of whether the impact is cumulative over time or space or not, and is expressed as being: Unlikely (the event is either a low-impact rare event, or recovery is rapid, such that effects will not accumulate over time or area); Possible (depending on extent, severity, natural disturbance levels and recovery rates); or Definite (at the intensities occurring, effects will endure such that, over time or space, impacts from a number of separate operations will accumulate).
- Overall Significance - The overall significance of each impact is then evaluated from the combination of duration, extent, intensity and cumulative effects. Overall Significance is determined as follows:
    - Low: Where the impact will have a negligible influence on the environment and no active management or mitigation is required. This would be allocated to impacts of low intensity and duration, but could be allocated to impacts of any intensity, if they occur at a local scale and are of temporary duration.
    - Medium: Where the impact could have an influence on the environment, which will require active modification of the management approach and / or mitigation. This would be allocated to short to medium-term impacts of moderate intensity, locally to regionally, with possibility of cumulative impact.
    - High: Where the impact could have a significant negative impact on the environment, such that the activity causing the impact should not be permitted to proceed without active management and mitigation to reduce risks and impacts to acceptable levels. This would be allocated to impacts of high intensity that are local, but last for longer than 5-20 years, and/or impacts which extend regionally and beyond, with high likelihood of cumulative impact.

The separate assessments against these criteria for New Zealand’s proposed exploratory bottom longlining for toothfish in 2016 are summarised in Table 1 (details of the assessment are contained in the larger tables below). Although some of the deepwater benthic taxa and seabirds potentially impacted are long-lived, and both the target species and most seabirds range over regional to oceanic distances, the exploratory fishing activity was assessed as having low to medium risk. Significant mitigation and monitoring will be in place for the entirety of the exploratory fishing and information will be collected during the first exploratory fishing trip that will decrease the uncertainty in impact and risk assessments for any subsequent exploratory trips or commercial fishing.

Table 1: Summary of risk assessment for New Zealand proposed exploratory bottom longlining for toothfish in the SPRFMO Area in 2016.

	Extent	Duration	Intensity	Cumulative	Overall
Direct impact of bottom lines on VMEs	Site-specific	Long	Low	Possible	Low / medium
Over-exploitation of bottom lined species	Regional-oceanic	Medium	Low	Possible	Low / medium
Loss of bottom line fishing gear	Site-specific	Short	None-low	Unlikely	Low
Incidental mortality of seabirds*	Oceanic	Medium	Low-medium	Possible	Medium

*, depending on species

Recommendations

It is recommended that the Scientific Committee:

considers this impact and risk assessment as part of New Zealand proposal for exploratory fishing for toothfish

Impact of bottom line fishing on VMEs			
Description of Impact: Bottom line fishing operations make some catches of benthic organisms, including vulnerable hard corals, gorgonians and sponges. Bottom line operations can either catch benthic organisms directly on the fishing hooks, or may cause damage to benthic communities if lines are dragged laterally across the seabed by currents, or during hauling.			
Extent: Site specific	*Duration*: **Long**		*Intensity*: **Low**
Cumulative impact: **Possible**		Overall significance: **Low / Medium**	
Extent – Seabed impacts will be limited to areas directly damaged by the fishing gear, including areas across which it may move during hauling. In the absence of accurate bathymetry data for the exploratory fishing areas, a precautionary estimate of impact could be estimated using CCAMLR's footprint index of 6.67 x 10^{-3} km^2 of seabed area per km of longline deployed. A highly precautionary sensitivity analysis was conducted using the greater line movement cited by Welsford et al. (2014). Using Welsford's mean lateral line movement of 6 m, a cluster of 17,500 hooks could disturb up to 0.147 km^2 compared with the total area of the exploratory fishing boxes of 91,150 km^2 or the expected fishable area of ~4500 km^2. In this sensitivity analysis, a cluster of lines within the specified survey design could be expected to disturb ~0.003% of the fishable area and a similar proportion of VMEs if such VMEs are entirely restricted to the fishable area. The actual extent of impact is very likely to be less. Duration – Given the very low growth rates of some deepwater benthic organisms which may be impacted, a duration of Long must be assumed. However, at the proposed low fishing effort levels, the duration of impacts at an ecosystem level may be lower. For the limited areas expected to be damaged by bottom lining, re-colonisation from adjacent areas would be expected to be more rapid than for a larger impact area. Intensity – Considered Low at the proposed exploratory fishing effort levels and spatial scales. Cumulative Nature – Possible, given poor knowledge of the area. Overall significance: Potentially Medium because of the possible low recoverability of the benthic species concerned but, given the constrained nature of the proposed exploratory fishing, the significance is considered to be Low-medium Management & Mitigation – At the proposed low levels and spatial scale of exploratory fishing effort and the spatially dispersed fishing design, active management or mitigation measures are not thought necessary. However, should a substantive fishery develop, fishing effort intensity and spatial scale, as well as benthic bycatch rates and composition would need to be monitored to ascertain whether effort or impacts rise to levels requiring active management. All information will be reviewed following the first fishing trip. Monitoring – Catch and effort returns will include start and end positions for bottom longline operations to allow the spatial scale of fishing effort to be monitored and analysed. Observer coverage will provide information on benthic bycatches, using the Benthic Materials form, to monitor and evaluate composition of benthic bycatches by bottom lines.			

Classification of SPRFMO VME-indictor taxa (VME-indicator taxa in red)

1. Phylum Porifera – Sponges

Phylum Cnidaria, Class Anthozoa,

2. Order Actiniaria – Anemones

3. Order Alcyonacea – Soft corals, and 4. Gorgonian sea fans

5. Order Pennatulacea – Sea pens

6. Order Scleractinia – Stony corals

7. Order Antipatharia – Black corals

8. Class Hydrozoa, Order Anthoathecatae, **Family Stylasteridae – Hydro corals**

9. Phylum Echinodermata, **Class Crinoidea – Sea lilies**

10. Class Asteroidea, **Order Brisingida – Armless stars**

Over-Exploitation of Bottom Lined Species		
Description of Impact: This exploratory fishery will target toothfish, a relatively long-lived species (M ~ 0.13, A_{mat} ~ 12–17 years, Mormede & Dunn, CCAMLR Science 21: 39–62, Day et al SARAG 51, Hobart, 24 February 2015). Bycatch of non-target fish species is likely to be a small proportion of the total catch, especially sharks.		
Extent: **Regional / Oceanic**	*Duration*: **Medium**	*Intensity*: **Low**
Cumulative impact: **Possible**	Overall significance: **Low / Medium**	
Extent – Given the circumpolar distribution of both species of toothfish and the substantial distances travelled, the extent of impacts stemming from this lining is Regional, potentially Oceanic, in scale. Duration – At the proposed exploratory fishing effort and catch, duration of impacts are likely to be Medium compared with the life history of the species. Intensity – Low, for the proposed exploratory fishing, given the very low level of bottom line fishing effort proposed Cumulative Nature – Possible, depending on exploitation rates. Overall significance: Potentially medium because of the life history of the target and bycatch species concerned but, given the constrained nature of the proposed exploratory fishing, significance is considered to be Low-medium. Management & Mitigation – The proposed low effort and catch levels for this exploratory fishing are not considered to require any active management or mitigation measures. The exploratory fishing has a survey design that focusses on information gathering that will facilitate assessment of any subsequent fishing. Monitoring – Existing New Zealand commercial catch return systems are already specifically designed to collect the necessary high-resolution catch and effort data for such species. Scientific observers will monitor catch and effort for the target species and supplement this with length-frequency and biological sampling (gonad staging and otoliths) as per the survey design. Shark bycatch is not expected but bycaught sharks will be returned for identification.		

Loss of Bottom Line Fishing Gear Description of Impact: Bottom line fishing operations targeting toothfish has an inevitable risk of gear loss (Webber & Parker, CCAMLR WG-FSA-11/48). The greatest risk is loss of weights and anchors, and gear may be rigged with weak links to such gear to prevent loss of fishing components and catch, should anchors stick fast. Lost anchors pose little ongoing threat to the seabed. For bottom longline gear using integrated weighted cores, there is a significant risk of sections of bottom line plus snoods being lost.		
Extent: **Site-specific**	*Duration*: **Short**	*Intensity*: **None / Low**
Cumulative impact: **Unlikely**	Overall significance: **Low**	
Extent – Usually Site Specific, as weighted lost gear will remain at the site at which it was lost. There is some risk of loss of floating components which may then drift away from the fished area. These pose no threat to the seabed. Duration – Short: Lost gear is likely to take years to decades to degrade and become covered with benthic growth and integral with the seabed communities. This constitutes a level of pollution that will persist for 20 years or more. However, there is not likely to be any additional impact on benthic fauna once the gear is lost and the bait degrades in much less than 1 year. Intensity – Low, there is almost no risk of ghost fishing by lost gear because the gear ceases to become effective once baits have been removed by scavengers or decayed away. Cumulative Nature – Unlikely given the scope of the proposed exploratory fishing. Management & Mitigation – Operational procedures are in place to minimise expensive gear loss and consequent pollution (e.g., anchor trips). The proposed exploratory fishing has a focus of collecting information and is limited by catch and effort limits. Monitoring – The vessel will record position, depth, type and quantity of gear loss.		

Capture of seabirds Description of Impact: Seabirds can be captured on baited hooks and those caught during line setting are likely to be drowned. A wide variety of seabirds are likely to use this area (see table below) and any impacts will depend on the species and the number captured (which is expected to be very low).		
Extent: **Oceanic**	*Duration*: **Medium**	*Intensity*: **Low / Medium***
Cumulative impact: **Possible***	Overall significance: **Medium***	
Extent – Oceanic due to the migratory nature of many seabirds, including those thought to use the general area of the proposed exploratory fishing Duration – the duration of the impact is likely to be medium, between the age at first maturity (up to ~10 years for albatross species) and the lifespan (50 years or more for some long-lived species) Intensity – The relative intensity will depend on the species attending and how many are caught. A rating of Low-medium is given rather than Low because of the large uncertainty about what species are involved Low. Cumulative Nature – Cumulative impacts are possible, depending on the extent of captures and the rarity, threat status, and productivity of seabird species involved. Overall significance: The overall significance is considered Medium because, depending on the species attending, the impact could have an influence that will require active modification of the management approach and / or mitigation in the future. The distribution of seabirds in this area is poorly known and it is not known what seabirds will attend the vessel. Management & Mitigation – Operational procedures to minimise seabird interactions and captures will be rigorously applied. Fast-sinking integrated weight line and streamer lines are used, there will be no offal discharge, and all setting will be done at night. These measures have been found to be highly effective in reducing seabird captures in CCAMLR and New Zealand fisheries. Monitoring – The vessel will carry a scientific observer who will record, in conjunction with the crew and a dedicated video recording system to observe the hauling of all hooks, the number and identity of birds attending the vessel, the application of mitigation measures, and the capture of any seabirds. All dead seabirds will be retained by the observer for identification and necropsy. Birds returned alive (and any birds landing on the deck or colliding with the vessel) will be photographed.		

*, depending on species

New Zealand seabird taxa potentially attending the vessel during exploratory fishing (G. Taylor, Principal Science Advisor, Department of Conservation, personal communication). IUCN and New Zealand Threat Classifications (NZTC) are shown (ACAP taxonomy generally takes precedence) and taxa with either of the highest two threat classifications in either of the classification systems are shown in red.

Common name	Scientific name	NZTC category	IUCN category
Wandering albatross	*Diomedea exulans*	Non-Resident Native: Migrant	Vulnerable
Antipodean albatross	*Diomedea antipodensis antipodensis*	Threatened: Nationally Critical	#Vulnerable
Southern royal albatross	*Diomedea epomophora*	At Risk: Naturally Uncommon	Vulnerable
Grey-headed albatross	*Thalassarche chrysostoma*	Threatened: Nationally Vulnerable	Vulnerable
Light mantled sooty albatross	*Phoebetria palpebrata*	At Risk: Declining	Near Threatened
Sooty shearwater	*Puffinus griseus*	At Risk: Declining	Near Threatened
Northern diving petrel	*Pelecanoides urinatrix urinatrix*	At Risk: Relict	#Least Concern
Southern diving petrel	*Pelecanoides urinatrix chathamensis*	At Risk: Relict	#Least Concern
Subantarctic diving petrel	*Pelecanoides urinatrix exsul*	Non-Resident Native: Coloniser	#Least Concern
South Georgian diving petrel	*Pelecanoides georgicus* †	Threatened: Nationally Critical	Least Concern
Grey petrel	*Procellaria cinerea*	At Risk: Naturally Uncommon	Near Threatened
White-chinned petrel	*Procellaria aequinoctialis*	At Risk: Declining	Vulnerable
Southern Cape petrel	*Daption capense capense*	Non-Resident Native: Migrant	#Least Concern
Southern giant petrel	*Macronectes giganteus*	Non-Resident Native: Migrant	Least Concern
Northern giant petrel	Macronectes halli	At Risk: Naturally Uncommon	Least Concern
Fairy prion	*Pachyptila turtur*	At Risk: Relict	Least Concern
Chatham fulmar prion	*Pachyptila crassirostris crassirostris*	At Risk: Naturally Uncommon	#Least Concern
Lesser fulmar prion	*Pachyptila crassirostris flemingi*	At Risk: Naturally Uncommon	#Least Concern
Antarctic prion	*Pachyptila desolata*	At Risk: Naturally Uncommon	Least Concern
Blue petrel	*Halobaena caerulea*	Non-Resident Native: Migrant	Least Concern
Chatham petrel	*Pterodroma axillaris*	Threatened: Nationally Vulnerable	Endangered
Mottled petrel	*Pterodroma inexpectata*	At Risk: Relict	Near Threatened
Chatham Island taiko	*Pterodroma magentae*	Threatened: Nationally Critical	Critically Endangered
White-headed petrel	*Pterodroma lessonii*	Not Threatened	Least Concern
Wilson's storm petrel	*Oceanites oceanicus*	Non-Resident Native: Migrant	Least Concern
Black-bellied storm petrel	*Fregetta tropica*	Not Threatened	Least Concern

# indicates that the IUCN classification is based on a broader definition of the species than listed in this table.

† Taxonomically Indeterminate in the New Zealand Threat Classification Scheme.