

## **6th Meeting of the Scientific Committee**

Puerto Varas, Chile, 9 - 14 September 2018

### **SC6-DW01**

Cook Islands Fisheries Operation Plan for an Exploratory Potting Fishery in the  
SPRFMO Area

*Cook Islands*

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# **Fisheries Operation Plan**

## **Great Southern Fisheries Limited**

**“FV Great Southern”**

**To fish in the South Pacific Regional Fisheries Organization Management Area  
Targeting deep-water species of lobster and crab**

Dated April 30<sup>th</sup>, 2018

*Jasus caveorum*

Photo credit: Museum of New Zealand Te Papa Tongarewa



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## 1 Introduction

This document is the Fisheries Operation Plan including data collection procedures for a new Exploratory Potting Fishery (EPF) for *Jasus spp.* And *Projasus spp.* lobster, and *Chaceon spp.* crab. The “Exploratory Fishing Application” for the Great Southern Fisheries, LTD (GSF), COMM6-INF 07, was approved at the 6<sup>th</sup> South Pacific Regional Fisheries Management Organisation (SPRFMO) Commission meeting held in Lima, Peru on February 3<sup>rd</sup>, 2018 with the adoption of Conservation and Management Measure, CMM 14b-2018. This Fisheries Operation Plan, based on the exploratory fishing application recognizes the Commission is mandated to adopt a precautionary approach and an ecosystem-based approach to the management of the fisheries resource within the SPRFMO Convention Area. GSF recognizes this EPF must be conducted in a manner consistent with all relevant CMMs adopted by the SPRFMO Commission listed in Section 12 of this document and is not exempt from complying with any Convention obligations or any other CMMs adopted by the Commission. GSF new EPF anticipates a start date on or before October 1<sup>st</sup>, 2018. The EPF will proceed with a precautionary and gradual approach until sufficient information is acquired to enable the Commission to adopt appropriately detailed CMMs in the future.

The objective of this new EPF (responsive to CMM 14b-2018) to be implemented by the F/V Great Southern (GS) is to collect and provide the scientific data for evaluating the long-term fishery potential for *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* in the Foundation Seamount Chain within the SPRFMO Convention Area. To ensure the EPF is developed on a precautionary and gradual basis according to the best available science, the data collected during GS operations will be made available to assess any potential impacts on the target species, associated or dependent species, and the marine ecosystem, and to evaluate any mitigating measures.

This EPF will collect fishery data to:

- (1) Determine the geographical range of the target species within the Foundation Seamount Chain, which includes depth range contours, vertical stock distribution and relative stock density on eight (8) seamounts to be surveyed (see Figure 1, Table 1, and Appendix 1).
- (2) Evaluate the biology of the target species including review of size composition, sex ratios, variation in DNA signatures and other relevant biological information to better understand these species.
- (3) Document any potential Vulnerable Marine Ecosystems (VMEs) in the research zone, plot their locations and produce a VME map in 3D projections for each seamount researched.
- (4) Identify the composition and extent of potential VMEs using video to assist in the evaluation of potential VMEs and other seafloor structures to better understand the type of habitat and the density of the target and by catch species.
- (5) Build a robust reporting plan while collecting all research data, and have it compiled for easy dissemination to the SPRFMO SC and Ministry of Marine Resources (MMR) Cook Islands to better understand the biology of the target species, stock densities, population dynamics and species

interactions across the research zone and the development of a sound biomass assessment in support of a management strategy for a future fishery.

Given the changes in the high seas management of the fishery resources in the Southern Pacific Ocean with the formation of the SPRFMO Commission, GSF acknowledges that exploratory and commercial fishing voyages for target species are now mandated to account for interactions and footprints left on the environment. GSF is familiar with and will have on board their vessel the following documents:

1. FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas.
2. The Conservation and Management measures as adopted, amended and added to, from time to time, by SPRFMO.
3. Ecosystems and Biodiversity in Deep Waters and High Seas. (2006) UNEP Regional Seas Report and Studies no. 178. United Nations Environment Programme.
4. Evidence of a VME form. (2008). Ministry of Fisheries, New Zealand.
5. Template for the compilation of information describing specific habitats in the Southern Pacific Ocean.

For the first year of the EPF, the first trip is scheduled to start on or before October 1<sup>st</sup>, 2018 followed by a second trip starting on or before January 1<sup>st</sup>, 2019 and a third trip starting on or before April 1<sup>st</sup>, 2019 and extending into June of 2019. The fishing with long line traps will be conducted in the first year on eight (8) selected seamounts from the 62 documented seamounts in the Foundation Seamount Chain (see Figure 1). CMM 14b-2018 calls for the survey of eight (8) seamounts in three (3) trips, each with a maximum of 30 fishing days. The maximum harvest level is 1,000 tonnes of green weight for the species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* For further details for the first year of operation see section 7.

The second year of the EPF is anticipated to start on or before October 1<sup>st</sup>, 2019 and will continue on or before June 1<sup>st</sup>, 2020. CMM 14b-2018 calls for the survey of eight (8) seamounts with three (3) trips, each with a maximum of 30 fishing days. The maximum harvest level is 1,000 tonnes of green weight for the species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* For further details for the second year of operation see section 7.

The fisheries operation plan for the third year of operation will be determined after the research data from the first year is analyzed and a new operation plan submitted by GSF to the SPRFMO SC6 at their annual meeting to be held in September 2019. If the SPRFMO SC6 supports the new fisheries operation plan for year three then that document would be forwarded to the SPRFMO Commission for their consideration at their annual meeting scheduled to be held in February 2020. GSF anticipates this new plan would include a broader based research of more seamounts in the Foundation Seamount Chain which will also include more robust investigation on the species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* For further details regarding the third year of operation see section 7.

## 2 Points of Contact

### 2.1 Owners' Representatives

The below named individuals are the primary contacts for all operational, management and corporate matters.

John Chadderton  
3 Henry Street, Fremantle, WA 6160, Australia  
[antartic@iinet.net.au](mailto:antartic@iinet.net.au)

Mark Maring  
4430 SE Flavel Street, Portland, Oregon 97206, USA  
[mfm@markfmaring.com](mailto:mfm@markfmaring.com)

### 2.2 Vessel Owners

The owner of the vessel is Great Southern Fisheries LTD, a company incorporated under the laws of the Cook Islands and based in Avarua, Rarotonga, Cook Islands.

## 2. Official Contact Ministry of Marine Resources

Tim Costelloe  
Director Offshore  
Ministry of Marine Resources  
PO Box 85, Avarua, Cook Islands  
[t.costelloe@mmr.gov.ck](mailto:t.costelloe@mmr.gov.ck)

## 3 Vessel Details

The vessel will be converted for dedicated use to deploy and retrieve longline strings of traps for setting in deep water.

Vessel Name:	Great Southern
International Call Sign	TBC
Flag State	Cook Islands
Port of Registry	Avatiu
Hull	Steel

Length overall	69.35m
Registered length	63m
Breadth	10.7m
Depth	6.8m
Gross tonnage	1,094
Hold capacity	1,000cbm
Freezing capacity	80 tons/day
Freezer plant	157cbm
Fresh water capacity	22cbm
Crew accommodation	Up to 35
Main engine	Akasaka K31FD of 1800Bhp

#### Auxiliary Engines and Generators

1. NIIGATA 6L18CX of 620 hp at 900 rpm
2. NIIGATA 6L18CX of 620 hp at 900 rpm
3. SHINKO of 520 Kva
4. SHINKO of 520 Kva
5. Fuel Capacity Fuel Oil 577 cbm
6. Vessel Markings: Once the conversion is complete, GS will be marked in accordance with FAO 415 Annex J: Fishing vessel identification and marking. Photos will be provided to MMR and the Secretariat once available along with the vessel's International Tonnage Certificate.

#### **4 Principals**

The above named principals, John Chadderton and Mark Maring, both have substantial experience in the type of exploratory research fishing operation proposed, including experience in other exploratory and research fishing in similar fisheries. They are cognizant of the requirements and objectives of SPRFMO, particularly in respect of the sensitive nature of the marine environment and benthos when conducting bottom fishing operations.

## 5 Proposed Activities in the Management Area and the Target Species

### 5.1 Licensing

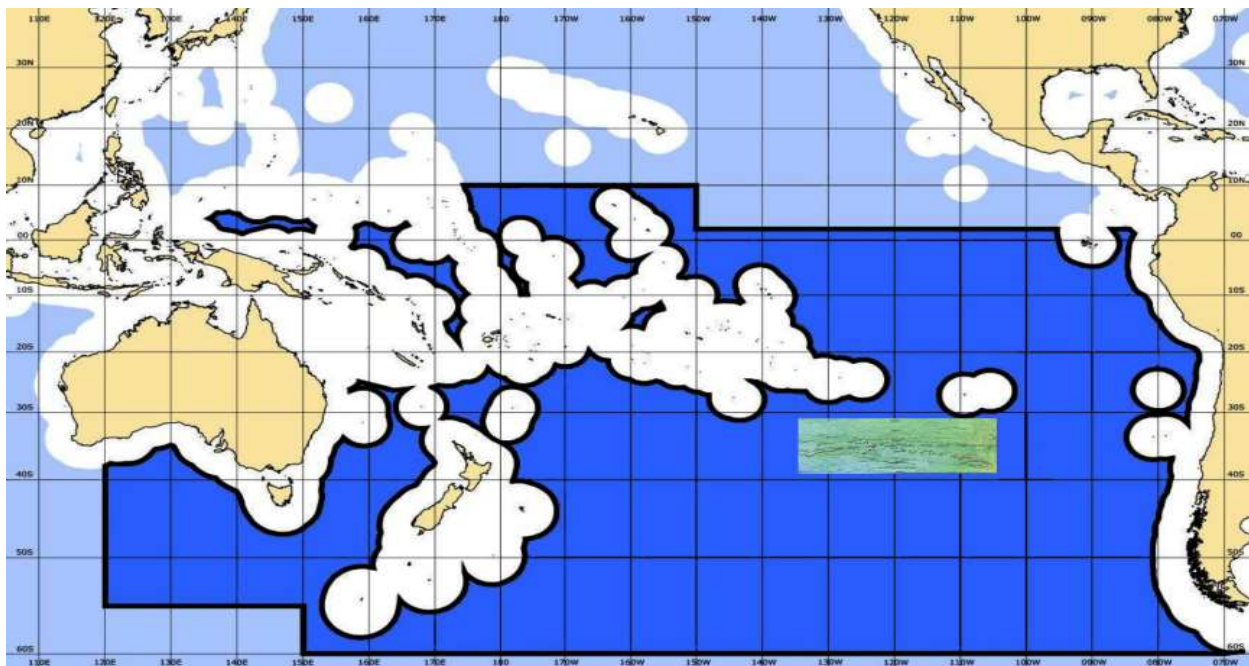
GSF will apply for an Access Agreement with the Government of the Cook Islands through the Ministry of Marine Resources (MMR), which will, *inter alia*, provide for the annual authorization of the vessel. This Access Agreement will require the company and the vessel to comply with all Cook Islands laws and the regulations, and all Conservation and Management Measures adopted by the SPRFMO Commission such as CMM 14b-2018, CMM 02-2017 on standards for the collection, reporting, verification, and exchange data, CMM 03-2017 on the management of the Bottom Fishing and the CMM 09-2017 on Minimizing By catch of Seabirds, and any other CMMs adopted by the SPRFMO Commission. Under the Marine Resources Act 2005, the Cook Islands has considerable powers of sanction against the company the master, crew and the vessel in the event that requirements of this EPF are not met.

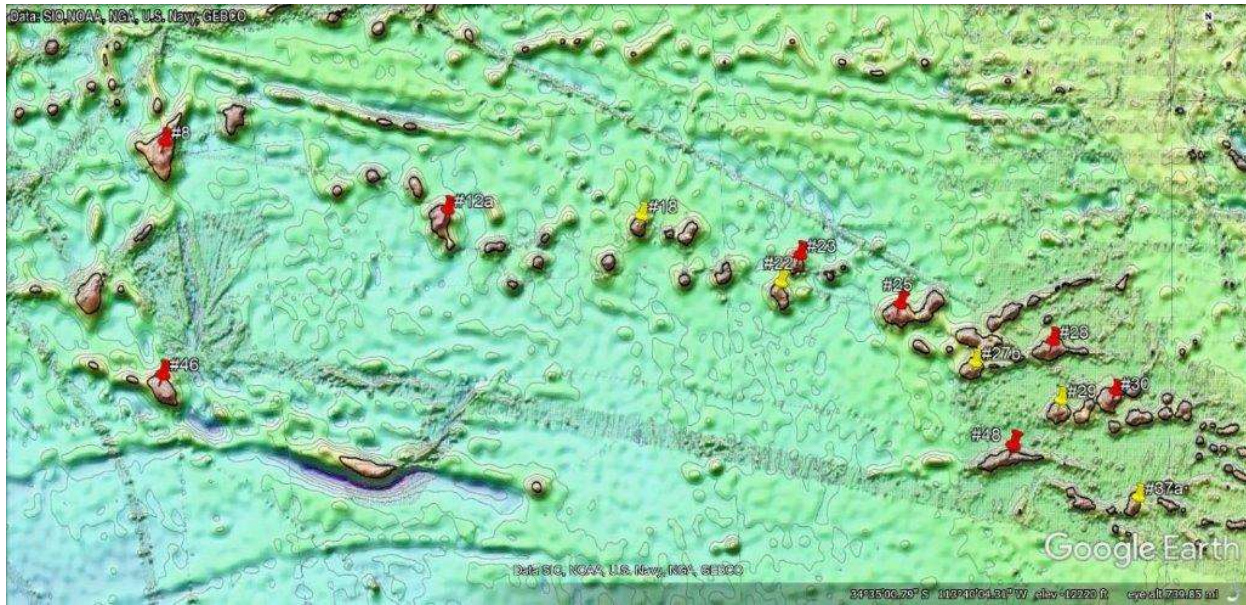
### 5.2 Area

This document confirms the area to conduct the EPF as that discussed in CMM 14b-2018 by the SPRFMO Commission. The geographic area for this EPF is identified in the following boxed area of the SPRFMO Management Area (see Figure 1 and Appendix 1).

#### Foundation Seamount Chain

- a. 100 degrees west to 134 degrees West
- b. 31 degrees South to 40 degrees South
- c. 2,400 kilometers by 880 kilometers: 2,100,000 square kilometers



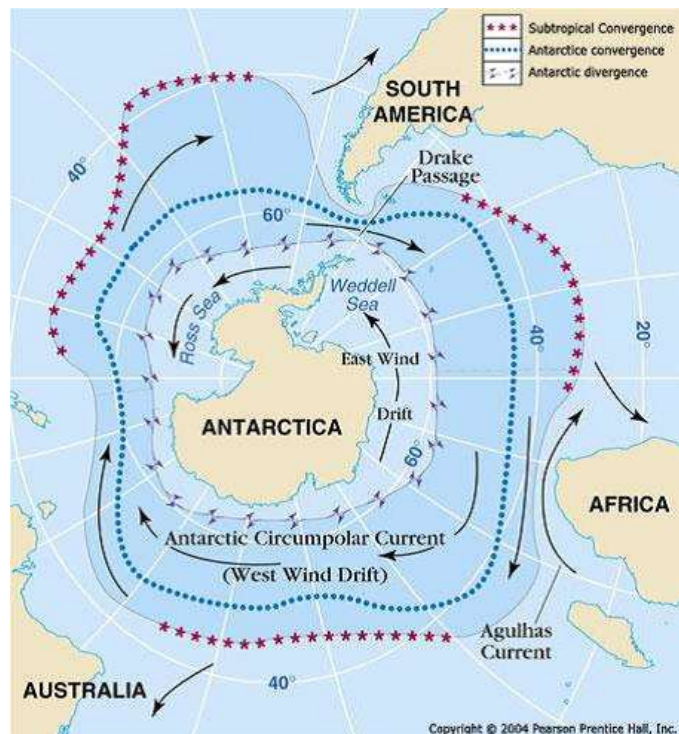


**Figure 1.** Expanded graphics of the seafloor of this area, showing the seamounts to be surveyed and a map of the SPRFMO Management Area showing the above area is attached. Red = chosen eight (8) seamounts to be surveyed; Yellow = alternate five (5) seamounts.

The Foundation Seamount chain, due to its location, length and East/West orientation is subject to dramatic upwelling of nutrient-rich water from the Antarctic circumpolar current, which is forced by the Earth’s rotation, and the presence of the Pacific-Antarctic Ridge including the South American continent into a hump effect, or gyre driving the cold nutrient-rich waters north where a mixing of the Easterly sub-tropical current takes place (see Figure 2).

This flow travels largely parallel to and across the Ridges and Seamounts in the Foundation Seamount chain, mixing the sub-tropical waters with the cold sub-Antarctic waters. The mixing extends from the sea surface to depths of 2000-4000 m and can be as wide as 400 km.

The cold flow is intensified by upwelling of deep water caused by the combined effects of the drag of surface winds of the Southeast Trades and the Earth’s rotation. The upwelling brings abundant nutrients close to the surface, where the eddies are believed to be sufficiently strong to reverse the direction of



**Figure 2.** Charted depiction of Antarctic circumpolar current.

the surface currents in this area where shallow undercurrents exist, that flow in a direction counter to that at the surface. The East/West latitudinal trend mentioned earlier is expected to allow for a regional “hot spot” of biodiversity for crustaceans, molluscs, and microalgae across the Foundation Seamount Chain, whereby the same benthos is likely to occur throughout the chain.

### 5.3 Bathymetry of Foundation Seamount Chain

The oceanography of the Foundation Seamount Chain had not been extensively investigated on a fine scale, except by a high resolution bathymetrical multinational survey conducted in part by Dr. David Sandwell of Scripps Institute of Oceanography in California. GSF has communicated with Dr. Sandwell regarding his work on Marine Gravity Anomaly from Satellite Altimetry and Predictive Seafloor Topography. This fine scale bathymetric survey of FSC provided him with soundings data to enhance and validate his predictive model to map seafloor topography from satellite altimetry data. He has shared with GSF his comprehensive bathymetric charts of the Foundation Seamount Chain generated from his survey. In return GSF has agreed to forward all their soundings data to Dr. Sandwell collected during their research fishing on the Foundation Seamount Chain which he will use to improve his predictive model for the Foundation Seamount Chain. The development of this technology will be very important to future distant deep-water fisheries in the area. Dr. Sandwell’s predictive modelling of seafloor topography will improve the ability of Natural Resources Consultants, Inc. (NRC), under contract with Great Southern Fisheries Ltd, to delineate the bottom structure in crustacean habitat and any potential VMEs seamount surveyed by GS within the Foundation Seamount Chain.

### 5.4 Methods

GSF will deploy longline pot gear carefully designed and dedicated to capturing species of crustaceans on deep-water seamounts. GSF intends to be very selective about the exploratory pot fishing methods and only survey areas where there is a likelihood of a high density of the target species. The approach should have minimal adverse impact on the environment. It is anticipated that at least 95% of the marine creatures harvested will be the target crustacean species, *Jasus spp.*, *Projasus spp.*, or *Chaceon spp.* Very little non-crustacean by catch is expected. Based on prior knowledge and design of the trap, GSF can conduct their exploratory pot fishing very cautiously.

### 5.5 Operational Approach Under CMM 14b-2018

The SPRFMO Commission’s CMM 14b-2018 for an EPF in the SPRFMO Convention Area implemented by GSF is binding beginning on May 5<sup>th</sup>, 2018 and expires May 4<sup>th</sup>, 2021. In the first year GS will conduct three (3) 30 fishing day exploratory trips on eight (8) of the documented 62 seamounts in the Foundation Seamount Chain. These three (3) fishing trips will start on or before October 1<sup>st</sup>, 2018 and

end in May or June 2019. In this first year, fishing will target *Jasus spp.* on the known seafloor structures above the 500 m depth. Any *Projasus spp.* caught will also be retained although it is expected to be a secondary target species in the first year. Exploratory fishing for both *Projasus spp.* and *Chaceon spp.* will be addressed in years two (2) and three (3) in addition to continued effort targeting *Jasus spp.*

Of the 62 documented seamounts, GSF believes 13 have seafloor that rise above 500 m (see Figure 1, Table 1, Appendix 1) which are planned to be surveyed starting in 2018. Of those 13 seamounts, eight (8) will be surveyed during the first three (3) fishing trips of 2018/2019 as discussed in CMM 14b-2018. Given the nature and condition of these eight (8) seamounts is unknown, the remaining five (5) seamounts will be held in reserve as alternates only to be surveyed in the event some of the original eight (8) seamounts are unfishable with longline trap gear, deeper than 500 m or absent of target species. GS will deploy longline pot gear designed specifically to capture species of crustaceans. This approach should have minimal adverse impact on the environment.

**Table 1.** The 13 seamounts with seafloor depths expected to be above 500 m of which eight (8) are listed to be surveyed in the 2018/2019 Fisheries Operation Plan outlined in the adopted CMM 14b-2018 and five (5) seamounts are identified as alternate seamounts to replace any of the eight (8) seamounts if they are unfishable with trap longline gear.

Seamount No.	Seamount	Depth Range	2018/2019 fishing status	sqkm 0-500M	Description	Comments
1. #8	Buffon	300-500	Yes	1.17	N-S Elongated Structure	Scatted Cones
2. #12a	Darwin A	300-500	Yes	90.41	Elongated Structure	Flat Summit Plateau
3. #18	Galilei	300-500	Alternate	12.40	Conical Structure	Circular Flat Summit
4. #22	Humboldt	300-500	Alternate	3.22	Circular Structure	Flat Summit
5. #23	Jenner	300-500	Yes	22.72	Elongated Structure	Flat Summit
6. #25	Kopernik	180-500	Yes	115.20	Circular Structure	Flat Summit
7. #27b	Linne b	200-500	Alternate	11.89	Circular Structure	Flat Summit
8. #28	Mendel	150-500	Yes	47.96	Elongated Structure	Flat Summit
9. #29	Mendeleiev	200-500	Alternate	9.18	Circular Structure	Flat Summit
10. #30	Mercator	300-500	Yes	46.77	Elongated Structure	Flat Summit
11. #37a	Platon	300-500	Alternate	3.11	Flank Structure	Rift Zone
12. #46	MM	150-500	Yes	318.87	Elongated Structure	Flat Summit with Cones
13. #48	GB	150-500	Yes	13.59	Elongated Structure	Flat Summit
Total sqkm				696		

It should be noted that the terms *pot* and *trap* are used synonymously throughout this document to describe the gear type used. The traps to be used (see Appendix 2) are 150cm diameter at the base, 75cm high and 50cm diameter at the top. The entrance to the trap is 35cm in diameter and the trap is covered with netting of 5cm mesh. The backbone (ground line) and float line for each string of traps is made of 25mm polypropylene rope with each trap on each string spaced 25m apart. The traps will be constructed with “escape gaps” to allow for escapement of the small organisms. When targeting the

Jasus spp. or Chaceonspp. the escape gaps will remain open. When exploratory fishing is commenced for the smaller Projasus spp., the escape gaps will be closed with a flap of netting.

The importance of recording lost gear and traps is noted by GSF as it will be an indicator of the vessel's imprint in this region. As traps are expensive, GS will make every effort to find lost traps to minimize any impact to the environment. If any gear is lost, GS will report the event in the daily logs during the survey. Although no fishing method is 100% benign to the environment, GSF believes that its choice of gear, methods and prior knowledge of the type of area to be researched will only leave a negligible imprint on the seafloor, even on the sensitive areas. GS will set and haul 1,000 traps per day in strings of 200 traps per string, or may only fish 100 traps per string when fishing smaller seamounts. The soak time for the pots on the bottom will vary between 24 to 72 hours, depending on the retrieval cycle during the research fishing.

The backbone line (ground line) used to attach the traps and float line used are buoyant and, as such, the risk of entanglement and bottom damage is minimal. Floats for each longline string will be appropriately marked to ensure easy identification. The methodology of setting is as follows: The first float and float line are deployed behind the vessel from the stern and paid out in full, the length of the float line being 1.5 times the maximum bottom depth in the area. The backbone line which the traps are attached is then similarly paid out, while the vessel steams slowly ahead. Finally, the remaining float line and float are paid out from the opposite end of the longline string. It is important to note that no "anchors" are used, the traps themselves will act as the anchors being sufficient to keep the gear in place on the bottom. This eliminates the impact of any "anchor damage" to the seabed and benthos or other environmental aspects in the fishing area. The entire gear is "stretched" gently to minimize the risk of self-entanglement on the way to the bottom. The sink rate of these trap strings is observed to be quite slow; less than 1 m/s, so a trap will take approximately 10 minutes to reach a depth of 500m. The methodology of the set and slow sink rate of the gear, combined with variations in wind and current conditions, mean it's practically impossible to set the gear in the exact location twice which can cause variations in bottom placement of up to several thousand meters from the same surface release point. This has the benefit of limiting damage to sensitive benthos by avoiding repeated contact in the exact same area. Deployment of the trap longline directly off the stern of the vessel will minimize the potential of bird interaction with the lines. In addition, the bait jars will be filled with bait and tethered to the inside of the trap while the traps are being staged to be attached to the ground line just before they are deployed off the stern of the vessel. This methodology should minimize the attraction of the birds during the setting and deployment of the fishing gear. Traps will be retrieved from the hauling station located midship on the starboard side where the catch of the target species will be weighed. All bycatch from a set will be cumulated in a small, stackable, plastic deck container (tote) and weighed and counted at the end of the set. The observer station will be near the hauling station so the observer has easy access to select samples of the catch from specific traps before the catch is moved to the factory.

It should be noted that the total footprint of all traps set of the first year of the EPF will be approximately 0.159square kilometer (sqkm) or just 0.023%out of the assessed total seafloor of the target areas defined as the 13 seamounts identified in Table 1, Figure 1, and Appendix 1.

For the setting and hauling of the longline trap sets, fishing effort as defined in the plan and catch will be recorded. Biological sampling will follow the specification of the Scientific Sampling Plan (section 8.6). Catch of each trap will be sorted into target species and bycatch. The catch of the target species will be weighed. The weight will be summed over all traps in the longline set. For a subset of traps sampled by the GSF Biologist, the retained catch will be counted and will be sub sampled for individual weight, carapace length, sex, maturity and spawning stage. Depending on the amount landed bycatch or a subsample of by catch will be sorted to the nearest taxon to estimate the total amount of by catch by taxon per longline set, following the sampling plan.

It is anticipated the entire catch will be frozen whole on board, so very little onboard processing or creation of waste will occur. Should this processing methodology be altered, GSF will notify MMR and SPRFMO of the change and will advise what measures will be taken to deal with waste accordingly. There will be no dumping of offal while lines are being set or while lines are being hauled and all offal or discards shall be macerated by machine prior to discharging. Discharging shall take place only at the end of a haul or while steaming; no biological material shall be discarded for at least 30 minutes before the start of any set or during any set. Discharging may only take place from the opposite side of the vessel from the hauling position.

The seamount chain in the research zone is different than isolated seamounts which are known to demonstrate degrees of endemism. Individual seamounts and structures throughout the Foundation Seamount Chain are unlikely to hold only endemic species due to the prevailing conditions which would appear to reflect similar diversity throughout the chain. A very small subsample of target species from each seamount will be packaged and preserved to be distributed at the end of the trip to collaborating scientist for further biological laboratory studies such as DNA research to confirm species identity and to assess the potential for genetic separation of stocks between seamounts.

Data will be recorded daily and summarized on a trip by trip basis. This data will be forwarded to MMR to be sent to NRC where it will be analyzed and summarized at the end of each trip and again at the end of the first year. These analyses and summaries will be used to draw conclusions and findings of the EPF to assess the impact on the target resources, bycatch species, interaction with marine mammals and seabirds, habitat and potential VMEs. The fishing data and NRC reports will be forwarded to MMR and the SPRFMO SC for evaluation.

The operation of the EPF may require some adjustments to the actual deployment and retrieval of the fishing gear, deck handling of the catch and the data collection procedures as the Captain, crew and observers learn what works and doesn't work. It is understood there are several unknown factors which may impact the efficiency of the operation, such as the size of the catches per trap, rough weather, occurrence of large quantities of bycatch, more incidence of marine mammals and seabirds than expected, as an example. Management of *Jasus spp.* in nearly all commercial fisheries in the Southern Oceans does not allow retention of berried females. GS will follow this policy and not target *Jasus spp.* when females are in berried condition. GSF is also not aware of any markets for berried lobsters, so GSF will not fish in habitat areas where berried females might be found. Currently there is no clear data

on the distribution and seasonality of the Jasus spp., Projasus spp. or Chaceon spp. in the designated seamounts. Any minor adjustments will be made as the data are gathered during the survey trip. Major adjustments will likely not occur until the vessel is in port and between trips so everyone involved with developing the fisheries operation plan has an opportunity to provide input to the change. GSF will inform MMR of any changes for approval by the Ministry. In addition, these changes will be documented in the trip and annual reports submitted to both MMR and the SPRFMO SC.

## 5.6 Target Species

The primary target research species will be Jasus spp. and Projasus spp. lobster, with an expectation of secondary target research species of Chaceon spp. crab.

## 5.7 Non-target, associated and dependent species

It is largely unknown at this point exactly which non-target species will be encountered as bycatch. Although from previous experience GSF expects the levels of bycatch to be extremely low. A very high estimate of 5% has been suggested but it is likely that it will be considerably lower. The nature of these types of interactions will only be known once the EPF begins.

## 5.8 Landing and/or Transshipment

GS will discharge all catch from the EPF outlined in CMM 14b-2018 to an approved facility at an approved port and does not intend to engage in any transshipment operations either at sea or in port. GS will follow all requirements as discussed in the “Conservation and Management on Minimum Standards of Inspection in Port” (CMM 07-2017). GS anticipates all production from the EPF outlined in CMM 14b-2018 will be discharged at Lima, Peru and will follow all aspects of CMM 07-2017 including Annex I-Port Call Request, Annex II-Port State Inspection Standards and Annex III-Format for Port Inspection Reports (these templates are available for review in CMM 07-2017).

## 6 Resource Biomass Calculations and Potential Management Reference Points

The maximum allowable catch approved by SPRFMO in CMM 14b-2018 for GS EPF is 1,000 tonnes of green product for the first year. Jasus spp. will be the primary target species above 500 m depths, but if catch rates are significantly below expectations then the fishery will likely switch to fishing deeper depths to target Projasus spp. and Chaceon spp. Based on fisheries in other seamount areas outside the Foundation Seamount Chain, GSF has an expectation that each of the target species exists in

considerable volumes within the proposed area. Although, the species composition of the GS catches is somewhat uncertain given the lack of information on the depth distribution of resources in the Foundation Seamount Chain, and conditions such as weather and currents which may dictate the area and depths surveyed by the longline pots. It is not expected that there will be a significant incidental catch of *Chaceon spp.* when *Jasus spp.* is being fished and vice versa as they tend to appear in depth ranges discrete from one another as the dominant bottom carnivore and the nature of these depth separations will become clearer as the exploratory fishing progresses. GSF has endeavoured to find possible relevant fishery data from South Africa, Chile, Australia and New Zealand on lobsters to refine if necessary the biomass estimates but in many cases for near shore stocks biomass estimates are established through constant monitoring of puerulus settlement, catch size, and male to female ratios. As a result, it is only possible to work from the known catches and effort from previously known fishing in the Foundation Seamount Chain. Simple catch-density estimates across areas of likely habitat were based on speculations about various levels of density multiplied by the documented areas above 500 m (see Appendix 3).

The Foundation Seamount Chain exploratory fishing area has 62 documented seamounts for which GS has detailed bathymetric information. This information identifies the location and depths of these 62 seamounts and notes there are other known and unknown seamounts but without depth data. This raises the possibility that there may be many additional seamounts with similar features that have yet to be located and surveyed. This information was provided to GSF by the Scripps Institute of Oceanography, La Jolla, California, USA. The availability and accessibility of this information is the reason the Foundation Seamount Chain was chosen to conduct an exploratory fishing investigation. Based on these data, GSF has calculated the surface area of the 62 documented seamounts for the three depth zones; 0-500, 501-1,000, 1,001-2,000 m (see Appendix 4). The total area across all the 62 seamounts above 2,000 m contour is 11,207 sqkm. These area measurements for these depth zones can be used to derive a range of possible population biomass levels to judge the potential for developing a future fishery. Appendix 4 documents the surface area for the 62 seamounts for the three depth zones in sqkm. Of these 62 seamounts, 13 are thought to have seafloor above 500 m. Total area above 500 m depth contour for these 13 seamounts is 696 sqkm. Only eight (8) of these 13 will be fished by GS during the first year of the EPF as instructed in CMM 14b - 2018. These area data can then be used to expand catch density rates observed for the three (3) short fishing trips in the northwest corner of the Foundation Seamount Chain carried out by Chadderton, Cave and Peterson in 1988, 1992 and 1995 respectively. Appendix 4 contains the summaries of those trips for average lobster catch per pot in numbers and kilograms per 1 square meter (sqm), assuming the effective fishing area of a baited pot to be 1 sqm, 10 sqm, 25 sqm, 50 sqm, 75 sqm, or 100 sqm. This approach also assumes that the lobster distribution and benthos at these three (3) fishing sites will be similar across the Chain and, specifically, for the eight (8) seamounts that will be surveyed. GSF is not aware of any other exploratory fishing trips to the area that could assist in this assessment of the productivity of the general area. Appendix 5 contains estimates of expected biomass for *Jasus spp.* for the 0-500 m depth zone on the 13 seamounts identified in Appendix 5 using the catch rates in Appendix 4. The dominant crustacean in the 0-500 m zone will likely be *Jasus spp.*, the deeper two zones will likely be *Projasus spp.* and *Chaceon spp.* for which no past catch data exist from the Foundation Seamount Chain.

A range of estimated densities of crustaceans per 10 sqm, 25 sqm, 50 sqm, 75 sqm and 100 sqm of seafloor can be expanded to abundance or biomass for this exploratory fishing area. Jasus spp. are expected to inhabit the seafloor area of 696 sqkm within the depth band of 0-500 m for the 13 seamounts. Total estimated biomass is only for the 13 seamounts and depths above 500 m (see Appendix 5). Total biomass across the area for Foundation Seamounts is likely to exceed the estimates included herein due to the possibility of unknown seamounts in the area that will not be fished. The SPRFMO Commission approved EPF operations that are designed to be precautionary and will be developed on a gradual basis starting at 1,000 tonnes for the first year. Initial estimates of Jasus spp. biomass on the 13 seamounts range from 355,210 to 3,552,099 tonnes assuming a range of the effective area of fishing for lobster pots. If the Jasus spp. habitat on these seamounts is only 25% of the available area above 500 m, then the biomass range would be 88,802 to 888,025 tonnes. In either case the total allowable catch of 1,000 tonnes for the first year of operation ranges from 0.028 to 1.13% of the total Jasus spp. biomass based on the available data and reasonable range of assumptions on effective fishing area per trap and available habitat. Given this wide range of 88,802 to 3,552,099 tonnes in the estimate of Jasus spp. biomass on the 13 seamounts, the Jasus spp. harvest over the first year of 1,000 tonnes is very conservative and precautionary even at the lower biomass estimate. These biomass estimates will need to be revised once all eight (8) seamounts have been fished during this EPF using the new Catch per Unit Effort (CPUE) data and any addition depth sounding data to improve the accuracy of depth contours of the surveyed seamounts. The collection of this new data to make these revisions can only be provided through exploratory research fishing and analysis of the results. Additionally, and as stated, it is anticipated that a substantial number of new seamounts will be discovered and identified as the fishing vessel transits across the Foundation Seamount Chain.

The assessment and the management of the EPF will rely on the collection of commercial catch and effort data and the derived CPUE time series to track the trends in stock biomass. Since much of crustacean habitat at the Foundation Seamount Chain is likely to be untrawlable, the use of area-swept trawl surveys is not practical. Since crustaceans are nearly impossible to age, unlike most vertebrate fish stocks, assessment for this Jasus spp. will rely on models based on CPUE and length composition data rather than age-structured assessment models. A simple harvest rule has been designed, given the limited availability of data, to ensure a precautionary approach is followed during the EPF and in the early stages of a developing commercial fishery. To use CPUE to track biomass level over time, the efficiency of a unit of fishing effort must remain constant and not fluctuate or improve over time. If effort efficiency is stable over time and saturation of fishing gear is not an issue, then CPUE can serve as an index of biomass. For this pot fishery, saturation could be an issue if pots are often stuffed full of Jasus spp. Also, since the EPF will occur on multiple seamounts of different sizes, each seamount will need to be monitored separately. The biomass on a seamount will be a function of the size of the Jasus spp. habitat. Furthermore, standardization of fishing pot longline gear, bait, soak time, and deployment and retrieval of a set of longline pots is critical so that effort efficiency is stable over the exploratory fishing period and consistent with any future commercial fishing operation conducted by GS. The first year of the EPF provides the opportunity to collect CPUE that can be considered to be proportional to the density of the unfished biomass,  $B_0/A$  where A is area of the Jasus spp. habitat for a seamount, or in

terms of the Schaefer Surplus Production Model,  $B_{\max}$  if gear saturation does not exist. From classic fish population dynamics, CPUE in units of weight is a simple function of biomass:

$$\text{CPUE} = qB/A$$

Where:  $q$  is the coefficient of catchability for a unit of fishing effort

Plus, if it is assumed that *Jasus spp.* population is in a state of equilibrium needed for the Schaefer model, then the maximum sustainable yield occurs when the resource biomass is one half of  $B_{\max}$ , i.e.

$$B_{\text{msy}} = \frac{B_{\max}}{2}$$

CPUE at MSY harvest level is then

$$\text{CPUE}_{\text{msy}} = qB_{\text{msy}}/A = \frac{qB_{\max}}{2A} = \text{CPUE}_{\max}/2$$

The value of  $\text{CPUE}_{\max}/2$  can be used as a control rule to lower annual harvest level in the upcoming year for a specific seamount when its CPUE for the current year is closing in on  $\text{CPUE}_{\max}/2$  and potentially reducing its harvest to near zero when CPUE drops below  $\text{CPUE}_{\max}/2$ . Management may want to continue with a small harvest in the latter case to monitor CPUE to detect any further change, up or down, in the biomass. Once a time series of catches, fishing effort and length composition of catches have been collected from the planned EPF, the values of catch per pot from the three(3) historic fishery trials can be replaced with the new values from the 2018-2019 fishing trips to update the range of biomass values for the 13 seamounts in Appendix 5. Also catch per set of longline (CPUE) from the first exploratory fishing year will be used to estimate  $\text{CPUE}_{\text{msy}}$  for each of the eight (8) seamounts. In addition, since catch for individual traps will be weighed and documented, these catch per pot data can provide new information on the size of areas with *Jasus spp.* to adjust the 25% value assumed for the portion of habitat occupied by *Jasus spp.* on the eight (8) seamounts in Appendix 5.

If 2018-19 CPUE values for the three fishing trips do not show a declining trend for eight (8) seamounts, then GS may consider increasing the harvest levels in year 2 on one (1) or two(2) seamounts to force a reduction in CPUE required to conduct a depletion experiment. The design of the depletion experiment is easiest when the effectiveness of a unit of fishing effort is known to be stable so the estimate of  $q$  is unbiased. This should be the case for this EPF including any future commercial fishery conducted by GS.

The planning and design of the depletion experiment would be initiated once the results of the first year are available. The selected seamounts should have a size between 9 and 23 sqkm, have an above average catch rate in year one relative to the other seven (7) seamounts, and be a reasonable distance away from the nearest seamount. The longline set needs to be identical to the standard set for the EPF operation but given the small amount of area above 500 m the standard gear may require using 100 pots per set rather than 200 pots per set to stay within the range of *Jasus spp.* habitat. If gear saturation

on the selected seamount is an issue, then soak times should be as short as possible. Soak time should not be longer than 24 hours but needs to be consistent with year 1. All the sampling protocols developed for the EPF need to be followed for this experiment although the number of observed pots in a set to be sampled might need to be increased.

The depletion experiment may need to extend over three (3) or four(4) years to drive down the *Jasus spp.* biomass to level close to  $CPUE_{max}/2$  to provide a reliable estimate of  $B_0$ . The data analysis would follow the approach of the classic DeLury depletion method but using modern statistical modeling methods reported in recent literature on depletion studies to estimate  $B_0$  and  $q$  including variances. The number of sets of longline gear will be determined by the number of days available without exceeding the limit of 30 fishing days or the catch limits per trip.

## 7 Planned Trips in Management Area

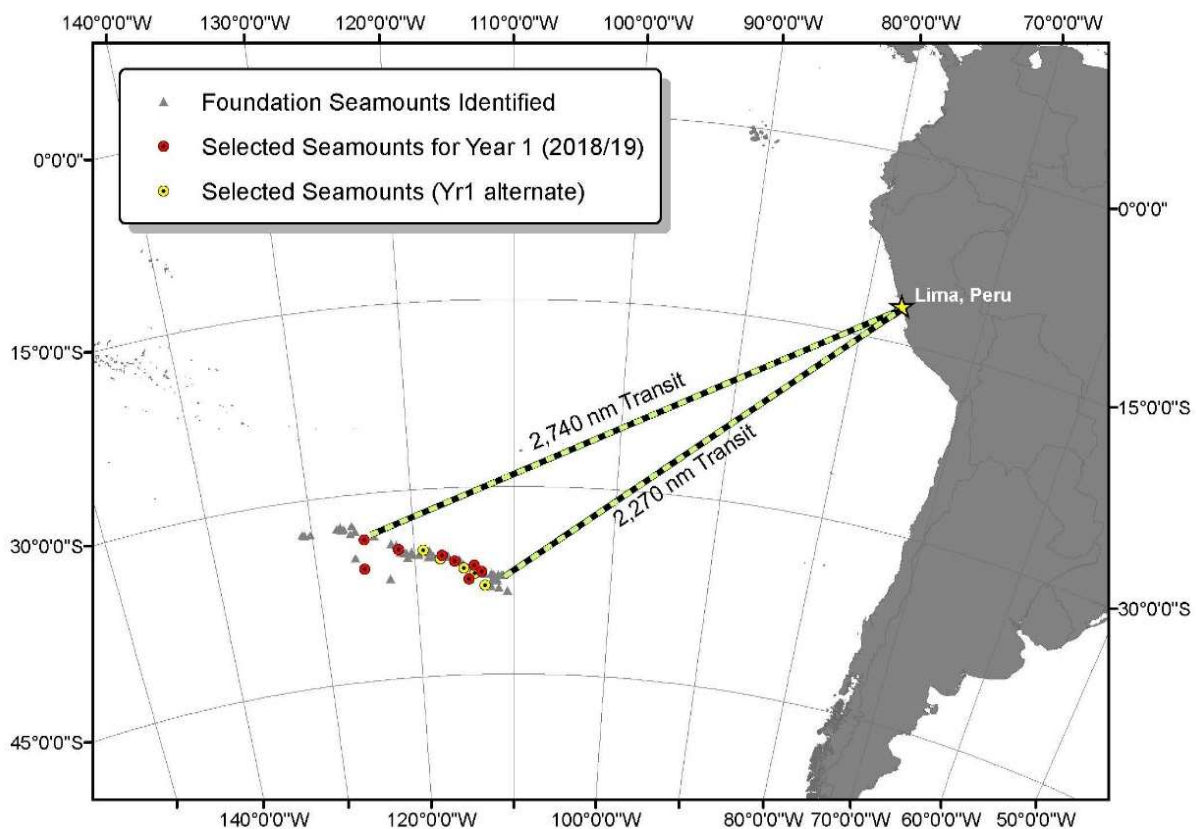
The Fisheries Operation Plan outlined in this document has two operational sections, the first section covers the survey plan for 2018/2019 which includes a total of 90 fishing days divided into three (3) fishing trips of 30 fishing days and a maximum harvest level of 1,000 tonnes of green product of the target species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* on eight (8) chosen seamounts to be surveyed as described in CMM 14b-2018. It is intended to commence EPF operations as soon as practical on or before October 1<sup>st</sup>, 2018 and complete on or before June 1<sup>st</sup>, 2019. The second section covers the survey plan for the period 2019/2020 which includes a total of 90 fishing days divided into three (3) fishing trips of 30 fishing days and a maximum harvest level of 1,000 tonnes of green product of the target species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* on eight (8) chosen seamounts to be surveyed as described in CMM 14b-2018. It is anticipated to commence this EPF operation in October 2019 and complete this survey by May 2020 (see Table 2).

GSF anticipates submitting a second Fisheries Operations Plan to the SPRFMO SC at their annual meeting scheduled in September 2019 where by GSF will present their findings from the first section of the first Fisheries Operation Plan. The new plan will cover the time frame for what GSF calls the third year or the period from May 5<sup>th</sup>, 2020 to the end of the CMM 14b-2018 which will expire on May 4<sup>th</sup>, 2021. The new plan will be developed from the survey data collected in year 1 with the intention to complete a wide spread survey of additional seamounts for further investigations of the target species *Jasus spp.*, *Projasus spp.* and *Chaceon spp.*

**Table 2.** References for voyages per year and trip, and target landings for *Jasus spp.*, *Projasus spp.*, and *Chaceon spp.* combined.

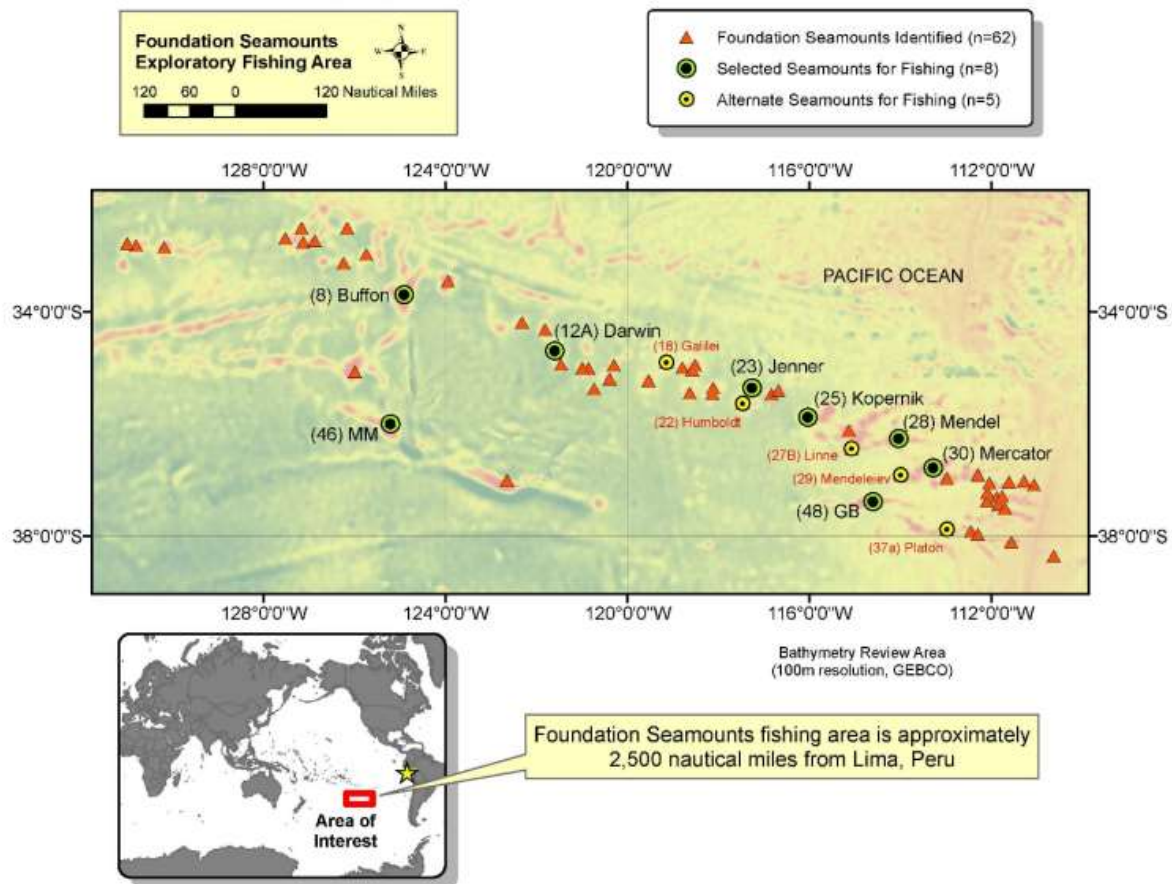
Year	Trip 1	Trip 2	Trip 3	Target Landings of <i>Jasus spp.</i> , <i>Projasus spp.</i> , and <i>Chaceon spp.</i> (tonnes - green weight)
1 (2018/2019)	Y1T1	Y1T2	Y1T3	1,000
2 (2019/2020)	Y2T1	Y2T2	Y2T3	1,000
3 (2020/2021)	TBD	TBD	TBD	TBD

Critical to the scheduling of GSF EPF is the consideration of scale. The area of interest, the Foundation Seamount Chain, consists of distant-water, high seas seamounts and adjacent fishing grounds that cover an expansive area of approximately 2.1 million sqkm (~612,000 square nautical miles) (see Figure 1 and Appendix 1). The grounds are near 35° South latitude approximately 2,500 nautical miles from GSF home port of Lima, Peru (see Figure 3 and Appendix 6).

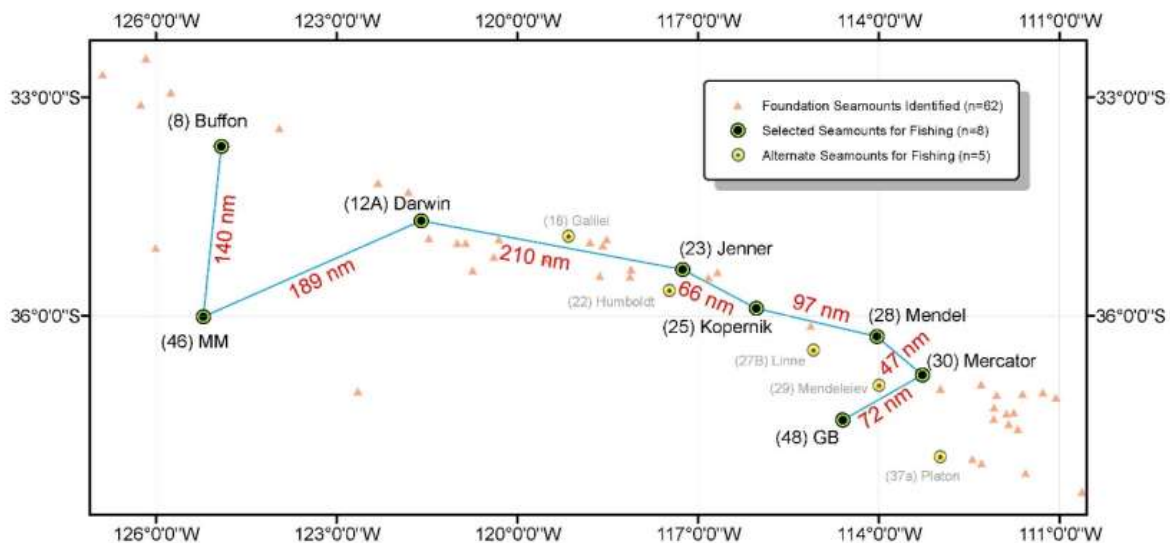


**Figure 3.** Distance from port at Lima, Peru to selected seamounts for GS exploratory fishing within the Foundation Seamount Chain.

Of the 62 documented seamounts in the Foundation Chain, 13 have been identified as the target fishing grounds with seafloor structure at water depths 0-500 m; of which, longline pot fishing effort will occur on eight (8) of the seamounts (see Figure 4 and Appendix 6). Figure 5 and Appendix (6) depicts the scale of the fishing grounds, and distance between target seamounts for the fishing schedule of Year 1. The remote nature of the target research grounds in the central-south Pacific Ocean has been a conservation buffer and a barrier to sustainable fisheries development. This schedule of fishing operations takes into consideration the balance between capital costs to get to these grounds and the important opportunity to collect scientific information without jeopardizing the goal of successful fishing operations.



**Figure 4.** Selected seamounts for GS exploratory fishing within the Foundation Seamount Chain.



**Figure 5.** Distance between each selected seamounts for GS exploratory fishing within the Foundation Seamount Chain.

The first fishing trip (Y1T1) of the F/V Great Southern (GSF) is anticipated to depart Lima, Peru on or before October 1, 2018. The GS will transit directly to the Foundation Seamount Chain arriving at the first of eight (8) seamounts in approximately 10 to 12 days, depending on weather and other conditions (see Figure 3 and Appendix 6). The order in which the seamounts will be surveyed is shown in Figure 5 and Appendix (6). Upon arrival at the first seamount, and each thereafter, bathymetric depth of the predetermined set locations will be surveyed and recorded prior to commencement of fishing operations to confirm the depth is less than 500 m and the seafloor structure is compatible with longline pot fishing. Fishing activity will start with the deployment of 1,000 pots, divided into five (5) strings of 200 pots each. GS anticipates a 24 to 72-hour soak time for each string of pots, and plans to set and haul 1,000 pots during each day of fishing. While this is the general plan for fishing operations during Year 1, GSF intends to maintain flexibility in the amount of effort (i.e., number of strings, number of pots, soak time) applied to each seamount so that adjustments can be made depending on weather, currents, magnitude of catch, and vessel operations. The estimated number of days fished on each seamount is outlined in Table 3 and is dependent on the size of the fishing grounds of each seamount. Large geographic seamounts with depths < 500 m will receive more fishing effort than the smaller ones (Table 3). When fishing on the smaller seamounts, the longlines might be changed from 200 pots strings to 100 pot strings to ensure the gear is deployed within the targeted research depth zone (< 500 m) to maintain integrity of the research model. Once the last set is pulled on the first seamount per the schedule, the vessel will transit to the next seamount on the list and continue this process through the eight (8) seamounts identified in Table 3. If any of the eight (8) seamounts are found to be unfishable because of the seafloor structure, depth zone profile, or has no evidence of *Jasus spp.*, then one of the alternative seamounts will be selected to replace it. The observer on board the vessel will be involved in this decision making process, and will notify MMR of any proposed change. It is anticipated that fishing on the eight (8) seamounts identified in Table 3 should be completed by the end of 30<sup>th</sup> fishing day (not

including transit time between seamounts) of Y1T1, at which point the vessel will conclude fishing operations and transit back to port to offload product and prepare the vessel for Y1T2.

**Table 3.** Selected eight (8) seamounts (and 5 alternates) for exploratory fishing with distances between seamounts, area of seamount depth above 500 m, estimate days fished at each seamount, estimated footprint of fishing gear per seamount, and percentage of area above 500 m covered by fishing gear. Highlighted rows are chosen seamounts; non-highlighted rows are alternates.

Seamount #	Seamount Name	Distance to Next (NM)	Seamount Area for Depths <500 m (sqkm)	Estimated Days Fished	Footprint of Gear (sqm)	Percent of Fishing Area (<500 m) covered by Footprint of Gear
8	Buffon	140	1.2	2	3540	0.303%
46	MM	189	318.9	7	12390	0.004%
12A	Darwin a	210	90.4	4	7080	0.008%
18	Galilei		12.4			
23	Jenner	66	22.7	3	5310	0.023%
22	Humboldt		3.2			
25	Kopernik	97	115.2	6	10620	0.009%
27B	Linne b		11.9			
28	Mendel	47	48.0	3	5310	0.011%
30	Mercator	72	46.8	3	5310	0.011%
29	Mendeleiev		9.2			
48	GB	NA	13.6	2	3540	0.026%
37A	Platon		3.1			
Total		821	696	30	53100	0.008%

The plans for Y1T2 are to repeat the fishing operations completed in Y1T1. Upon the return to port from Y1T1, the plan for Y1T2 will be finalized with adjustments made based on progress and information gathered from Y1T1. If for any reason less than eight (8) seamounts were fished during Y1T1 as planned, then Y1T2 will start on the next seamount following where Y1T1 was completed. If the catch rates at any of the seamount sampled on the Y1T1 were unproductive, then that seamount will be replaced with one of the five (5) alternative seamounts. If any area within a seamount was found not to be populated with *Jasus spp.*, effort would not be applied to that portion of the seamount during the Y1T2. If time is available, additional sets can be made in the more productive portions of the more productive seamounts. One of the main objectives of the Y1T2 is to determine if the CPUE values and length compositions change from the values observed in the first trip Y1T1. Other objectives for both Y1T1 and Y1T2 will be to determine the geographical distribution boundaries, depth and vertical distribution of *Jasus spp.* GS plans to embark on Y1T2 on or before January 1, 2019 and a return to port after approximately 60 days at sea, in March 2019.

The anticipated embarkation date for Y1T3 from Lima, Peru will be on or before April 1, 2019; with an estimated return in June 2019. GSF anticipates this trip to last 60 days or less, depending on if and when the vessel reaches the cumulative maximum 1,000 tonnes total allowable catch as approved by SPRFMO CMM 14b-2018 before the 30<sup>th</sup> fishing day. The fishing objectives of Y1T3 are the same as the Y1T2 if the catch rates for *Jasus spp.* are productive and similar to those observed in Y1T1 and Y1T2. If the catch rates on specific seamounts in Y1T3 fall below half of the CPUE values observed in the Y1T1, then GSF will stop fishing on those identified seamounts with fishing grounds above the 500 m contour and either concentrate on more productive seamounts listed in Table 3, pick alternate seamounts from the list in Table 3, or initiate exploratory pot fishing in depths deeper than 500 m targeting on *Projasus spp.* In any case, once the fishing days period reaches 30 fishing days, the vessel will return to port, concluding the first year of fishing operations.

Upon completion of Y1T3 in June 2019, the GSF management team will develop a new fisheries operation plan for Year 3 based on the findings of the survey work conducted in Year 1, which will be submitted to the SPRFMO SC for consideration at their scheduled annual meeting in September 2019 (SPRFMO SC 6) and then to the SPRFMO Commission for consideration at their annual meeting scheduled in February 2020 (SPRFMO COMM8) for final year of the EPF CMM 14b -2018. Year 3 of operations is anticipated to start once the SPRFMO COMM8 approves the new expanded research plan in February of 2020 and will finish before the end of the CMM 14b-2018 which is on May 4<sup>th</sup>, 2021.

Year 2 of CMM 14b – 2018, the fishing plan includes three (3) trips of 30 fishing days and a total of 1,000 tonnes of green weight harvest and will replicate the fishing schedule of Y1T2 and Y1T3. During Y2T1, fishing on high-density seamounts will be conducted to assess and document changes in CPUE, vertical distribution of the species, and length to weight ratios. Also during Y2T1 the plan will include an optional depletion study of *Jasus spp.* based on the DeLury depletion method depending on the available fishing days and catch limits. The depletion study methods are described in Section 8.9; the seamount(s) chosen for the depletion study will be determined following analysis of catch data from Year 1. Depending on what is found in Year 1, GSF will pick one or two seamounts and an area within these seamounts to conduct this DeLury depletion study. Operations during Y2T2 and Y2T3 will follow a similar operational plan as Year 1 including the depletion study. It is also anticipated GS will deploy gear in depth ranges between 501-1000 m to investigate the *Projasus spp.* and the *Chaceon spp.* This will be important information to collect for future work in the following years.

Year 3 of the CMM 14b-2018 will follow the fisheries operation plan that will be presented to the SPRFMO SC (SPRFMO SC 6) in September 2019 and then will be sent the SPRFMO Commission for consideration in February 2020. If the SPRFMO Commission approves the new expanded research plan to conduct a wide scale research study, GS would start fishing in Year 3, and continue until the end of CMM 14b-2018 on May 4<sup>th</sup>, 2021.

## 8 Data Collection Methods and Scientific Sampling Plan

GSF will undertake a robust exploratory pot fishing operation including test pot surveys, camera surveys to confirm the existence of VMEs in the research zone, biological data collection of the target species and a data collection reporting system to compile data sets necessary to evaluate biomass assessments and geographical distribution of the target species using traps.

During the EPF, data will be collected daily in accordance with CMM 02-2017 using two daily logs:

1. A Daily Effort regarding Catch data and Production Log will be collected to better understand and research the target species. The Daily Effort, Catch and Production (SPRFMO Fishing Activity Report) will capture operational information on a string-by-string basis and will be described on this form. Lost gear is also recorded on a string by string basis or trap by trap basis.
2. Daily Environmental Log to record discards and waste management, wildlife abundance and interactions and mitigation measures. Prior to each exploratory pot fishing trip, an assessment will be made to determine whether the area might be a Vulnerable Marine Ecosystem (VME).

A decision on whether an area might be a VME will be made in accordance with CMM 03-2017 using a form for VME classification approved by MMR in line with the SPRFMO policy. Data collected from the pot hauling operation and the camera study may identify VME areas, which will be duly reported.

If significant quantities of coral or sponge are found in or attached to traps or by the camera study, then the vessel will move on in accordance with CMM 03-2017. Knowing GSF will have the capability to deploy cameras to film bottom structure and benthos, GSF will deploy these cameras per the camera study on a regular basis, especially where new areas are being fished and the data will be provided to MMR in the reports at the end of each trip.

During all EPF operations conducted by GS during each trip the following standard data will be collected, as defined by the SPRFMO data standard for exploratory research fishing activity:

1. Data are to be collected on an un-aggregated (string-by-string) 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) Vessel's IMO number (if allocated)
  - (f) Set start date and time (UTC format)
  - (g) Set end date and time (UTC format)
  - (h) Set start position (1/10th degree resolution – decimal format)
  - (i) Set end position (1/10th degree resolution – decimal format)
  - (j) Intended target species (FAO species code)

- (k) Bottom depth at start of set
- (l) Bottom depth at end of set
- (m) Type of Pot deployed
- (n) Total number of Pots set
- (o) Type of bait used
- (p) Estimated catch retained on board by species (FAO species code) in live weight
- (q) An estimation of the amount of living marine resources discarded by species if possible
- (r) Were any marine mammals, sea-birds, reptiles or other species of concern caught (yes/no/unknown-Y, N, U)

Contingent on the final data record keeping and reporting, more detailed data will be collected as described further in the Scientific Sampling Plan (Section 8.6). GS is capable of reporting and electronically transmitting this information daily.

Datasets provided by GS will be sent to MMR at the end of each trip and will comply with or exceed the following SPRFMO report template requirements:

- Annual Catch Data;
- Bottom Footprint;
- CMM 2.03 Monthly Report;
- CMM 2.05 Vessel Details;
- CMM 2.07 Port Call Request;
- CMM 2.07 Port inspection Summary;
- Fishing Activity – Potting;
- Landings (Fishing Vessel);
- VMS.

It should be noted that Great Southern Fisheries Ltd has agreed to the appointment of a person to be in sole charge of the data collection responsibilities for the Exploratory Fishing Research program.

The name of the company in charge is Natural Resources Consultants, Inc. (NRC) located in Seattle, Washington and Scott Goodman has been appointed to assist with scientific data collection, analyses and reporting for the project.

At the end of each trip NRC will forward a report to MMR summarizing catch effort, detailed maps of fished areas, summary data of depth ranges where species were caught, and weight of retained target species.

In the report any discovery of VMEs will be noted as well as all wildlife abundance and interactions. Scott Goodman on behalf of NRC will also report on a trip by trip basis the size distribution and other important data collected on the target species to develop a robust comprehensive biomass model. Further details of NRC reporting are provided in subsections below.

### **8.1 Vessel Movement in the Management Area**

The vessel and its operators will report to MMR all the vessel's activities in the Management Area to MMR's legal specifications and requirements. This will include, but is not limited to, notification of:

- Entry and Exit from SPRFMO waters;
- Adequate prior notice when planning a trip into SPRFMO Convention waters;
- Adequate prior notice of date and port of arrival after a trip in SPRFMO Convention waters.

### **8.2 Control of Vessel**

While at sea the vessel will report its location and current activity to MMR through VMS and through mandated email reporting. While at sea, the Master will be responsible for the day-to-day operations of the vessel and ensuring compliance in accordance with Cook Islands law and SPRFMO CMMs.

### **8.3 Reporting of Vessel Sightings**

The Master will be responsible for recording details of any other fishing vessels sighted in the SPRFMO Management Area. Details of identifying features, names and numbers will be recorded and photographs taken where possible. At the end of each trip all information on vessel sightings will be reported to MMR.

### **8.4 Vessel Monitoring System**

GSF will have a VMS system of an approved type on board the GS and will report simultaneously to both the Cook Islands and SPRFMO as contemplated in CMM 06-2017 for the option described in Paragraph 9.b, once the SPRFMO system is advised as operational.

### **8.5 Observers**

GSF will ensure and comply with all of the directions from MMR in relation to 100% Cook Islands Observer coverage during all fishing operations described in this Fisheries Operation Plan. GSF will also have its own marine biologist on board collecting the physical data as described in the Scientific Sampling Plan. The Cook Islands Fisheries Observer will be provided by the Cook Islands National Observer Programme (CINOP)

## 8.6 Scientific Sampling Plan

GSF will follow this scientific sampling plan to collect biological and fishery catch data from catches of *Jasus spp.*, *Projasus spp.* and *Chaceon spp.* species during the EPF conducted by GS in the SPRFMO management area (see section 5.2). Data collected and summarized will improve the scientific understanding of abundance and management options for the target species in the Foundation Seamount Chain. This plan includes preliminary details for two primary elements of data collection; 1) a number of elements integrated into the EPF and 2) plans for separate experimental work. This sampling plan takes into consideration the balance between capital costs of the operation and the important opportunity to collect scientific information without jeopardizing the goal of successful exploratory pot fishing and research.

The biological sampling that is integrated into the EPF operation covers the following:

- GSF Marine Biologist training and requirements
- Target species catch weighing including bycatch
  - a. Data recording
  - b. Deck sampling
  - c. Subsampling procedures
  - d. Weighing catches
  - e. Hard copy & electronic logbook data recording options
- Species sampling
  - a. Whole specimen collection
  - b. Tissue or blood sampling

The experimental fishing elements in this sampling plan cover three methods:

- Randomized exploratory pot fishing plan
- Controlled/limited scale depletion study (optional)
- Placement of small mesh traps within the EPF strings of gear.

The Marine Biologist will provide catch and bycatch accounting during the GS EPF operations. GSF will ensure there is complete compliance with 100% coverage by a CINOP Observer at all times and as described in CMM 14b-2018. GS shall follow all directions from MMR in relation to Observer coverage.

### *Catch Counting*

Catch counting will be completed as a regular part of the EPF operations on the GS. Counting will occur in both numbers and weight when appropriate. All species will be documented in retained catch, and any bycatch will be identified to the species level if possible. The GS crew will conduct all sorting and weighing of catch in pots not chosen for Observer sampling. Further size grading of the target species

will be performed during processing which will give GS size grade information of the target species. The Observer work station will be setup to allow for work to be done safely and efficiently as part of the EPF record keeping/reporting and catch accounting process.

It is expected that crewmen will assist the Observer in isolating the pots chosen for sampling, and their contents. It is assumed that most *Jasus spp.* and *Projasus spp.* retained will be processed frozen, whole which will allow for on deck and processed weights to be reconciled closely. In cases where retained individuals will not be processed whole, there will be a method to account for whole-round weight when the tailed product for these large individuals is processed.

### *Data Recording*

The data recording will be completed accurately and precisely with minimum terms and conditions mandated by the Marine Resources Act 2005, on forms approved by MMR. On deck logbook summaries will be kept which include notebooks, data forms, and electronic logging systems. The standard data recorded will include the following information which may be broken out into more than one reporting format depending on the observer activity:

General catch accounting (for all traps, all strings, all EPF activity; in addition to SPRFMO data standard fields for EPF activity):

- Vessel name
- Skipper name
- Observer name
- Date of fishing deploying traps
- Date of fishing hauling traps
- Start latitude of string (taken from wheelhouse GPS)
- End latitude of string (taken from wheelhouse GPS)
- Start time of string deployment (UTC format)
- Time at mid-string deployment (UTC format)
- End time of string deployment (UTC format)
- Number of traps set in string
- Depth at first trap of string (taken from wheelhouse instruments)
- Depth at mid-trap of string (taken from wheelhouse instruments)
- Depth at last trap of string (taken from wheelhouse instruments)
- General weather conditions during fishing setting gear
- Sea-state during fishing setting gear
- General weather conditions during fishing hauling gear
- Sea-state during fishing hauling gear
- Water temperature at string start (both surface and bottom, taken from deck deployed instruments)

- Water temperature at string end (both surface and bottom, taken from deck deployed instruments)
- Start time of string hauling (UTC format)
- Time at mid-string hauling (UTC format)
- End time of string hauling (UTC format)
- Were any traps lost, or not retrieved?
- Which pots were lost/not retrieved (if applicable)?
- Reason for pot loss (if applicable)
- Number of traps sampled by observer in string
- Individual trap number in string selected by observer
- Total number retained by species per sampled trap
- Who counted retained species per trap
- Total weight retained by species per trap
- Who weighed retained species per trap observer/crew?
- Total weight retained by species per string
- Total number discarded by species per string
- Total weight discarded by species per string
- Who weighed discarded species per string observer/crew?

Detailed catch accounting will be for observed traps and/or special sampling traps/strings and will include at least the above and further details below:

- Lobster/crab species present in trap for retention?
- Lobster/crab species whole haul or subsample in trap?
- Lobster/crab carapace length and sex by species (several records per trap)
- Indications of reproductive change – females gravid?
- Shell conditions per individual measured (clean v. dirty, new v. old, etc.)
- Specimen weights taken for selected individuals (in grams on Marel scale)
- Biological samples including blood or tissue samples taken (Y/N?)
- Other species present in trap (Y/N?)
- Bycatch species recorded if present
- VME, coral or sponge presence in trap (Y/N?)
- VME, coral or sponge species recorded if possible
- Pictures taken for trap catch (Y/N?)
- Estimate of, or measured total weight for bycatch by species, if possible

#### *Deck Sampling*

Deck sampling gear will be required to assist with the counting and measuring of *Jasus spp.*, *Projasus spp.*, *Chaceon spp.*, and other species catch. The gear will include three (3) to four (4) plastic totes capable of holding the complete contents of a trap in a single tote, and several plastic baskets to sort the

catch by species, size, and sex into groups. A deck-mounted motion compensated Marel scale will weigh all catch totes or baskets. Marine grade manual or electronic calipers, clipboards, and waterproof write-in-rain data forms/notebooks will be used to measure and record data. A deck computer or electronic data logger will be used for data recording and data entry. Duplicates of all critical sampling gear will be onboard, as the redundancy of all deck gear including electronics is critical to sampling in the expected conditions on deck. All sampling equipment will be first approved for use by MMR.

Each trap will be brought onboard by the GS crew. If the trap is selected to be sampled by the Marine Biologist it will be moved to the Observer sampling area. If the trap is to be processed without observing, it will be dumped into a general catch sorting area where all contents of the catch will be sorted and weighed. Total catch per trap will be weighed above deck.

For the Biologist sampled traps the catch will be dumped and sorted in the observer area. The Marine Biologist will strive for whole haul sampling if possible. For each trap sampled, the Marine Biologist will measure and record the detailed information (see detailed catch records above) for each individual captured. Calipers will be used to measure the carapace lengths to the nearest tenth of one millimeter. MMR approved electronic waterproof manual calipers or electronic auto-logging calipers may be used by the Observer as long as all individual specimen data is safely logged and backed-up frequently onto onboard computer systems.

As much as possible, deck sampling procedures will progress without interrupting the pace of fishing unless there is a gear problem or important biological reason to change the pace of fishing (i.e., excessive catch, gear damage, or other).

### *Subsampling Procedures*

Subsampling procedures should be used only when the volume of catch in an Observer sampled trap is too large to whole-haul sample. Subsampling should be done by weight if possible, but can be accomplished by numbers, generally following the methods described below.

If it is obvious that all catch can be processed then all *Jasus spp.*, *Projasus spp.* And *Chaceon spp.*(lobsters/crab) will be quickly sorted into baskets regardless of size for measuring. If this can't be gauged then Marine Biologist will proceed with sorting for either whole haul or subsampling. Sometimes the determination for subsampling won't be made until all lobsters/crab catch has been sorted. If there are large numbers of lobsters/crab, the observer will designate multiple baskets for the species and sort by size class and sex, keeping lobsters/crab of similar size and shell condition together; ensuring that baskets are being filled with approximately the same number of lobsters/crab in each basket. An example of a possible set could be three (3) baskets full of mature female lobsters/crab shell condition new, one (1) basket full of mature female lobsters/crab shell condition old, and 2.5 baskets full of juvenile male lobsters/crab shell condition new. Near the beginning of sorting, it may be evident that only a few large lobsters/crab are in the catch, and near the end of sorting it may be evident that only a few small lobsters/crab are in the catch – in each case, the observer will isolate these lobsters/crabs into

designated baskets for whole haul sampling during data recording. Some or all of these lobsters/crab can be pulled out from the catch and set aside at any time during sorting.

Once baskets of lobsters/crab are ready to be processed after sorting, each basket will be weighed. For each basket set that represents too many individuals to whole haul measure, a subsample will be removed from that basket, weighed and then processed. The removed (subsampled) weight can either be taken separately or can be the difference of the basket with the subsample removed. The subsampled lobsters/crab will be isolated for complete measurement and any other data recording. These lobsters/crab are the representative that will be expanded back – by a subsampling factor – over the total catch (from that basket set) of that species, sex, and size group. The subsample factor by weight is calculated as the total sample weight divided by subsampled weight which will yield a factor  $>1$ . For example, if the catch is sorted and yields one (1) partial basket of female *Jasus spp.* and eight (8) full baskets of male lobsters *Jasus spp.* then the males would be subsampled only. If all eight (8) male baskets weighed 64.3 kg, and 9.4 kg are selected out as a portion to subsample, then the subsample (expansion) factor would be 6.84 (64.3 kg divided by 9.4 kg).

For instances where subsampling is an obvious requirement to process the catch and a faster method is needed, the subsampling may be completed by selecting one (1) from a subset in groups to process that category of the catch quickly. For example, if there are several hundred presorted *Jasus spp.* that are small juveniles then a selection such as one (1) of every five (5) may be applied to process that volume of catch. The measurement would proceed with the observer removing five (5) individuals from the catch, measuring one (1) and then discarding the other four (4) – and continuing with this process until all catch is counted. In this case, the subsample (expansion) factor would be five (5), as calculated based on count not weight.

In some cases where subsampling would be required to process very high volumes or counts of a complex catch, a combination of the above processes will be used to provide an equally robust subsampling method and expansion factor.

### *Weighing Catches*

Catches of retained species will be weighed pot by pot in a string by a Marel hopper scale after the retained species are sorted. For species sizes that are processed whole there should be relatively little difference between the weights taken on deck and weights taken as final product. Calibrated motion compensated Marel scales will be present both on deck and in the processing facilities below deck .

### *Species Sampling*

Scientific samples of species from the catch may prove to be very important in understanding the potential commercial and ecological importance of the lobsters and crabs in the EPF area. As a very remote, high seas area, there is the potential to capture and observe new species, and to validate the presence of existing species with the collection of samples. Immediate verification of species will rely on known information and field guide information referenced in this application including: A guide to

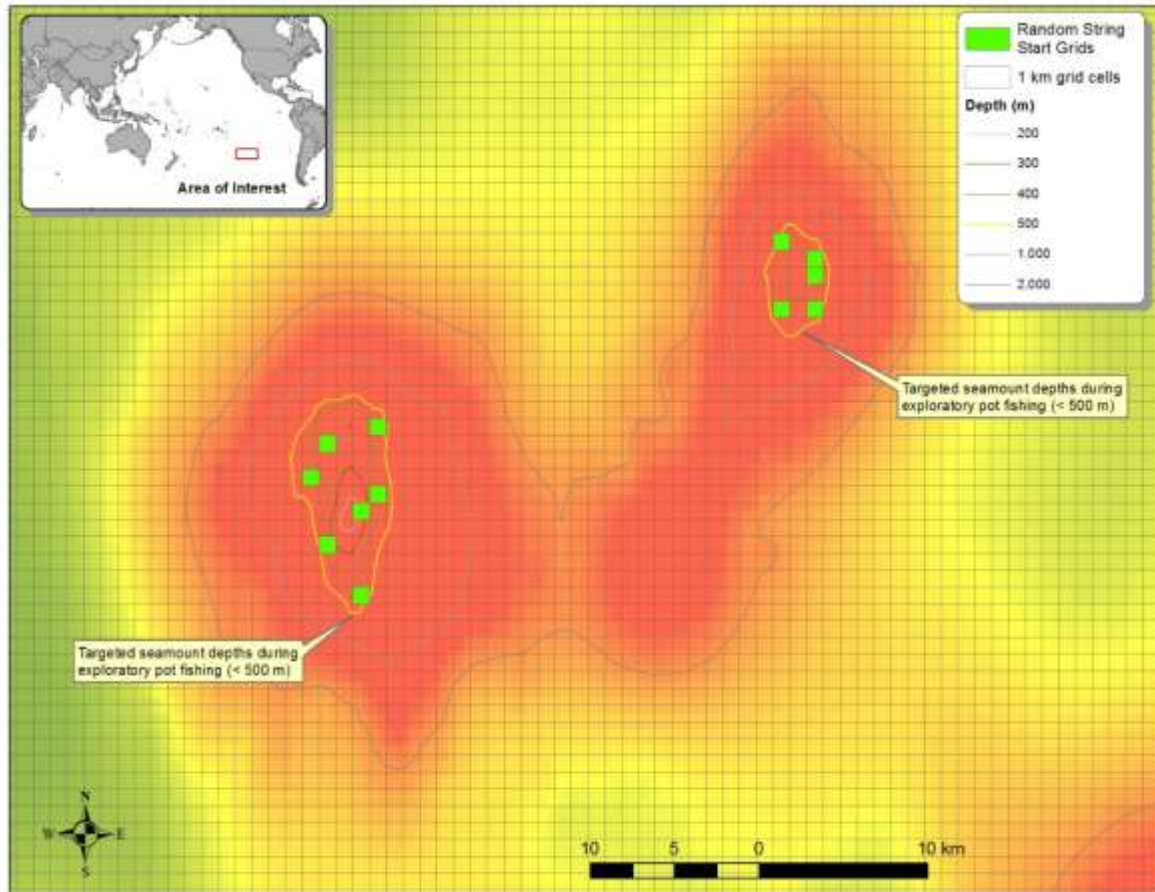
common deep-sea invertebrates in New Zealand waters, NZ Aquatic Environment and Biodiversity Report No. 1, 2 and 86. Whole specimen collection will follow typical protocols for the freezing whole, or preserving in formalin solution methods. Whole specimen collection schedules and detail methods will be overseen by shellfish researchers in New Zealand. In addition to whole specimens, both tissue and/or blood samples may be taken from lobsters and crab in the catch. GSF is investigating further logistics of what samples may be of most interest for new or ongoing research and where lab work may be completed.

### **8.7 Randomized Exploratory Fishing Plan**

When exploratory fishing in a new area where fishing grounds are very remote and access is very limited, many aspects of important data recording are susceptible to change once fishing begins. Further, after a number of trips, much more information will be available to inform focus areas and important logistics of on-deck sampling. GSF acknowledges that all the uncertainties about the area and the fishing together require that Year 1 planning methods remain flexible. GSF has outlined some general terms below to provide guidance in the fishing and data recording in Year 1, that will assist in reducing bias in abundance or biomass estimates based on CPUE data.

#### *Methods*

There is potential for bias from using CPUE data alone to understand the abundance and biomass of a latent or unassessed stock of crustaceans. A random or semi-random fishing strategy along with a method for the observer to take random or semi-random observed traps could reduce bias in CPUEs from exploratory pot fishing for lobster and crab. The methods could be used together or independently to draw samples from fished areas and samples from total traps fished. Given the large, remote scale of the proposed fishing area, a random approach to deploying strings of fishing traps should be narrowed in space to be applied during the second trip, but could be part of the EPF within the first trip. Longline string placement could be selected based on a semi-random known starting grid of defined target depths (< 500 m) within an exploratory fishing area (see Figure 6).



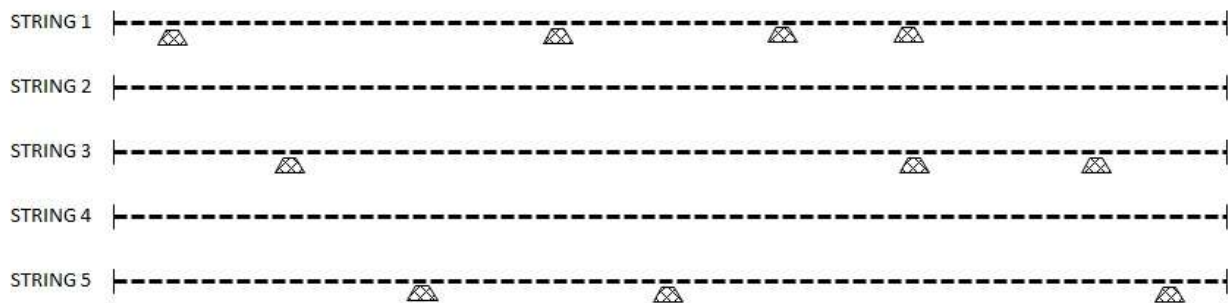
**Figure 6.** Example of randomly selected starting positions on seamounts of interest for exploratory potfishing lobster/crab trap strings. Source: NRC

## 8.8 Survey Traps & Biologist Selection of Traps

A challenge to strategic planning for the collection of data using a Marine Biologist onboard for exploratory pot fishing operations is to estimate the rate of trap retrieval (e.g. how many traps come onboard in a given time period) and to estimate how long it will take an Biologist to process the biological sampling work from a single trap of average catch. GS anticipates setting and hauling five (5) longline strings per day, each string with 200 traps; for a total of 1,000 pots fished per day. For a 200 trap string the spacing between traps is 25 m and total string length is estimated at approximately 5,000 m. It is anticipated that the Biologist will work in shifts, and one trap will take 30 minutes on average to process for measuring. Two (2) to three (3) of the five (5) strings set per day will be chosen randomly by the observer for sampling, and three (3) to four (4) standard mesh traps will be selected from each

string of gear for sampling by the Biologist. The numbers of strings and observed sampled pots set per day will vary based on size of fishing grounds and/or the observed or estimated CPUE on particular seamounts. These plans and assumptions are expected to be flexible, dependent on the pace of fishing and conditions onboard the boat during EPF activity. In locations where the fishing area on a seamount is very small, or CPUE is relatively high, the number of pots sampled by the Biologist will likely be less than larger seamounts and/or those with moderate to low CPUE. Prior to daily operations, the Biologist will decide how many and which strings will be sampled, and which pots on each string will be sampled. That information will be relayed to the GS Captain and crew so that the pots to be sampled will be identified prior to hauling (see Figure 7).

Groundline shown as dashed bold line



\* the trap symbols represent observer processed standard traps

**Figure 7.** Display of observed sampled traps at varying frequency.

Additionally, small mesh “survey” traps will be incorporated into the gear rotation, to be deployed during regular operations of exploratory pot fishing. While the current standard gear plans call for traps with 5 cm stretch mesh covering the trap; small mesh survey traps will be the same traps structurally and functionally, except will be covered in 2 cm stretch mesh. The survey traps will be adapted to retain as many deep-sea marine creatures as possible. The amount of survey traps deployed during a day, or on a seamount will be determined by the Biologist in conjunction with the observer and GS Captain and crew. GSF anticipates one (1) to two (2) survey traps being deployed per fishing day, with chosen placement in a semi random fashion. When possible and practical, the deployment of survey traps will be focused on the initial sets of strings on the target seamounts.

If GS encounters an area of interest for its biodiversity or potential commercial value, then additional survey traps may be deployed.

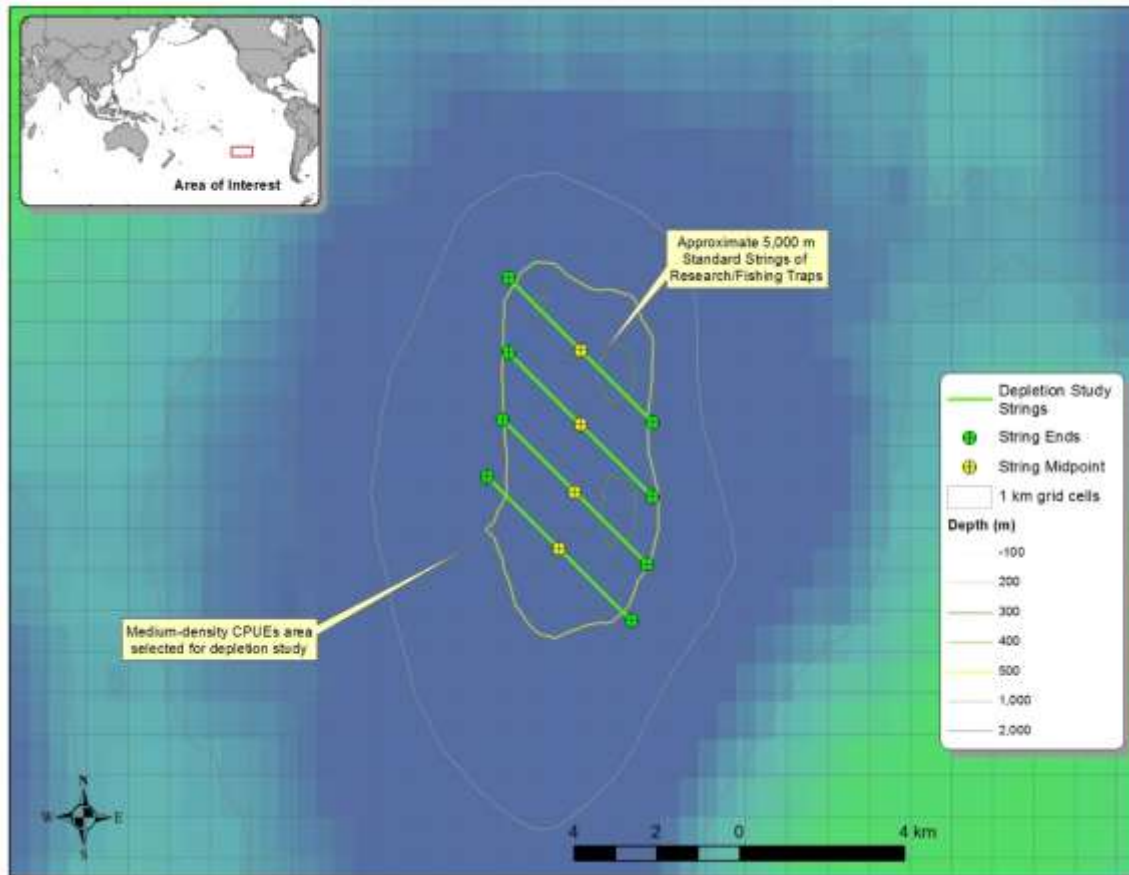
## 8.9 Potential Depletion Study Methods

A DeLury experiment is an option within operation fishing plan to estimate the *Jasus spp.* biomass on a midsize seamount during the GS EPF under CMM 14b-2018. Once the fishing results from Year 1 are available, NRC will undertake a study to design a depletion experiment for one or two seamounts if

resource conditions appear feasible for carrying out a successfully experiment. The decision criteria on whether to conduct a depletion experiment on a seamount would include the size of the seamount, potential influence from nearby seamount or lobster habitat, the rate of decline in CPUE over the three (3) trips in 2018-2019, an estimate of the amount of catch needed to be removed from the seamount relative to the trip limit, species composition of pot catches relative to that of other seamounts, extent of any gear saturation, occurrence of a VME, and amount of bycatch. The depletion study would be initiated in year 2 although the year 1 catches and CPUE would be the base year. The study will likely continue for another three (3) or four (4) years depending on the rate of decline in the CPUE. If rate of decline from year 1 to year 2 is small, then amount of lobsters removed per trip should be increased but not more than the catch limit per trip or require more than 30 fishing days. Over the course of the study, the unit of effort must be consistent with year 1, so that no change in efficiency of the standard gear occurs over the duration of the study. The experiment should be terminated when the CPUE for the area drops below  $CPUE_{max}/2$

The design of the depletion experiment will be initiated once the results of the first year are available. The study will follow the approach of the DeLury method. The analytic methods and actual model will incorporate the latest statistical procedures that improve estimates of the parameters and associated variances. The longline gear needs to be identical to the standard set used for the exploratory fishing operation. If dimensions of the seamount area in the depletion study exceed 5,000 m then the standard longline set of 200 pots will be used but if one of the dimensions is less than 2,500 m, then longline set of 100 pots could be the standard. If gear saturation is occurring on a few of the pots then soak times should be as short as possible and not exceed 24 hours but needs to be consistent with the year 1. All the sampling protocols developed for the EPF need to be followed for this experiment although the number of pots sampled per set might need to be increased. The number of sets of longline gear for the depletion experiment will be limited by the number of fishing days available without exceeding the limit of 30 days or the catch limit. The design of experiment has a couple of options on how best to schedule the fishing down periods. One option is to assign a few days for each fishing trip to the depletion experiment on the selected seamount. The alternative option is to set aside most or all of one trip each year, i.e. up to 30 fishing days, to be dedicated to the depletion study. This might be the most practical if the size of the seamount is large and the biomass is extremely dense. The decision will be made by NRC during their study to design the depletion experiment.

This sampling plan outlines the important components of executing the field work including some detail of methods specification, controls on fishing effort, spatial design, standardization of gear, and others to reduce bias in the data collected. A relatively small, medium-density (CPUE) area would likely be a statistically strong choice for the depletion study without being too prescriptive, or limiting the utility of how the study may inform estimates of biomass, or consideration of relative CPUEs across other areas (see Figure 8).



**Figure 8.** Depletion study example area with plotted strings of research traps for controlled methods during repetitive trap fishing. Source: NRC

The methods should rely on standardized GS EPF approaches that include:

- using the standard traps in strings of 200 units of gear without the placement of small mesh traps
- using the same bait for all traps fished during the depletion experiment
- controlling soak times as much as possible for all traps
- recording the start, middle and end locations (possibly more) of all strings to closely control the spatial aspect of trap fishing footprint
- observer selection of the same traps per string in each repetitive set of the gear (which may include potentially increasing the number of sampled traps per string above 24 traps per day)
- recording the information used to calculate CPUE per species per string consistently per each set of the gear

The control methods for the depletion study should be closely followed but should have some flexibility to be modified during the study to resolve any unforeseen complications. Complications may be directly related to low or no catch, lack of a declining trend in repeated longline sets in the same area, which could be due to immigration from adjacent areas or gear saturation. Close consideration will be taken to

monitor the catch in real-time to assess if the spatial scale should be adjusted. Further, if CPUEs are remaining level, then consideration must be given to increase fishing until CPUE declines can be documented. In general, a single seamount should be the target area of the depletion study. The string length at 200 traps and spacing between pots will be held to the standard gear of the EPF. However, if prior information from Year 1 shows that only a smaller portion of a seamount has lobsters, then a smaller scale study area would fit with a feasible gear change (100 trap string), and this could be considered a reasonable option.

Assuming the standard exploratory pot fishing methods, the depletion study could take 10 to 30 days of the GS's time on the fishing grounds. A three (3) day soak period would account for 3-4 repetitive cycles of the four (4) strings of gear being fished in the same location at a 10-day study level. Increasing up to 30 days may account for 10 repetitive cycles of the gear through the area. A smaller scale depletion study with a lower amount of gear placed across a smaller total area may allow for a more efficient documentation of declining CPUE in less time committed to the depletion experiment. Further development of this experimental option will be completed and presented with full methodology, including details of the descriptive statistical considerations and tests in Year 2 sampling methodology.

### **8.10 Camera Study**

During the proposed EPF, underwater video cameras will be dropped periodically when evidence of very high CPUE, gear damage, anomalous substrate, or sensitive bycatch areas are observed. Cameras will be attached to traps for observation of gear function and the recording of the substrate near the footprint of the gear. GS has investigated the correct camera system to use during the camera survey/study. The Sexton Company developed a deep-water camera which is currently being used worldwide. Their focus is in the fisheries science industry using these cameras for trawl work and bottom structure analysis. Camera systems will utilize a pressure switch that will trigger at a specified depth to turn on, which will engage LED lighting and also the video recording switch. The recording of information is expected to be on a SD micro memory chip which is removable from the camera after retrieval. Review of the video footage will occur after uploading the SD memory directly to an onboard computer. Immediate and periodic review will occur to assess if there are modifications to the camera configurations, settings, or lighting that will improve the quality of video recorded. Examples of video footage should clearly show target specimens on the substrate as shown in video screen captures below(see Figure 9).



**Figure 9.** Example screenshots from video footage of submarine video used during invertebrate trawl surveys in the Bering Sea, Alaska. Source: NRC.

## 9 Catch Reporting and Information Summary Plan

The catch reporting and information summary plan is intended to inform the collection of catch data, analyses and reporting format of information back to MMR. The plan lays out information guidelines that will allow for the credible documentation of all record keeping, reporting and analyses of information collected during the GSFEPF. The plan includes details of reporting frequency, catch data types, biological summaries, spatial detail, and some details of reporting logistics.

The primary data to document from the GS fishing operations is the retained catch of the targeted species of lobsters and crab. Lobster species included in these summaries are *Jasus spp.* and *Projасus spp.*, crab species included in these summaries are *Chaceon spp.* species. Discarded species will also be documented. Bycatch species will also be enumerated by number and weight for all strings where traps are sampled by the observer.

The GS fishing operations will also be documented on a string and trap basis. Plans call for 200 traps per string but accurate counts will be made if this changes. The total count of traps hauled (trap lifts) will be tabulated and will be the denominator for the calculations of CPUE. The EPF will be conducted by GS as planned, and will provide accurate spatial records of where gear is fished to allow for estimates of the total “footprint” of fished traps per area and in aggregate.

Biologically important information will be summarized for all species captured. For lobster and crab species; the observer information (sampling methods) will allow for the reporting of sex ratios, size compositions, shell conditions, and observed measures of reproductive status. Reporting will provide the length compositions per sex, per species, per area. Aggregated reporting will also be able to group summaries across areas or species.

Reports will be prepared at regular intervals (to be determined) that will provide summaries of each trip, and each exploratory fishing area. Trip by trip, and annual reports will be provided. The Year 1 reporting

and summaries are expected to provide a wide range of relative catches by species densities, magnitude, intensity and area. Years 2 and 3 of the GS fishing operations will be informed by review and summary of the prior data.

A comprehensive database will be compiled from all reported data as described by the fields in Table 4.

**Table 4.** List of data fields included in the GS Fishing Operation's Database.

Data type - catch or production	Total weight retained by species per trap
Vessel name	Who weighed retained species per trap observer/crew?
Skipper name	Total weight retained by species per string
Observer name	Total number discarded by species per trap
Area or Seamount name	Who counted discarded species per trap observer/crew?
Date of fishing deploying traps	Total number discarded by species per string
Date of fishing hauling traps	Total weight discarded by species per trap
Start latitude of string (taken from wheelhouse GPS)	Who weighed discarded species per trap observer/crew?
End latitude of string (taken from wheelhouse GPS)	Total weight discarded by species per string
Start time of string deployment	Lobster/crab species present in trap for retention?
End time of string deployment	Lobster/crab species whole haul or subsample in trap?
Number of traps set in string	Lobster/crab carapace length and sex by species (several records per trap)
Depth at first trap of string (taken from wheelhouse instruments)	Indications of reproductive change - females gravid?
Depth at mid-trap of string (taken from wheelhouse instruments)	Shell conditions per individual measured (clean v. dirty, new v. old, etc.)
Depth at last trap of string (taken from wheelhouse instruments)	Specimen weights taken for selected individuals (in grams on Marel scale)
General weather conditions during fishing setting gear	Biological samples including blood or tissue samples taken (Y/N?)
Seastate during fishing setting gear	Other species present in trap (Y/N?)
General weather conditions during fishing hauling gear	Bycatch species recorded if present
Seastate during fishing hauling gear	VME, coral or sponge presence in trap (Y/N?)
Water temperature at string start (both surface and bottom)	VME, coral or sponge species recorded if possible
Water temperature at string end (both surface and bottom)	Pictures taken for trap catch (Y/N?)
Start time of string hauling (UTC format)	Estimate of or measured total weight for bycatch by species if possible
Time at mid-string hauling (UTC format)	Product form - whole frozen, tailed
End time of string hauling (UTC format)	Product weight in kg
Were any traps lost, or not retrieved?	Product count per kg
Which pots were lost/not retrieved (if applicable)?	Product species
Reason for pot loss (if applicable)	Product voyage and trip number
Number of traps sampled by observer in string	Product area
Individual trap number in string selected by observer	Product catch date
Total number retained by species per trap	Product processing date
Who counted retained species per trap observer/crew?	Product condition
Total number retained by species per string	Product size grade

The database will be a combined effort, catch and production database which can be summarized in aggregate or split to look specifically at each component. An important component of record keeping and reporting will be the accurate positional information for all trap strings so that the database can be incorporated into Geographical Information System (GIS). The spatial review of information will be a critical component from both a biological and a productivity perspective. A regular part of NRC reporting will be to produce GIS summary maps for the areas, species, and activities of interest. Examples of reporting tables by trip, species, area, and product are shown below (see Figures 10 a-c) and the format may be revised when actual data is received and compiled.

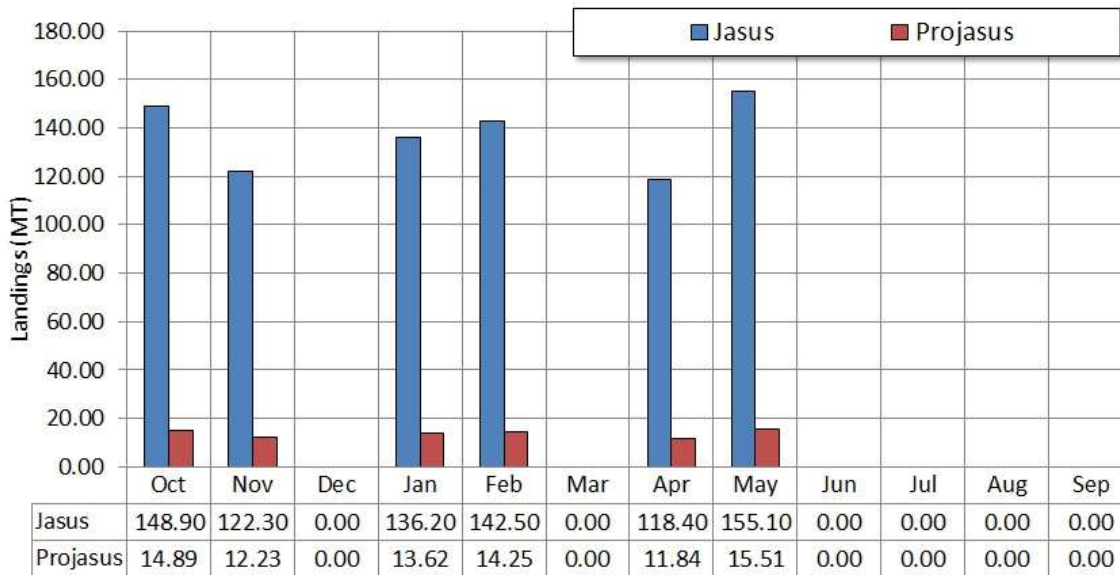


Figure 10a. Monthly production summary, available by area: (Example graph). Source: NRC.

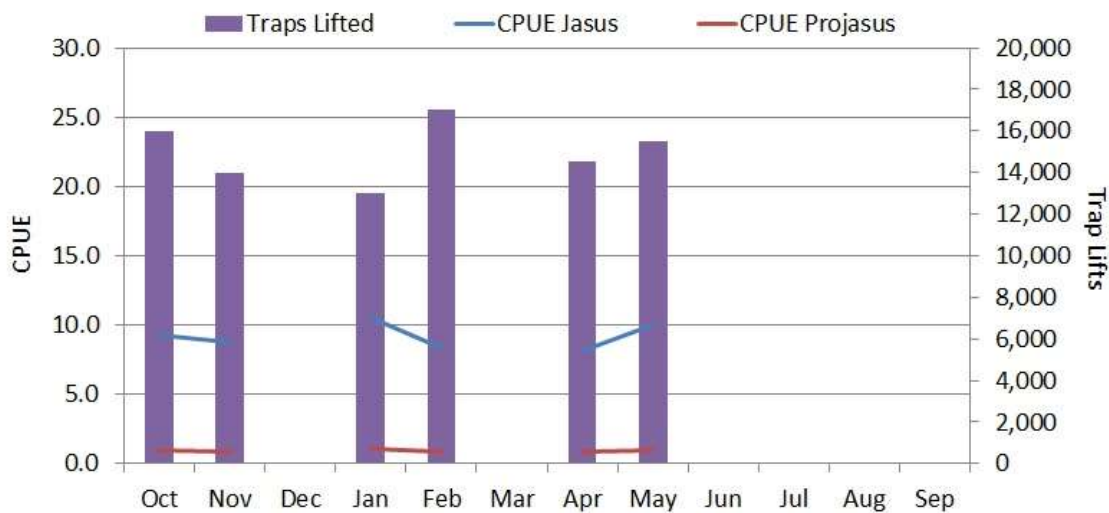
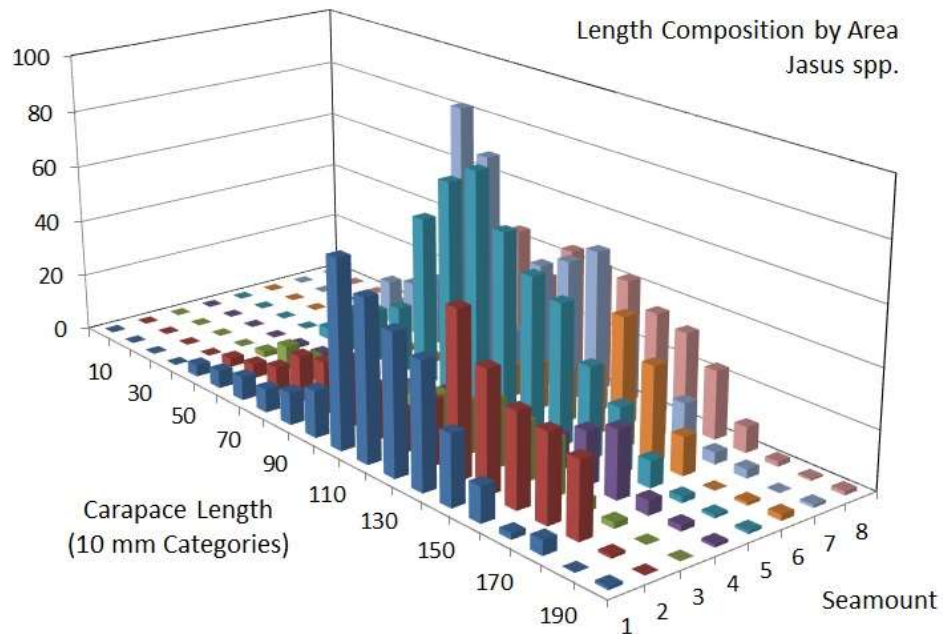


Figure 10b. Monthly CPUE summary, available by area: (Example graph). Source: NRC.



**Figure 10c.** Length composition by species and area – available per species/sex/month/season: (Example graph).  
Source: NRC.

Further NRC summary information will reflect full tabular and spatial reporting. Spatial reporting will also include the expansion of CPUE information across areas during the EPF, which is expected to include estimates of relative abundance and biomass with variance. Further development of reporting procedures and requirements will continue as some plans for exploratory and research fishing are further refined.

## 10 Biological Sampling

Scientific sampling of the crustacean's representative of the main target species will be landed whole. Samples of lobster *Jasus* spp., *Projasus* spp. and *Chaceon* spp. crab will be bagged on a species by species basis and landed at the end of each voyage. The sample bags containing the crustaceans will identify the vessel, common name and scientific name (if known) of the crustaceans, approximate weight of the total samples and details of a contact person. The samples will then be sent to MMR.

Additionally, any interesting species caught as bycatch and unable to be identified at sea by the observers will be bagged and preserved along with details mentioned above. Species identification will rely on existing FAO material. Additionally, GS will have aboard the following documents;

1. Ministry of Fisheries <sup>1</sup>(2005) A guide to common deep-sea invertebrates in New Zealand waters. New Zealand Aquatic Environment and Biodiversity Report No 1.
2. Ministry of Fisheries (2005) A guide to common offshore crabs in New Zealand waters. New Zealand Aquatic Environment and Biodiversity Report No 2.
3. Tracey, D.M., Anderson, O.F., Naylor, J.R. (comps) (2011). A guide to common deep-sea invertebrates in New Zealand waters (3rd edition). New Zealand Aquatic Environment and Biodiversity Report No. 86. 317 p.
4. Other relevant publications as may be recommended or available.

### **10.1 Rick Webber**

Dr. Rick Webber is the Invertebrate Curator at the Museum of New Zealand. He is a marine biologist specializing in Crustacea. His research is mostly on the identity of crabs, lobsters and shrimps, and especially the larvae of crabs. Dr. Webber has the capacity at TE PAPA to do all biological testing as well as he works closely with NIWA and their labs when needed. Dr. Webber may assist in receiving and processing biological samples taken during the exploratory and research fishing.

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<https://www.tepapa.govt.nz/learn/research/our-curators>

## **11 Assessment of the Potential for Significant Adverse Impacts on Vulnerable Marine Ecosystems (VMEs)**

By using the analysis of seamounts included Appendix 3, and only considering seamounts which occur above 500 m in depth but is where the majority of potential VMEs might be expected to occur. The total bottom contact on these areas over a full year of exploratory pot fishing effort will contact just 0.0232% of the assessed target areas. When considering the total area in the Foundation Seamount Chain this percentage is significantly reduced. However, GS will take a precautionary approach where

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<sup>1</sup> The New Zealand former Ministry of Fisheries is now called the Ministry of Primary Industries

VMEs are encountered. All data including video images will be recorded and the vessel will leave the VME area and “move-on” in accordance with the relevant CMMs.

The trigger for “moving on” is likely to occur when observed damage to fishing gear rather than the recovery of onboard coral or sponge fragments due to the low probability of such benthos both becoming entangled in the mesh and then making it all the way to the surface. The majority, if not all of the seamounts GS has identified for this EPF have not been commercially fished in the modern era and, as such, very little is known about the potential for VMEs to occur on these seamounts.

The approach GSF will undertake will be proactive towards developing and collecting data to allow comprehensive VME assessments to be undertaken by MMR. With the use of the camera study GSF will be able to enhance the data collection of VMEs in the research zone and will report on a trip by trip basis to MMR or more frequently is so directed by MMR.

### **11.1 Camera Study**

GSF will use two different camera systems during the EPF, the first system is designed to video record each trap at the hauling station. The second camera system will use an underwater camera attached to selected fishing traps to record the seafloor at and around trap placement. The main reason to use these underwater cameras is to compare the actual data collected during the camera survey to the predictive VME models being used today. It's important to fully understand the seafloor of the Foundation Seamount Chain to determine if VMEs are present, and if so GS can adjust their fishing plan to avoid areas containing VMEs. The camera study is part of Fisheries Operation Plan (see Section 8.10). The Sexton Company will provide both video camera systems. The video data for each trip will be stored on a hard drive and when the vessel arrives to port to off-load the catch the hard drive will be shipped to MMR for analysis and storage.

The main reason for using these cameras is to compare the actual data collected during the survey to the predictive VME models which are in use today (see Appendix 7).

### **11.2 Cumulative Impacts**

GSF is not aware of existing bottom fishing operations in the proposed research areas by any method. As such because of this and the near-impossibility of setting gear in the exact same a place repetitively GSF does not expect there to be any observable cumulative effects of fishing other than the target species.

### **11.3 Report Writing**

A voyage summary including daily reports and VME signature information and other information collected will be forwarded to MMR at the completion of each voyage, or more frequently as so directed by MMR. GSF will describe the bottom footprint left in the areas any pot fishing was conducted.

Further, GSF has contracted with an independent scientific body, Natural Resource Consultants (NRC) located in Seattle, Washington USA. NRC will compile regular trip reports for submission to MMR and SPRFMO SC after each voyage, as well as to produce an annual report which will be presented to SPRFMO at their annual Scientific Committee meeting.

This will include assistance with, analysis of and further advice in respect to the following; the development of bathymetric charts of the fished areas, catch rates/biomass assessments, bycatch data, size and gender relationships along with bottom temperatures.

NRC will assist with the research fishing plans to insure robust survey sampling reports for each structure researched and all data are recorded and available which will confirm the data are being collected according to this Fisheries Operation Plan. The report will be a comprehensive analysis of the operation and will report the population densities of the targeted species and the dynamics of the species population as the research plans are executed.

NRC will analyze the camera data to assist in the evaluation of potential VMEs and seafloor structures to better understand the type of habitat where the target species concentrate.

### **11.4 Dr. Malcolm Clark and Dr. Ashley Rowden**

Drs. Malcolm Clark and Ashley Rowden are experts on deep-sea ecosystems and have worked extensively on VMEs in the South Pacific and Southern Oceans. Both are based at National Institute of Water and Atmospheric Research (NIWA) located in Wellington, NZ and may assist with the detailed evaluation of all observed and reported VME information collected during the GS exploratory fishing and research activities.

Contact Info:

Dr. Malcolm Clark

Principal Scientist-Fisheries

NIWA

[www.niwa.co.nz](http://www.niwa.co.nz)

[malcolm.clark@niwa.co.nz](mailto:malcolm.clark@niwa.co.nz)

## **12 Conservation & Management Measures**

### **02-2018 Standards for the Collection, Reporting, Verification and Exchange of Data**

GS will implement the requirements of this CMM. The data fields as described in Annex V of the CMM will be collected and the requirements for the collection of Observer & VMS data will be provided for.

### **03-2018 Bottom Fishing in the SPRFMO Convention Area**

GS will implement the requirements of this CMM and recognizes its importance in terms of managing sensitive resources and ecosystems.

### **05-2016 Establishment of the Commission Record of Vessels Authorized to Fish in the SPRFMO Convention Area**

GS will ensure that it provides to MMR the full data requirements of this CMM, with updates as they occur from time-to-time, to ensure that the CMM can be fully complied with.

### **06-2018 Establishment of the Vessel Monitoring System in the SPRFMO Convention Area**

GS will comply with the requirements of this CMM as described above.

### **07-2017 Minimum Standards of Inspection in Port**

GS shall comply with this CMM, the data and reporting requirements as described to facilitate the Member or CNCP Port State conducting inspections as necessary aboard the vessel.

### **09-2017 Minimizing Bycatch of Seabirds in the SPRFMO Convention Area**

Although this CMM does not directly apply to trapping operations and additionally because the vessel will not be discharging significant amounts of processing waste (if any) it is not expected that there will be potentially harmful interactions with seabirds. However, if interactions with seabirds are observed whereby the birds are at risk of entanglement or entrapment this will be reported to MMR and appropriate measures adopted to mitigate the risk.

### **10-2018 Establishment of Compliance and Monitoring Scheme in the SPRFMO Convention Area**

GS will ensure that all data and records required to enable MMR to comply with this CMM are submitted in a timely and accurate manner.

### **11-2015 Boarding and Inspection Procedures in the SPRFMO Convention Area (effective from 24 August 2015)**

**12-2017 Regulation of Transshipment and Other Transfer Activities**

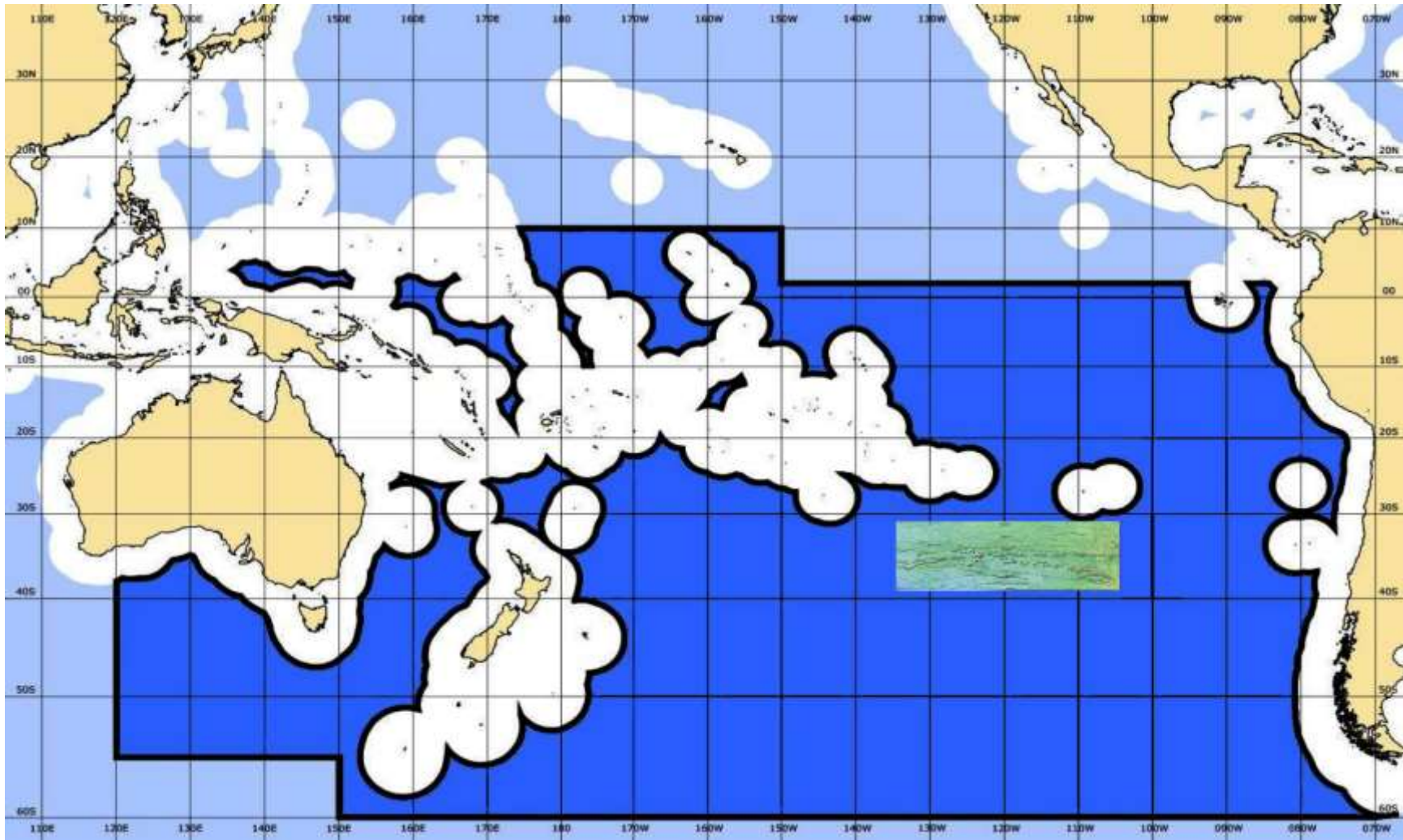
As stated above it is not the intention of GS to engage in transshipment activities but is aware of the requirements of this CMM should transshipment become necessary or desirable for operations.

**13-2016 Management of New and Exploratory Fisheries in the SPRFMO Convention Area**

GS has endeavored through this application and Fisheries Operation Plan to comply fully with the requirements of this CMM.

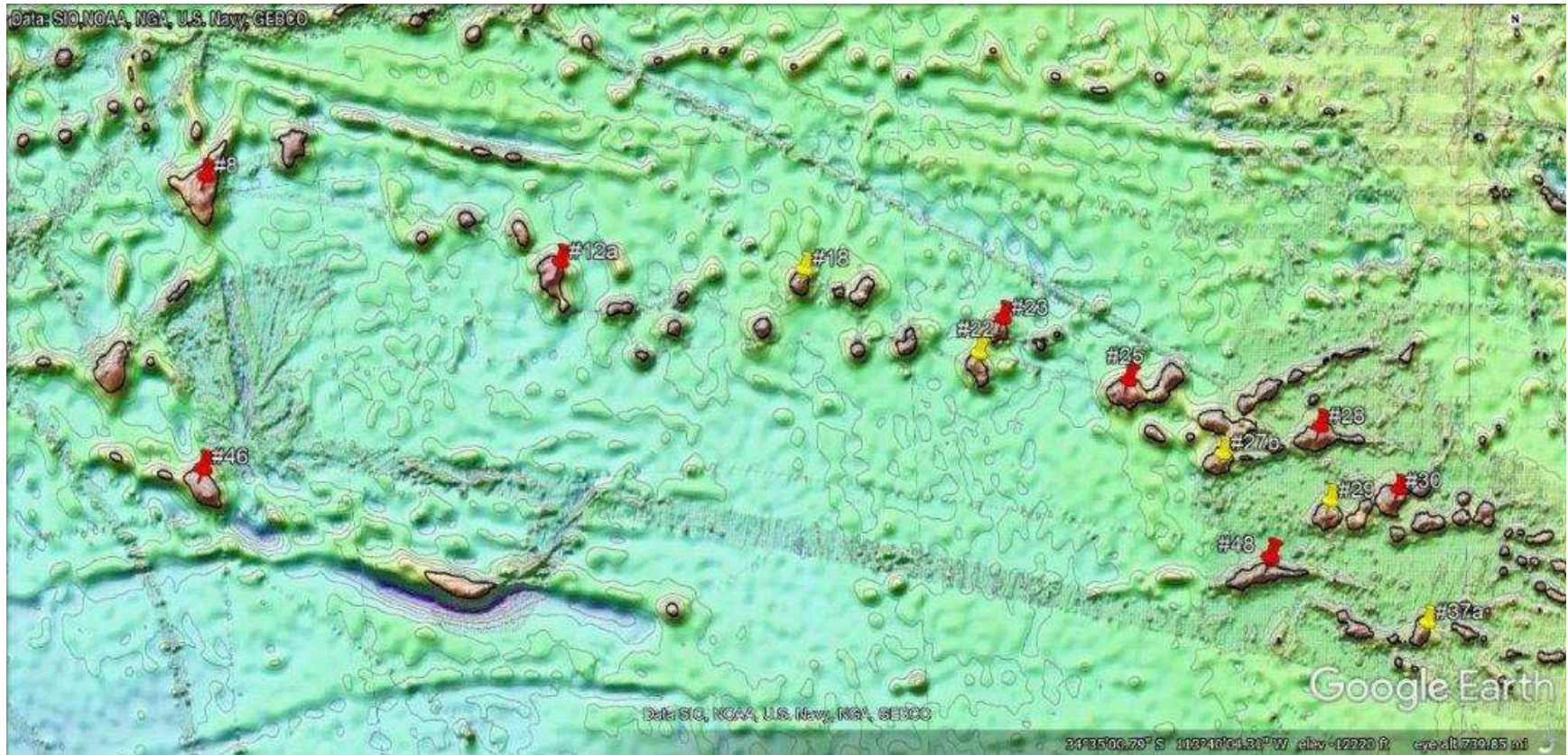
**14b-2018 Exploratory Potting Fishery in the SPRFMO Convention Area****16-2018 The SPRFMO Observer Programme (enters into force 27 April 2019)**

**Appendix 1**



**Area of Proposed Exploratory Fishing Operations**

### Appendix 1 Area of Proposed Exploratory Fishing Operations continued...



## Appendix 2

### Type & Configuration of Traps to be used in the Exploratory Fishing Operations



### Appendix 3 Historical Fishing Effort on the Foundation Seamount Chain

Operator Name	Description	John Chadderton	Joe Cave	Jim Petersen	Total
<b>Year Fished on Foundation Seamounts</b>	<b>Year Fished</b>	<b>1988</b>	<b>1992</b>	<b>1995</b>	
1. Total number of pots fished		15	50	120	185
2. Total number of days fished		5	16	22	43
3. Total number of pots hauledd		75	400	1,320	1,795
4. Total number of pots hauledd per day		15	25	60	100
5. Total lobster catch (tails)	Tonnes	4.50	6.60	19.80	30.90
6. Total live lobster production	kg	13,636	20,000	60,000	93,636
7. Average lbs per pot haul	lbs	401	110	100	115
8. Average kg per pot haul	kg	182	50	45	52
9. Average size of lobsters	Grams per lobster	1,500	1,667	1,500	1,536
10. Number of lobsters per pot haul	Average	121.21	30.00	30.30	34.03
11. Total number of lobsters		9,091	12,000	40,000	61,091
12. Percentage of catch per voyage		14.56%	21.36%	64.08%	100.00%
13. Bottom contact per voyage	sqm	150	500	1,650	2,300
14. Pot size	sqm per pot	2.00	1.25	1.25	1.28
15. Lobsters per sqm & kg per sqm	1	121.21	30.00	30.30	34.03
	kg per sqm	181.82	50.00	45.45	52.26
Note:	10	12.12	3.00	3.03	3.40
	kg per sqm	18.18	5.00	4.55	5.23
1. Blue is the area of bait attraction per pot	25	4.85	1.20	1.21	1.36
	kg per sqm	7.27	2.00	1.82	2.09
2. Red is the kg per sqm	50	2.42	0.60	0.61	0.68
	kg per sqm	3.64	1.00	0.91	1.05
3. Black is the # of lobsters per sqm	75	1.62	0.40	0.40	0.45
	kg per sqm	2.42	0.67	0.61	0.70
	100	1.21	0.30	0.30	0.34
	kg per sqm	1.82	0.50	0.45	0.52

## Appendix 4 Foundation Seamount Calculations

Seamount number	Seamount name	Depth range	sqkm	sqkm	sqkm	Description	Comments
			A 0-500 m	B 500-1000 m	C 1000-2000 m		
1. #1a	Ampere a	1,500-2,000			47	2 Circular Structures	Scattered Cones
2. #1b	Ampere b	1,400-2,000			104	Linear Structure	Scattered Cones
3. #2	Archiminds	1,260-2,000			78	Linear Structure	Flat Uneven Summit
4. #3	Aristotelis	1,340-2,000			47	Linear Structure	Flat Summit
5. #4a	Avogadro a	1,460-2,000			62	Linear Structure	Flat Summit
6. #4b	Avogadro b	1,780-2,000			26	Linear Structure	Flat Summit
7. #4c	Avogadro c	1,060-2,000			73	Linear Structure	Steps on Flank
8. #5	Becquerel	600-1,000		70		Circular Structure	Flat Summit
		1,000-2,000			171	Circular Structure	Sharp Basement Line
9. #6	Bohr	1,060-2,000			124	Circular Structure	Smooth Flanks
10. #7	Bouguer	1,860-2,000			3	Elongated Volcanic Cones	Southern Flank
11. #8	Buffon	400-500	1.17			N-S Elongated Structure	Scattered Cones
		500-1,000		207		N-S Elongated Structure	Sharp Basement Line
		1,000-2,000			466	N-S Elongated Structure	
12. #9	Celsius	500-600		65		Star-like Structure	Flat Summit
		600-1,000		210		Star-like Structure	Gentle Slopes
		1,000-2,000			78	Star-like Structure	
13. #10	Curie	500-600		5		Seamount Structure	Flat Summit
		600-1,000		31		Seamount Structure	Smooth Basement Line
		1,000-2,000			21	Seamount Structure	
14. #11	Da Vinci	1,000-2,000			218	Conical Elongated Structure	Summit Cones, Gentle Slope
15. #12a	Darwin a	300-500	90.41			Elongated Structure	Flat Summit Plateau
		500-600		104		Elongated Structure	No Basement Line
		600-1,000		57		Elongated Structure	No Basement Line
		1,000-2,000			129	Elongated Structure	
16. #12b	Darwin b	1,000-2,000			65	Conical Structure	Summit Cones
17. #13a	Einstein a	500-1,000			10	Elongated Conical Structure	Summit Cones, Gentle Slopes
		1,000-2,000			93	Elongated Conical Structure	
18. #13b	Einstein b	1,340-2,000			93	Elongated Conical Structure	Summit Cones, Gentle Slopes
19. #14	Fahrenheit	940-2,000			52	Conical Structure	Sharp Borders
20. #15	Faraday	860-2,000			93	Conical Structure	Summit Cones
21. #16	Fermi	840-2,000			10	Conical Structure	Elongated Summit
22. #17	Fleming	500-1,000		41		Conical Structure	Circular Flat Summit
		1,000-2,000			155	Conical Structure	Smooth Basement Line
23. #18	Galilei	400-500	12.40			Conical Structure	Circular Flat Summit
		500-1,000		52		Conical Structure	Smooth Borders
		1,000-2,000			104	Conical Structure	
24. #19a	Herschel a	1,040-2,000			41	Conical Structure	With Rift Zones
25. #19b	Herschel b	1,000-2,000			166	Conical Structure	With Rift Zones

## Appendix 4

### Foundation Seamount Calculations Continued...

Seamount number	Seamount name	Depth range	sqkm	sqkm	sqkm	Description	Comments
26. #19c	Herschel c	920-2,000			93	Conical Structure	With Rift Zones
27. #20	Hippocrate	500-1,000		41		Conical Structure	Gentle Slopes
		1,000-2,000			166	Conical Structure	
28. #21a	Hubble a	500-1,000		21		Elongated Structure	3 Summits, Gentle Slopes
		1,000-2,000			114	Elongated Structure	
29. #21b	Hubble b	840-2,000			62	Elongated Structure	3 Summits, Gentle Slopes
30. #22	<b>Humboldt</b>	<b>400-500</b>	<b>3.22</b>			<b>Circular Structure</b>	<b>Flat Summit</b>
		500-1,000		73		Circular Structure	Smooth Borders
		1,000-2,000			135	Circular Structure	
31. #23	<b>Jenner</b>	<b>300-500</b>	<b>22.72</b>			<b>Elongated Structure</b>	<b>Flat Summit</b>
		500-600		16		Elongated Structure	Gentle Slopes
		600-1,000		52		Elongated Structure	Smooth Basement Line
		1,000-2,000			73	Elongated Structure	
32. #24a	Kelvin	500-1,000		3		Conical Structure	Elongated Summit
		1,000-2,000			23	Conical Structure	
33. #24b	Kepler	1,400-2,000			10	Conical Structure	Elongated Summit
34. #25	<b>Kopernik</b>	<b>180-500</b>	<b>115.20</b>			<b>Circular Structure</b>	<b>Flat Summit</b>
		500-600		347		Circular Structure	Gentle Slopes
		1,000-2,000			321	Circular Structure	Smooth Basement, Lateral Cones
35. #27a	Linne a	500-1,000		93		Flat Summit Structure	Gentle Slopes
		1,000-2,000			290	Flat Summit Structure	Gentle Slopes
36. #27b	<b>Linne b</b>	<b>200-500</b>	<b>11.89</b>			<b>Circular Structure</b>	<b>Flat Summit</b>
		500-600		73			
		600-1,000		73		Circular Structure	Uneven Slopes, Rifts Zones
		1,000-2,000			186	Circular Structure	
37. #28	<b>Mendel</b>	<b>150-500</b>	<b>47.96</b>			<b>Elongated Structure</b>	<b>Flat Summit</b>
		500-600		49			
		600-1,000		78		Elongated Structure	Broad Volcanic Area
		1,000-2,000			311	Elongated Structure	
38. #29	<b>Mendeleiev</b>	<b>200-500</b>	<b>9.18</b>			<b>Circular Structure</b>	<b>Flat Summit</b>
		500-600		36			
		600-1,000		62		Circular Structure	Gentle Slopes
		1,000-2,000			129	Circular Structure	
39. #30	<b>Mercator</b>	<b>500-600</b>	<b>46.77</b>			<b>Elongated Structure</b>	<b>Flat Summit</b>
		600-1,000		52		Elongated Structure	Lateral Cones, Smooth Basement Line
		1,000-2,000			233	Elongated Structure	
40. #31	Newton	500-600		13		Elongated Structure	Flat Summit
		600-1,000		26		Elongated Structure	Broad Volcanic Area
		1,000-2,000			155	Elongated Structure	
41. #32	Ohm	600-1,000		10		Circular Structure	Flat Summit, Broad Volcanic Area
		1,000-2,000			104	Circular Structure	
42. #33	Pascal	1,160-2,000			23	Polygonal Structure	Gentle Slopes

### Appendix 4 Foundation Seamount Calculations Continued...

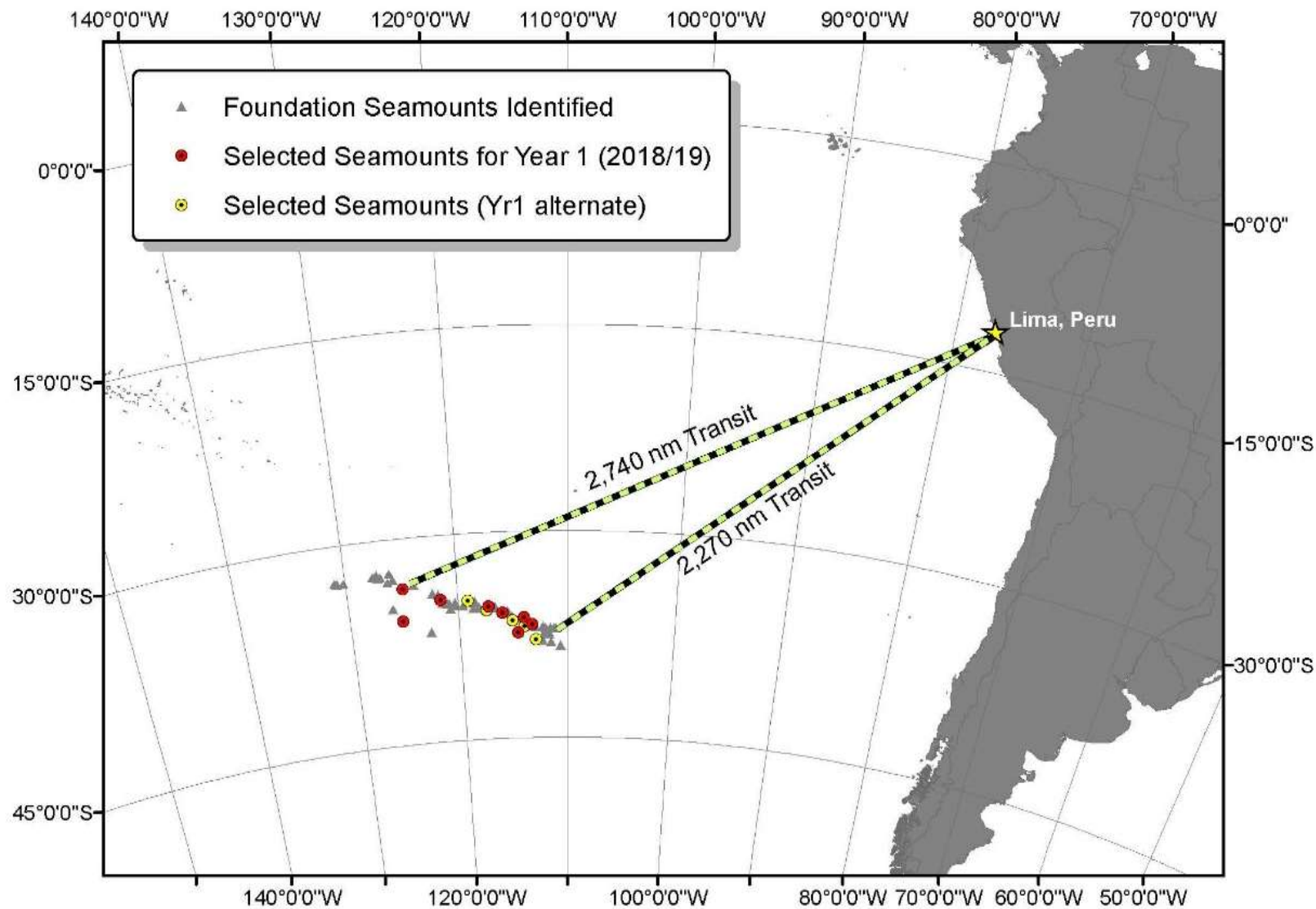
Seamount number	Seamount name	Depth range	sqkm	sqkm	sqkm	Description	Comments
43. #34	Pasture	1,300-2,000			41	Circular Structure	Polygonal Shape
44. #35	Pauling	1,600-2,000			98	Three Structures	Flat Summit, Two Craters
45. N. Ridge	N. Ridge	1,500-2,000			93	Elongated Structure	Volcanic Ridge, Flat Summit, 6+ Cones
46. #36	Planck	1,440-2,000			104	Elongated Structure	Flat Summit, Gentle Slopes
<b>47. #37a</b>	<b>Platon</b>	<b>300-500</b>	<b>3.11</b>			<b>Flank Structure</b>	<b>Rift Zone</b>
		500-600		21		Flank Structure	Rift Zone
		600-1,000		166		Flank Structure	Rift Zone
		1,000-2,000			373	Flank Structure	Rift Zone
48. #37b	Richter	980-1,000			124	Elongated Structure	Flat Summit, Gentle Slopes
49. #38	Rutherford	1,180-2,000			78	Circular Structure	
50. #39	Schrodinger	1,420-2,000			26	Polygonal Structure	Flat Plateau, Gentle Slopes
51. #40	Volta	2,340/up			23	Circular Structure	Elongated Summit, Conical Shape
52. #41	Watt	1,580-2,000			73	Polygonal Structure	Flat Summit, two higher areas
53. #42		1,400-2,000			23	Polygonal Structure	Flat Summit, Gentle Slopes
54. S. Ridge	S. Ridge	1,500-2,000			388	Elongated Structure	Flat Summit W/Crater & Gentle Slopes
55. #43		1,460-2,000			47	Polygonal Structure	Flat Summit W/Crater
56. #44		2,160/up			10	Elongated Structure	Flat Summit, Polygonal Shape
57. #45	JC	500-600		93		Elongated Structure	
		600-1,000		140		Elongated Structure	
		1,000-2,000			256	Elongated Structure	
<b>58. #46</b>	<b>MM</b>	<b>150-500</b>	<b>318.87</b>			<b>Elongated Structure</b>	<b>Flat Summit with Cones</b>
		500-600		62		Elongated Structure	
		600-1,000		62		Elongated Structure	
		1,000-2,000			186	Elongated Structure	
59. #47	Viola	600-1,000		60		Elongated Structure	Flat Summit
		1,000-2,000			409	Elongated Structure	
<b>60. #48</b>	<b>GB</b>	<b>150-500</b>	<b>13.59</b>			<b>Elongated Structure</b>	<b>Flat Summit</b>
		500-1,000		181		Elongated Structure	
		1,000-2,000			129	Elongated Structure	
61. #49	AJ	500-600		41		Elongated Structure	Flat Summit
		600-1,000		52		Elongated Structure	
		1,000-2,000			78	Elongated Structure	
62. #50	IT	500-600		10		Circular Structure	Flat Summit
		600-1,000		31		Circular Structure	
		1,000-2,000			62	Circular Structure	
<b>Total sqkm</b>			<b>696.49</b>	<b>2,877</b>	<b>7,581</b>	<b>11,155</b>	
<b>Total sqmiles</b>			<b>268.92</b>	<b>7,453</b>	<b>19,634</b>		

1. % of Area in sqkm      0-2,000 m      6.24%      25.80%      67.96%      100.00%
2. Yellow area shows the eight (8) seamounts for the first year
3. Blue area shows the five (5) alternate seamounts for the first year

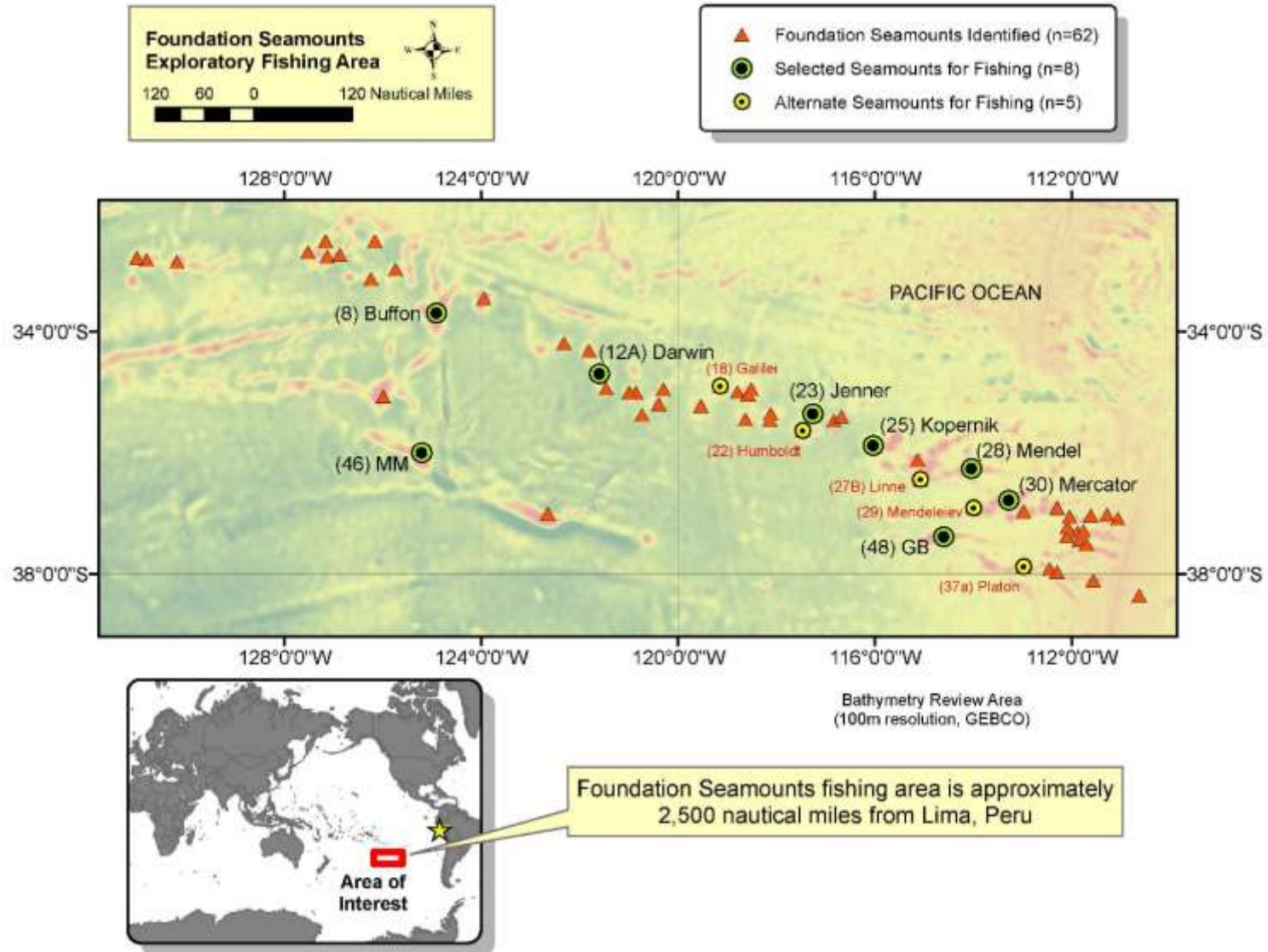
### Appendix 5 Resource Calculations (0 to 2,000 meters)

1. Foundation seamounts	Seamount numbers	Species	Gram per species	Biomass %	sqkm	Habitat area	sqm	10	25	50	75	100
							<i>Jasus spp.</i> per sqm	3.40	1.36	0.68	0.45	0.34
							<i>Projasus spp.</i> per sqm	0.10	0.04	0.02	0.01	0.01
							<i>Chaceon spp.</i> per sqm	0.10	0.04	0.02	0.01	0.01
								Tonnes	Tonnes	Tonnes	Tonnes	Tonnes
a. Seamounts A 0-500 m	8, 12A, 18, 22, 23, 25 27b, 28, 29, 30, 37a 46, 48	<i>Jasus spp.</i>	1,500	100%	696	25%	696,490,000	888,025	355,210	177,605	117,533	88,802
b. Seamounts B 500-1,000 meters	5, 8, 9, 10, 12a,17, 18, 20 21a, 22, 23, 24a, 25,27a 27b, 28, 29, 30, 31, 37a 45, 46, 47, 48, 49,50	<i>Projasus spp.</i> <i>Chaceon spp.</i>	150 500	50% 50%	2,877	25% 25%	2,877,000,000	5,394 17,981	2,158 7,193	1,079 3,596	719 2,398	539 1,798
d. Seamounts C 1,000-2,000 meters	62 Seamounts below 1,000 M	<i>Projasus spp.</i> <i>Chaceon spp.</i>	150 500	50% 50%	7,581	25% 25%	7,581,000,000	14,214 47,381	5,686 18,953	2,843 9,476	1,895 6,318	1,421 4,738
<b>Total</b>					<b>11,154</b>		<b>11,154,490,000</b>	<b>972,996</b>	<b>389,198</b>	<b>194,599</b>	<b>128,862</b>	<b>97,300</b>
<b>2. Total Biomass</b>												
a. <i>Jasus spp.</i>								888,025	355,210	177,605	117,533	88,802
b. <i>Projasus spp.</i>								19,609	7,844	3,922	2,615	1,961
c. <i>Chaceon spp.</i>								65,363	26,145	13,073	8,715	6,536
<b>Total</b>								<b>972,996</b>	<b>389,198</b>	<b>194,599</b>	<b>128,862</b>	<b>97,300</b>
<b>3. Bottom Contact</b>												
	Pot pulls per day	Fishing days per year	Pot Size sqm				sqm Bottom Contact	% of Bottom Contact				
a. Seamount A	1,000	90	1.77				159,300	0.023%				
b. Seamount B	1,000	0	1.77				0	0.000%				
c. Seamount C	1,000	0	1.77				0	0.000%				
<b>Total</b>	<b>1,000</b>	<b>90</b>	<b>1.77</b>				<b>159,300</b>	<b>0.023%</b>				

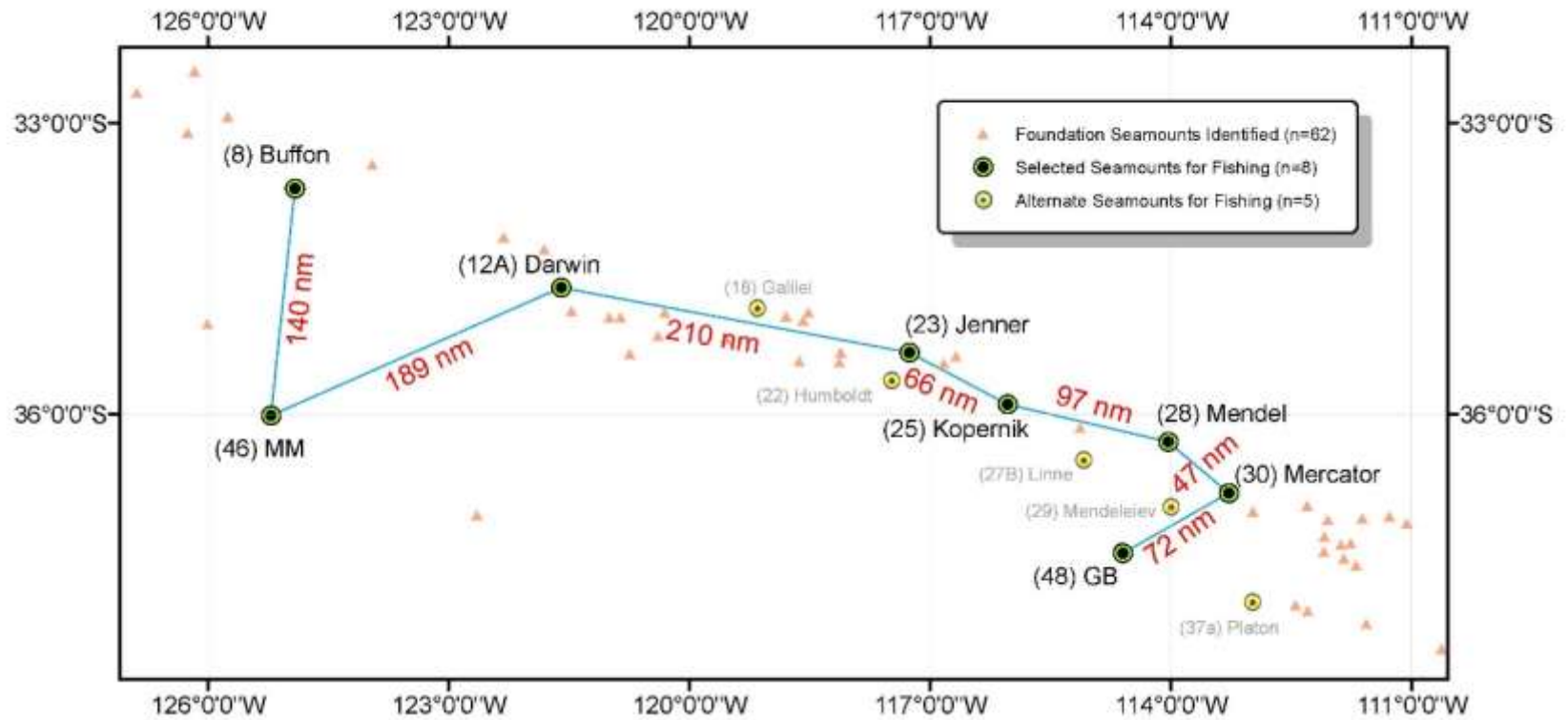
### Appendix 6 Relative Scale of Foundation Seamount Chain: Distance from Lima, Peru (home port)



### Appendix 6 Relative Scale of Foundation Seamount Chain: Selected Seamounts for Exploratory Pot Fisheries



### Appendix 6 Relative Scale of Foundation Seamount Chain: Transit Distance between selected seamounts



### Appendix 7 Protocol for Encountering VMEs

#### Vulnerable Marine Ecosystems Signature form

Date  Trap line set time

Taxon	Code	Common name	Threshold weight (kg)	Actual weight (kg)	VME indicator level
PORIFERA	ONG	Sponges	50	<input style="width: 40px; height: 20px;" type="text"/>	3
<b>CNIDARIA</b>					
Anthozoa (class)					
Alcyonacea (order)	SOC	Soft and runner corals	1	<input style="width: 40px; height: 20px;" type="text"/>	3
Gorgonacea (oder)	GOC	Sea fans, sea whips	1	<input style="width: 40px; height: 20px;" type="text"/>	3
Scleractinia (order)	SIA	Stony corals	30	<input style="width: 40px; height: 20px;" type="text"/>	3
Antipatharia (order)	COB	Black corals	1	<input style="width: 40px; height: 20px;" type="text"/>	3
Pennatulacea (order)	PTU	Sea pens		<input style="width: 40px; height: 20px;" type="text"/>	1
Actiniaria (order)	ANT	Anemones		<input style="width: 40px; height: 20px;" type="text"/>	1
Hydrozoa (class)	HDR	Hydrochorals, stylasterids	6	<input style="width: 40px; height: 20px;" type="text"/>	3
<b>ECHINODERMATA</b>					
Crinoidea (class)	CRI	Feather stars		<input style="width: 40px; height: 20px;" type="text"/>	1
Brisingida (order)	BRG	Armless stars		<input style="width: 40px; height: 20px;" type="text"/>	1
<b>Diversity Index</b>	Count the numbers of taxon from the Actual weight column, if any. Do not enter weight, a number from 1 to 10 is required, where 10 is the max number.			<input style="width: 40px; height: 20px;" type="text"/>	
<b>Total VME score</b>					

Name of Vessel: **Great Southern**

Time & position that hauling of gear commenced.

Time: \_\_\_\_\_ Position: \_\_\_\_\_

Was the vessel master informed of the total VME score before next set occurred? Yes, No If VME is triggered id the vessel moves 5 nautical miles from the position of hauling of the gear before commencing the next set.

Yes                      No

**INSTRUCTIONS FOR COMPLETION OF VME SIGNATURE FORM AND COLLECTION OF SPECIMENS**

Instructions:

- 1) Please try to identify any by catch down to the finest taxonomic level possible on the list given below. If the specimen is not included on this list, then ignore it for VME determination but include it in normal catch sampling for benthic materials.
- 2) If it is included in the list, enter the total weight (kg) in the actual weight column. Include a specimen if only one category. Unidentifiable coral is included as taxon if needed. Corals that can be identified should be considered at the appropriate taxonomic level even if dead.
- 3) If the actual weight is greater than the threshold weight, circle the corresponding VME indicator level row. Sum the number of taxon in the actual weight column and enter the total in the diversity index row for the event.
- 4) Sum the circled VME indicator column and enter in the total VME score row for the event. If the total VME score is greater than or equal to 3, the area is considered to have evidence of a VME. 5) Take a photograph of the organisms so the general scale and composition of the bycatch can be determined later.
- 6) At the end of trip provide the data to the Ministry of Marine Resources in Avarua, Rarotonga, Cook Islands. INSTRUCTIONS FOR THE COLLECTION OF SPECIMENS AT SEA If you are not confident that you can identify the organism to species, genus, or family level, then you are encouraged to use the generic codes provided in the pictorial guide (pages 9–18) NIWA Invertebrate Guide and ask that you retain the specimen (if possible) for identification ashore. Specimens are required to be collected only when they:

#### INSTRUCTIONS FOR THE COLLECTION OF SPECIMENS AT SEA

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- cannot be identified confidently
- are caught in an unusual depth or region
- are specifically requested for research purposes.

If samples or subsamples are retained, the following instructions should be followed.

#### Handling instructions

Place the benthic sample or representative subsample of the organism in a plastic bag, separating the groups/species (particularly the sponges). Write the trip number and station number (or lat and long) on a label, in pencil, and put inside the bag. Freeze immediately. If the organism is fragile (e.g., a crab or prawn), place in a container of seawater and freeze. Dead shells are not to be recorded on catch forms, but dead shell specimens can be retained for taxonomists.

## Appendix 8 Camera Information

[www.electromechanica.com/portfolio/uvas/](http://www.electromechanica.com/portfolio/uvas/)

[www.thesextonco.com](http://www.thesextonco.com)

