

**5<sup>th</sup> Meeting of the Scientific Committee**

Shanghai, China  
23 - 28 September 2017

**SC5-DW01\_rev1**

**Cook Islands proposal for an exploratory potting fishery**

*Ministry of Marine Resources*

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**Exploratory Fishing Application**

**for**

**Great Southern Fisheries Limited**

**FV Great Southern**

**To fish in South Pacific Regional Fisheries Organisation Management Area**

**Targeting deep-water species of lobster and crab**

Dated 21<sup>st</sup> July 2017\_revised Sept

## Overview

This document is in addition to an application to the Ministry of Marine Resources (MMR), Rarotonga, Cook Islands for an authorisation for Great Southern Fisheries Limited, of Avarua, Rarotonga (GS) to utilise their vessel, the FV Great Southern to fish in the South Pacific Regional Fisheries Management Area, outside of any previously established bottom fisheries footprint of the Cook Islands, in 2018, 2019 & 2020 initially and then subsequently as determined by MMR and the Scientific Committee (SC) and Commission of the South Pacific Regional Fisheries Management Organisation (SPRFMO). This document seeks to comply with the application requirements of SPRFMO Conservation and Management Measure (CMM) 13-2016 and includes, in full, all information material to such application for consideration by the SPRFMO SC at its next meeting in September 2017 and thereafter by the Commission, when it meets in early 2018. This application contains in full the Fisheries Operation Plan as required by CMM 13-2016 for the 3 years of 2018, 2019 & 2020.

The applicant, GS, acknowledges that since earlier exploratory and commercial voyages in the South Pacific with respect to the target species, that changes in respect of high seas management, in particular, the formation of SPRFMO, now mandate that interactions and footprints left on the environment are accounted for. GS 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 the South Pacific Regional Fisheries Management Organisation (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 Vulnerable Marine Ecosystem (VME) form. (2008). Ministry of Fisheries, New Zealand.
5. Template for the compilation of information describing specific habitats in the Southern Pacific Ocean.

## Principal Point of Contact

### Owners' Representatives:

The below name individuals will be the primary points of contact for all operational, management and corporate matters.

Name: John Chadderton

Address: 3 Henry Street, Fremantle, WA 6160, Australia

[antartic@iinet.net.au](mailto:antartic@iinet.net.au)

Name: Mark Maring

Address: 4430 SE Flavel Street, Portland, Oregon 97206, USA

mfm@markfmaring.com

#### **Official Contact:**

Name: Tim Costelloe, Director, Offshore Fisheries

Address: Ministry of Marine Resources

Avarua, Rarotonga, Cook Islands

t.costelloe@mmr.gov.ck

#### **Vessel Owners:**

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

#### **Vessel details**

The vessel is a typical “squid jig” vessel, converted for dedicated use to deploy and retrieve strings of traps for setting in deep water.

Vessel Name:	Great Southern – Schematic post-conversion at Appendix 10.
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International Call Sign	TBC
Flag State	Cook Islands
Port of Registry	Avatiu

#### **Vessel Description**

Hull	Steel
Length overall	69.35m
Registered length	63m
Breadth	10.7m
Depth	4.2m
Gross tonnage	655
Hold capacity	1908cbm
Freezing capacity	80 tons/day

Freezer plant	157cbm
Fresh water capacity	22cbm
Crew accommodation	Up to 30

<b>Main engine</b>	Niigata 6M31AFTE of 1800Bhp
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**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

**Fuel Capacity**

Fuel oil: 557cbm

**Vessel Markings**

Once 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

**Principals**

The principals' named above, John Chadderton and Mark Maring, both have substantial experience in the type of fishing operation proposed, including experience in exploratory and research fishing in similar fisheries. They are cognisant 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. Biographies of the fisheries and scientific experience of both individuals is attached at Appendix 1.

**Proposed activities in the Management Area and Target Species****Licencing**

An Access Agreement will be negotiated with the Government of the Cook Islands through MMR, which will, *inter alia*, provide for the annual authorisation of the vessel. This Access Agreement will require the company and the vessel to comply with all relevant Cook Islands laws and the rules, CMMs and other requirements of SPRFMO. The Cook Islands has considerable powers of sanction against the company, individuals concerned, including the Master, and the vessel, in the event, that requirements are not adequately met.

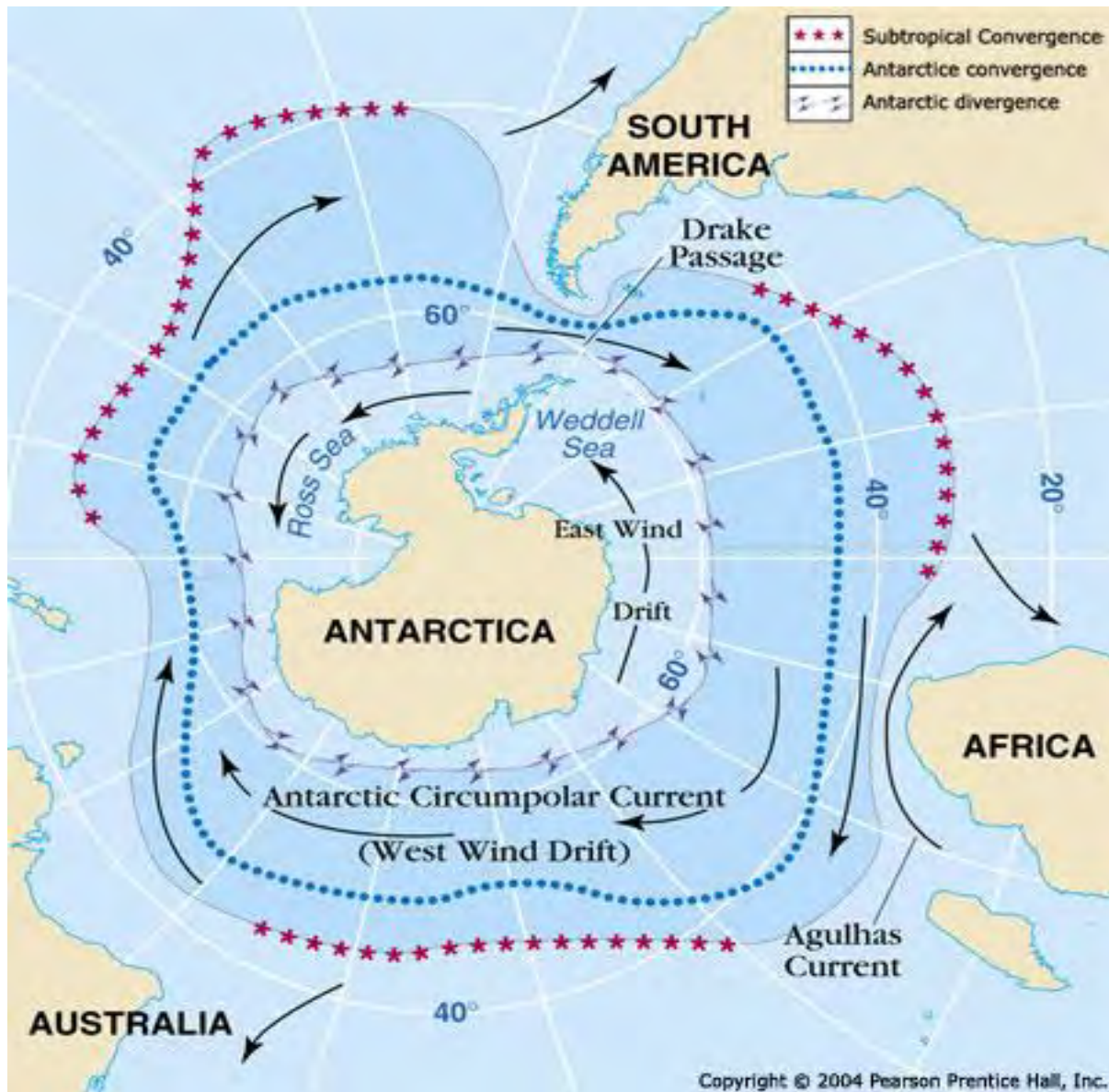
**Area**

This document is for an application to engage in a New & Exploratory Fishery on the seabed in the following boxed area of the SPRFMO Management Area:

1. Foundation Seamount Chain
  - a. 108 degrees West to 134 degrees West;
  - b. 31 degrees South to 39 degrees South;
  - c. 2,400 kilometres by 880 kilometres: 2,100,000 square kilometres.

Graphics of the seabed of this area, showing the features examined and a map of the SPRFMO Management Area showing the above area is attached at Appendix 2.

The Foundation Seamount chain, due to its location, length and East/West orientation is subject to dramatic upwellings, 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 and 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.



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, and the eddies may be sufficiently strong to reverse the direction of the surface currents in this area, where shallow undercurrents exist, flowing 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. This is unlike isolated seamounts, which are known to demonstrate degrees of endemism: individual seamounts and structures throughout the Foundation Seamount Chain are therefore unlikely to hold endemic species due to the prevailing conditions which would appear to encourage similar diversity throughout the chain.

It is in this area that very productive sea mounts were discovered in 1988.

## Method

GS will deploy gear carefully designed and dedicated to capturing particular species of crustaceans. GS intends to be very selective about fishing methods and fish only where there is a high likelihood of commercial success and minimal adverse impact on the environment. It is anticipated that at least 95% of marine creatures harvested will be the target crustacean species. Very little non-crustacean by-catch is expected. Based on prior knowledge, GS is able to fish selectively.

GS will use stationary gear, that is, traps which are relatively discriminate and their impact on the seafloor is already acknowledged to be very low. One of the potential negative impacts of trapping can be ghost fishing, which happens when traps are lost and the trap effectively could continue fishing over time. However, the design of these particular traps, with a large direct entrance is intended to only hold the catch when there is bait present, as lobsters, crabs and fish are able to exit the trap with relative ease, there being no barrier within the entrance to prevent this. This will sharply minimise the potential for ghost fishing in the event of lost gear.

Additionally, "escape gaps" will be designed into the construction of the traps. The measurements of these will be in line with the positions and measurements required under Australian and New Zealand fisheries management regulations for the Rock Lobster fisheries. When targeting the *Jasus Caveorum* species the Escape Gaps will remain open, but when targeting the far smaller *pro-jasus* these will be closed with a quick flap closure of netting.

Nonetheless, the importance of recording lost gear and traps is noted by GS as it will be an indicator of the vessel's imprint in this region. As traps are expensive, the GS will make every effort to find lost traps so that minimal, if any, loss of gear is expected.

Although no fishing method is 100% benign to the environment, GS believes that its choice of gear, methods and prior knowledge of the types areas to be fished mean a negligible imprint will be left, even on sensitive areas.

GS will carry approximately 3000 traps, setting 800-1000 traps, in strings of 200 traps, in a 24 hour period, with a 3 day set, soak, retrieve cycle. There are a number of other fisheries, including the

Hawaiian lobster fishery, Argentinian king crab fishery, Russian far-east crab fisheries and Canadian snow crab fishery, which have used a similar fishing strategy with similar volumes of the same type of traps over many years, in what remain well-managed and sustainable fisheries.

The traps used (see pictures at Appendix 3 of the exact equipment) are 150cm diameter at the base, 75 cm high and 50cm diameter at the top. The entrance to the trap is 35cm in diameter and the trap is covered with a mesh size of 5cm. The backbone and float line for each string of traps is made of 25mm polypropylene with each trap on each string spaced 25m apart. The line used to string the traps is positively buoyant and as such the risk of entanglement and therefore damage to bottom structure is very low. Floats 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 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 of traps is then similarly paid out, while the vessel steams slowly ahead and finally the remaining float line and float are paid out. It is important to note that no “anchors” as such are used, the traps themselves being sufficient to keep the gear in place on the bottom. This eliminates the impact of any “anchor damage”. The entire gear is then “stretched” gently to minimise 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 1m/s, so approximately 20 minutes to settle at a depth of 1000m. The methodology of the set and slow sink rate of the gear, combined with variations in wind and current conditions, mean that it is practically impossible to set the gear in the exact same place twice, with variations in bottom placement of up to several thousand meters from the same surface release point. This has the benefit of ensuring that highly localised stock depletion does not occur and limits damage to sensitive benthos by avoiding repeated contact in the exact same areas.

### Target Species

The primary target species will be *jasus spp* and *pro-jasus spp* of lobster with an expectation of secondary target species of *chaceon spp* of crab.

A document is attached at Appendix 4 describing the fishery in respect of the primary *pro-jasus spp*.

Because various *jasus spp.* and *chaceon spp.* are the subject of well developed fisheries in a number of areas around the globe, this application will not dwell on them as information is so widely available.

Various reports and studies on *jasus spp.* fisheries and *chaceon spp.* fisheries can be found here:

Jasus spp.

Tristan de Cunha fishery

[https://www.rspb.org.uk/Images/Tristan%20da%20Cunha%20fisheries%20detailed%20report%202017\\_tcm9-440551.pdf](https://www.rspb.org.uk/Images/Tristan%20da%20Cunha%20fisheries%20detailed%20report%202017_tcm9-440551.pdf)

South Australia

<https://www.environment.gov.au/system/files/pages/0706d910-18b1-4344-940f-1f639a662f90/files/reassessment-report.pdf>



New Zealand:

<https://www.mpi.govt.nz/document-vault/14566>

Chaceon spp.

South East Atlantic

<http://www.seafo.org/Science/Species-Summary/Deep-sea-Red-Crab> (download status report)

Northeastern USA

<https://www.nefsc.noaa.gov/sos/spsyn/iv/redcrab/>

IUCN notes the following in respect of the *pro-jasus parkeri* species of lobster that is expected to be encountered:

“*Pro-jasus parkeri* has been assessed as Least Concern. This is due to its wide distribution; having been found off South Africa, New Zealand and on the Kermadec Ridge. Furthermore, it occurs at depths and locations (such as seamounts) where harvesting is unlikely and/or restricted, and is said to be abundant in suitable habitat. This species is known from Cape Province, South Africa (Stebbing 1902); Valdivia Bank, Namibia; Ile Saint-Paul, French Southern and Antarctic Lands; and New Zealand (Holthuis 1991). A larval specimen has also been taken from New South Wales, Australia (Holthuis 1991). This species has also been found on seamounts along the Kermadec Ridge (A. MacDiarmid pers. comm. 2009).”

It is possible, but unlikely (see comments under “Area”) that other *pro-jasus spp.* may also be encountered and they are expected to have similar stock characteristics as have been observed for *parkeri*. It is assumed, but not known absolutely, that this species has a similar age to other *jasus spp.* of 3-5 years to maturity.

IUCN notes the following in respect of the *jasus caveorum* species of lobster that is expected to be encountered:

“*Jasus caveorum* has been assessed as Data Deficient. This species has a relatively small range, and its biology indicates that it may be susceptible to heavy fishing pressure. It is possible that this species was heavily fished during the 1960s though this cannot be confirmed. It is fished occasionally by New Zealand fishers. However, it is not known what impact this is having on the population. This species occurs in international waters and so is not subject to any management restrictions. Further research is needed on the fishing effort and abundance of this species before a more accurate assessment of conservation status can be made. This species is only known from a single seamount on the Foundation Seamount Chain (35°S 120°W), in the southeast Pacific Ocean, to the west of Chile (Webber and Booth 1995).”

It is possible, but unlikely (see comments under “Area”) that other *jasus spp.* may also be encountered and they are expected to have similar stock characteristics as have been observed for *caveorum*. The discovery of *jasus caveorum* was in the course of short experimental voyages by Chadderton, Cave &

Petersen (see commentary in “Catch and Fishery Products Produced” below). As a result of these voyages, it is believed that the species is present in considerable density and that it occurs at depths beyond 450m, but that after this depth *pro-jasus spp.* become dominant. The proposed exploratory fishery will provide an opportunity to conduct extensive scientific investigation of this species to enhance knowledge of it and provide a basis for management in this and other areas where it or similar deep sea *jasus spp.* are discovered. Age to maturity is unknown, but for the purposes of this application is assumed to be 3-5 years as per other *jasus spp.* until such time as better information becomes available as a result of this exploratory fishery.

Various reports of interest and upon which key assumptions regarding the *jasus caveorum* fishery have been developed are referenced above.

As per the referenced reports, *chaceon spp.* are known to occur at depth in many areas around the world’s ocean where suitable habitat exists. From the experimental fishing voyages carried out on the Foundation Seamount Chain by Chadderton, Cave & Petersen it is known that *chaceon spp.* are prevalent in the area below 500m. Following his 1995 voyage, Petersen sent samples of the crab caught to NIWA in Wellington, New Zealand, although it is unknown what analysis resulted from this. It is expected that the crab species encountered will have similar age to maturity to other *chaceon spp.* of 5-7 years. Scientific data and analysis can only be conducted on these resources following fishing effort by GS.

### **Transshipment**

It is not intended that the GS will engage in transshipment operations either at sea or in port, with the intention being to discharge to an approved facility in an approved port.

### **Catch and Fishery Products produced**

Appendix 5 is attached and is an examination of a sample of 60 bottom features in the proposed Foundation Seamount Chain exploratory fishing area. It should be noted here that these 60 features are those for which GS has detailed bathymetric and other information and the accessibility of this information is the reason that these features were chosen for examination here and used as the basis for the resource calculations herein. There are known to be at least an additional 100 features in the chain with similar characteristics and thought to be an additional unknown number of similar features also in the proposed research area. The detailed information on features, the estimate of the number of other known features and the advice that there are additional unknown features has been obtained by GS from The Scripps Research Institute of San Diego, USA.

Appendix 6 is attached and contains the results of the 3 known short research trips to the Foundation Seamount Chain carried out by Chadderton, Cave and Peterson in 1988, 1992 and 1995 respectively. GS is not aware of any other research or fishing trips to the area and as such can base its assessments on the productivity of the general area (noting above the expectation and benthos across the chain is expected to be similar) only on the results of these trips. Setting aside the fact that absolute spatial distribution of crustaceans can only be determined by continuous fishing across a gridded area over time and that the effect of “bait attraction” must be set aside due to the high number of variables,

then the weighted average of crustaceans per square meter of bottom contact was 266, which is an extremely high density.

Appendix 7 is attached and contains analysis of expected biomass at various depth bands (0-400m, 400-600m, 600-1000m & 1000-2000m) on the 60 features identified in Appendix 5 referred to above. The depth bands represent significant changes in expected catch composition for each. The total area across these features above 2000m in depth is 10,750 square kilometres. Given the extremely high density of crustaceans observed during the known, brief, experimental fisheries conducted on the area and noting the need for a precautionary approach, biomass estimates have been based on densities which are thought to be conservative, but are unknown, at this time. These are 1 crustacean per 10 square meters, 1 per 25, 1 per 50, 1 per 75 and 1 per 100 of bottom structure. Total estimated biomass is for the examined features only (Appendix 7) and for depths of above 2000m only. Total biomass across the proposed fishing area is therefore likely to considerably exceed the estimates included herein due to additional fishable features in the area.

The maximum production capacity of the vessel over the course of 12 months is expected to be no more than 6,000 ton of green product. It is intended to harvest approximately either 5500 tons of lobster (split to a maximum of 4000 of *jasus spp.*, and a maximum of 3000 tons of *pro-jasus spp.*) or 5000 tons of *chaceon spp.* or a mixture of both. The uncertainty about species composition is due to various unknowns in respect of the fishery, whereby weather, current, market prices and other variables may direct the areas and depths fished. Additionally, while GS has an expectation and some prior knowledge that each of the target species exists in considerable volumes within the proposed area, the composition of catch will depend largely on results. The lobster species will be the primary target species, but if catch rates are significantly below expectations then crab may be targeted as an alternative. It is not expected that there will be a significant bycatch of crab when lobster is being targeted 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 differentiations will become clearer as fishing progresses.

As such the tables attached at Appendix 7 show the methodology that has been used to both analyse bottom structure and estimate the size of relevant resources to reach these assumptions about catch and area. The areas described on the table of specific features and the biomass estimates therein will define the level of fishing to a maximum of 15% of estimated biomass based on the assumption of at least 1 animal per 25sqm of habitat. This assumption about density can only be properly analysed once fishing has been conducted over a period of time, but is considered to be conservative based on the information described above and in the relevant appendices. Additionally, and as stated, it is expected that a substantial number of additional bottom structures in addition to those already under consideration will be fished, so while the total intended catch will not change it will probably be spread over a greater area than currently contemplated and is why the area considered is described as a minimum. The catch estimates are based on a maximum depletion on each feature of less than 15% of the virgin biomass (based on a maximum harvest on either crab or lobster), where there is a population density of one animal per 25sqm. The entire catch will be frozen whole aboard, so that very little onboard processing or creation of waste will occur. Should this processing methodology be altered, GS will notify MMR and SPRFMO and advise of measures to deal with waste accordingly.

It should be recognised that the analysis of structures in Appendix 5 is estimated to be less than 40% of the total structures in the chain. The experimental fishing in 1988, 1992 & 1995 covered only a handful (2 very small features in the case of the Chadderton voyage) of features, but were very productive. GS intends to explore the total area widely over the 3 years of the initial exploratory fishery and as such the estimates of biomass in the area can be considered to be low as they are based on areas on which data is available. As such total biomass removal when considered over the entire area will be considerably lower than estimated above.

The design and mesh size of the traps is such that only mature animals are likely to be caught. With what is known of the target species and their assumed relatively quick maturity as well as the fact that over the exploratory period the same feature is unlikely to be fished on multiple occasions and that target species are expected to be distributed over the entire subject area, then it is expected that the total biomass reduction over 3 years will be very low: less than 5%. However, it is recognised that particular features of the species encountered may require that assessment to be revised, noting that data to inform these decisions can only be provided through fishing and analysis of the results.

### **Non-target, associated and dependent species**

It is largely unknown at this point exactly what other species will be encountered as by-catch. Although from previous experience GS expects the levels of by-catch to be extremely low (a very high estimate of 5% has been allowed for but it is possible and even likely that it will be considerably lower than this). The nature of these types of interactions will only be known once fishing begins as previous data from the earlier Russian fishing on these species was by trawl, where a higher incidence of by-catch would be expected but was still very low (see picture attached at Appendix 9 of the pre-sorting result of a 15 minute bottom contact trawl by a Russian vessel, where it can be observed that the incidence of fin fish by-catch is very low.).

From the experience of Chadderton in 1988 in the area the only by-catch were trumpeter, which occurred 3 or 4 traps of the 75 set and the only 1 or 2 fish per trap. So 10-20kg of by-catch compared to the 13,000+ kg of lobster caught. It should be noted that this was fishing with traps which impeded exit, unlike the traps that will be employed today.

In several decades of trap fishing, neither Chadderton, or Maring, have ever encountered bird or marine mammal interactions with traps and do not expect any in this fishery. Neither Chadderton, Cave nor Petersen noted or recall any interactions in this area during their voyages.

### **Planned Trips in Management Area**

It is intended to engage in approximately 210 days of fishing per annum, spread over the entire year and divided into approximately 7 trips of approximately 30 days duration. Should approval of this plan be given by SPRFMO it is intended to commence fishing operations as soon as practicable after the SPRFMO Commission meeting in 2018 and thereafter for the full duration of this Fisheries Operation Plan of 3 years.

## **Datasets and reporting of vessel movement and activities**

### **Datasets**

The following is the SPRFMO data standard for fishing activity by potting:

1. Data are to be collected on an un-aggregated (set by set) basis.
2. The following fields of data are to be collected:
  - (a) Vessel flag
  - (b) Vessel name
  - (c) Vessel call sign
  - (d) Registration number of vessel
  - (e) 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 design, more data will be collected. The nominated vessel is capable of reporting and electronically transmitting this information on a daily basis if necessary.

The GS will primarily undertake commercial fishing but will also complete some survey work using traps. Datasets provided by the authorisation holder to the Ministry of Marine Resources and any other relevant authority at the end of each voyage 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 MMR has appointed a person to be in sole charge of the data collection responsibilities. The name of the company in charge is Natural Resource Consultants located in Seattle, Washington and Scott Goodman has been appointed the head scientist for the project.

At the end of each trip NRC will forward a report to the Ministry of Marine Resources, Rarotonga, Cook Island summarizing catch effort, detailed maps of fished areas, summary data of depth range species were caught and numbers of retained production. In the report any discovery of VMEs will be noted as well as wildlife abundance and interactions. Scott Goodman as the Chief Scientist will also report on size distribution of the main species and develop a robust biomass model as the developed data is collected.

### **Survey traps**

In each location, two or three traps per week will be designated as survey traps. The survey traps will be adapted to retain as many deepsea marine creatures as possible by cladding the trap with fine mesh. The entire contents of the trap will be bagged and retained for onshore analysis and identification. A Survey Effort form (Appendix 8) will capture all background information relating to each trap or groups of traps. If GS encounters an area of particular interest for its biodiversity or potential commercial value, then additional survey traps maybe laid.

### **Commercial fishing Data Collection**

Data about commercial fishing will be collected daily in accordance with CMM 02-2017. There will be two daily logs:

1. A Daily Effort, Catch and Production Log to collect information about commercial or target species. The Daily Effort, Catch and Production (SPRFMO Fishing Activity Report) will capture operational information for each line of traps, or single or groups of traps will be described on

this form. As noted above, lost gear is also recorded on a line by line or trap by trap basis, similar to the CCAMLR Conservation Measures.

2. Daily Environmental Log to record discards and waste management, wildlife abundance and interactions and mitigation measures, similar to the CCAMLR Conservation Measures.

Prior to each commercial fishing event, an assessment will be made to assess 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 an adaptation of the New Zealand Ministry of Fisheries VME classification form which is in line with the SPRFMO policy. The GS does not expect to identify many such areas solely because their choice of gear and method is unlikely to make such areas discoverable.

If, in the unlikely event that significant quantities of coral or sponge are found in or attached to traps, then the vessel will move on in accordance with CMM 03-2017.

GS will also have the capability to deploy cameras to film bottom structure and benthos. These will be deployed on a regular basis, especially where new areas are being fished and the data provided to MMR.

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

The vessel and its operators will keep MMR in the Cook Islands informed of all of the vessel's activities in the Management Area. This will include notification of:

- Entry and Exit from SPRFMO waters;
- Adequate prior notice when planning a trip into SPRFMO waters;
- Adequate prior notice of where and when the vessel plans to dock after a trip in SPRFMO waters.

### **Control of Vessel**

While at sea the vessel will keep MMR fully informed of its location and current activity through VMS and direct email contact. While at sea, the Master will be responsible for the day-to-day operations of the vessel and ensuring compliance with all SPRFMO CMM and Cook Islands' requirements.

### **Reporting of Vessel Sightings**

The Master will be responsible for recording details of any other fishing vessels sighted in the 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.

## **Vessel Monitoring System**

GS will have a VMS system of an approved type aboard 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.

## **Observers**

GS will ensure that there is complete (100%) observer coverage for the first 3 years of the fisheries plan.

## **Biological Sampling**

Crustaceans representative of the main target species will be landed whole for on shore sampling.

Samples of lobster (*Jasus spp* and *Pro-jasus spp*) and crab (*Chaceon spp*) will be bagged on a species by species basis and landed at the end of the first trip. The samples bag/s 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 be sent to the Ministry of Marine Resources or their nominated agent.

Fish shall be individually wrapped, details of date, location, approximate depth, length, weight and common name will be written on waterproof paper and frozen with the sample. No less than 10 fish of the main target species will be landed after each voyage.

Additionally, any interesting species caught as bycatch and unable to be identified by the vessel will be bagged and frozen along with details mentioned above.

Species identification will rely on existing FAO material. A species list and codes for the main species is attached (Appendix 6). Additionally, GS will have aboard the following;

1. Ministry of Fisheries (2005) A guide to common deepsea 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. Other relevant publications as may be recommended or available.



## **Assessment of potential for Significant Adverse Impacts on Vulnerable Marine Ecosystems**

By using the analysis of features included in the table at Appendix 5, and only considering features which occur at above 1000m in depth, which accounts for just 36% of the fishable area, 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 fishing would contact just 0.0139%, or 139 one-hundredths of 1 percent of the assessed target areas. When the total fishable area in the chain is considered this percentage significantly reduces. Additionally, the areas in which the target species are known to occur are known to be discrete from large concentrations of deep-water corals. As such the potential for SAIs on VMEs is considered to be extremely low. However, GS will take a precautionary approach and where VMEs are encountered will record all known data and move-on in accordance with the relevant CMMs. In particular the trigger for “moving on” is likely to be observed damage to fishing gear rather than the recovery on board of coral or sponge fragments, due to the low chance of such benthos both becoming entangled in the mesh and then making it all the way to the surface. The majority, if not nearly all, of the features that GS has identified as of interest for exploratory fishing 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 features. The approach of GS will be proactive towards developing and collecting data to allow comprehensive assessments to be undertaken by the Cook Islands in the future.

## **Cumulative Impacts**

Neither GS nor MMR are aware of existing bottom fishing in the proposed areas by any method. As such because of this and the near-impossibility of setting gear in the exact same place repetitively there are not expected to be any observable cumulative effects of fishing.

## **Report Writing**

A trip summary including daily reports and VME signature information will be forwarded to the Ministry of Marine Resources, Rarotonga, Cook Islands at the completion of the trip. The GS will describe the imprint it perceives to have left in the areas it fishes

Further, the Ministry of Marine Resources, on the recommendation of GS, and recognising the limited resources of small governments has contracted with an independent scientific body, Natural Resource Consultants (NRC) located in Seattle, Washington USA. NRC will compile regular trip reports for use by MMR and SPRFMO on a monthly basis as well as 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 of the following; The development of bathymetric charts of the fished areas, catch rates/biomass assessments, discard data, size and gender relationships along with bottom temperatures, determination of food sources and what the species are consuming. NRC will also assist with fishing plans to insure robust survey sampling reports for each structure fished along with all data from the survey which would show what the operation is producing. The report will be a comprehensive analysis of the operation and will demonstrate the population densities of the species and the dynamics of the species population as the research plan is executed. NRC will also analyze the camera data recorded to assist in the evaluation

of potential VMEs and other bottom structures to better understand the type of bottom structures the targeted species concentrate to better understand the resource population dynamics.

## **Conservation & Management Measures**

### **02-2017 Standards for the Collection, Reporting, Verification and Exchange of Data**

GS will implement the requirements of this CMM. In particular, 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.

### **03-2017 Bottom Fishing in the SPRFMO Convention Area**

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

### **05-2016 Establishment of the Commission Record of Vessels Authorised 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.

### **06-2017 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, in particular the data and reporting requirements as described to facilitate the Member or CNCP Port State conducting inspections as necessary aboard the vessel.

### **09-2017 Minimising 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.

#### **10-2017 Establishment of a 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.

#### **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 endeavoured through this application and Fisheries Operation Plan to comply fully with the requirements of this CMM.

#### **Conclusion**

MMR recognises its limited resources and has indicated above that it will contract outside expertise to assist with the Scientific Analysis and Impact Assessments related to this fishery.

It is considered that because very little is known about the resource or species expected to be encountered that the only practicable way to gather data is to engage in an exploratory fishery along the lines described herein.

Cook Islands therefore requests the Scientific Committee, recognising its expertise, to consider this application carefully and to make recommendations, if necessary, for additional information or analysis, which the Cook Islands undertakes to provide to the SPRFMO Commission before it finally meets to consider this application in January 2018.

## Appendix 1

**John Chadderton****Fishing History****Fremantle, Australia**

Commenced fishing in 1964 in Australia. After qualifying as Master continued in that capacity pioneering and expanding fisheries in to Northern Australia.

1969 purchased first vessel forming Timor Shipping & Charter Co. (Position CEO) By 1975 owning three vessels covering Cargo, Ocean Salvage & Fishing.

1976 based from Singapore formed Timor International Fisheries, (Position CEO) fishing Lobster in the Southern Indian Ocean progressively developing across the vast expanses to 52Deg South.

Discovering previously unknown fisheries resources while charting the undersea terrain, providing data to Scripps Institute in addition to producing record volumes of lobster.

Expanded activities into pioneering the Aquaculture of Green Mussels (MAFCO Pte, Position CEO) to become the largest Mussel producer in the Southern Hemisphere, while adding Fish Farming and Mud Crab Production to supply international markets.

1980 formed Antarctic Fishing & Oceanographic Research Co AFORCO (Position CEO) to fish and develop new fishing opportunities across the Southern Ocean with larger and more sophisticated vessels.

Pioneered the production of and transport of Live Lobster from the Southern Ocean on the vessel directly to Japan. The new lobster discoveries changed forever the known distribution of lobsters in the region.

Pioneered the grow out of Southern Rock Lobster from Purulus stage to market size in 2.5 years.

1987 expanded research and fishing activities in to the Tasman Sea and Southern Pacific with the purchase of an additional vessel based out of New Zealand.

Revealed the presence of lobster across the Tasman and that Australian lobster phyllosoma drifted to NZ, working closely with NZ Marine Biologists and Wellington Museum on new discoveries.

Developed the Giant Spider Crab fishery 500 miles South of NZ establishing the live export to Japan, while providing a full quantitative resource survey for NZ Fisheries Dept.

Pioneered the at sea live holding of NZ Rock Lobster based in Fiordland holding 180tons, flying live to Christchurch for direct export to Japan.

Conducted a research and development fishery project for Sea Cucumber in Fiordland with the AFORCO vessel Mata-Whao-Rua.

Pioneered the discovery of highly productive Scampi resource at the Auckland Islands, NZ.

Conducted 10,000-mile fisheries research voyages East of New Zealand discovering new resources of lobster and fish, including surveying the Pitcairn Islands EEZ.

Discovered many new seamounts, another new species of lobster and expanded the known distribution of other lobster.

1993 formed Northern Australian Fisheries Pty Ltd, (Position CEO) owning a large 30,000 hook/ day auto liner to research and develop a Deepwater Red Snapper fishery in the Northern Territory, Australia.

Re-established the Northern Australian Sea Cucumber Fishery and the processing technics to frozen form, now the market form.

2002 established in partnership Bilyara Holdings Pty Ltd (Position CEO) purchasing a 33mtr vessel, converting it to a dedicated live Deepwater Red Crab and lobster vessel to research & fish the central Indian Ocean, operating from Fremantle & exporting to Japan.

2016 Research & development in partnership for a new Southern Pacific Deepwater Lobster & Crab fishery project, utilizing the most advanced technology and information progressing to the formation of Great Southern Fisheries PL and the conversion of a vessel to a dedicated trap long liner, the Great Southern.

**Mark F Maring**  
**Fishing History**  
**Portland, Oregon USA**

Mr. Maring has been working in the Fishing business for the past 40 yrs. He started his career as a deck hand on king crab vessels in Alaska. During his time fishing in Alaska he also attended Oregon State University and graduated in 1979.

After graduation Mr. Maring continued working in the fishing business and started out by building an oyster farm in Oregon, which was the basis of his senior thesis before his graduations. This business grew from only growing oysters to buying and selling several different seafood products in this region. This business expanded and once again Mr. Maring moved back to Alaska to develop this sector of the business by manufacturing black cod and halibut in areas of Alaska that were not being serviced.

In 1985 the first fishing vessel was purchased, a 54 meter crab vessel which participated in the developing snow crab fishery in the Bering Sea. From this development and over a period of years a fleet of six crab catcher vessels was developed participating in several crab fisheries in Alaska.

During this same time frame a new style vessel was built, the crab catcher processor. The first C/P was built in 1989 which allowed the development of not only larger harvesting capacity but also control of the marketing of the fishery products the company produced. Over a period of ten years the company built, converted or purchased four C/P's for the Alaskan crab fishery. The company also entered the hook and line fisheries by purchasing vessels which could not only catch but also process the catch on board. This project grew into three vessels which targeted black cod in the Aleutian Islands which had not been completely explored because of the remote location which made it hard for a straight catcher boat to operate. These small C/P vessels could reach remote fishing areas and produce a high quality products processed on board.

During the early 90's the Russian fishery started to open and Mr. Maring negotiated one of the early J/V agreement with a Russian company to use a few of the larger crab C/P's to operate in Russian waters. This operation developed into a much larger organization and the original group of three vessels was sold directly to the Russian partner. From this involvement in Russia the company developed many different operations managing Russian fleets and buying and selling additional crab C/P's from US groups to Russian partners.

Because of the move to Russia out of the Alaskan waters the company found other International opportunities to explore with a seasoned staff having the capabilities to work overseas. This developed into several different projects and also the first step into the scientific work the company completed developing new fisheries. The company conducted an exploratory black cod fishery in the Mexican Pacific Ocean deep water zone which the local fleet did not have the expertise. The company was required to work with the Government scientist in order to understand the resource most did not know existed. Because of this relationship with the Mexican Government the company also found a semi deep water crab that was not known at the time the company discovered. This project turned into a couple of vessels and a processing plant on shore to develop the market for this product. Both of these project required a close relationship with the scientific community knowing the resource was not well known which gave the company great experience working in this field.

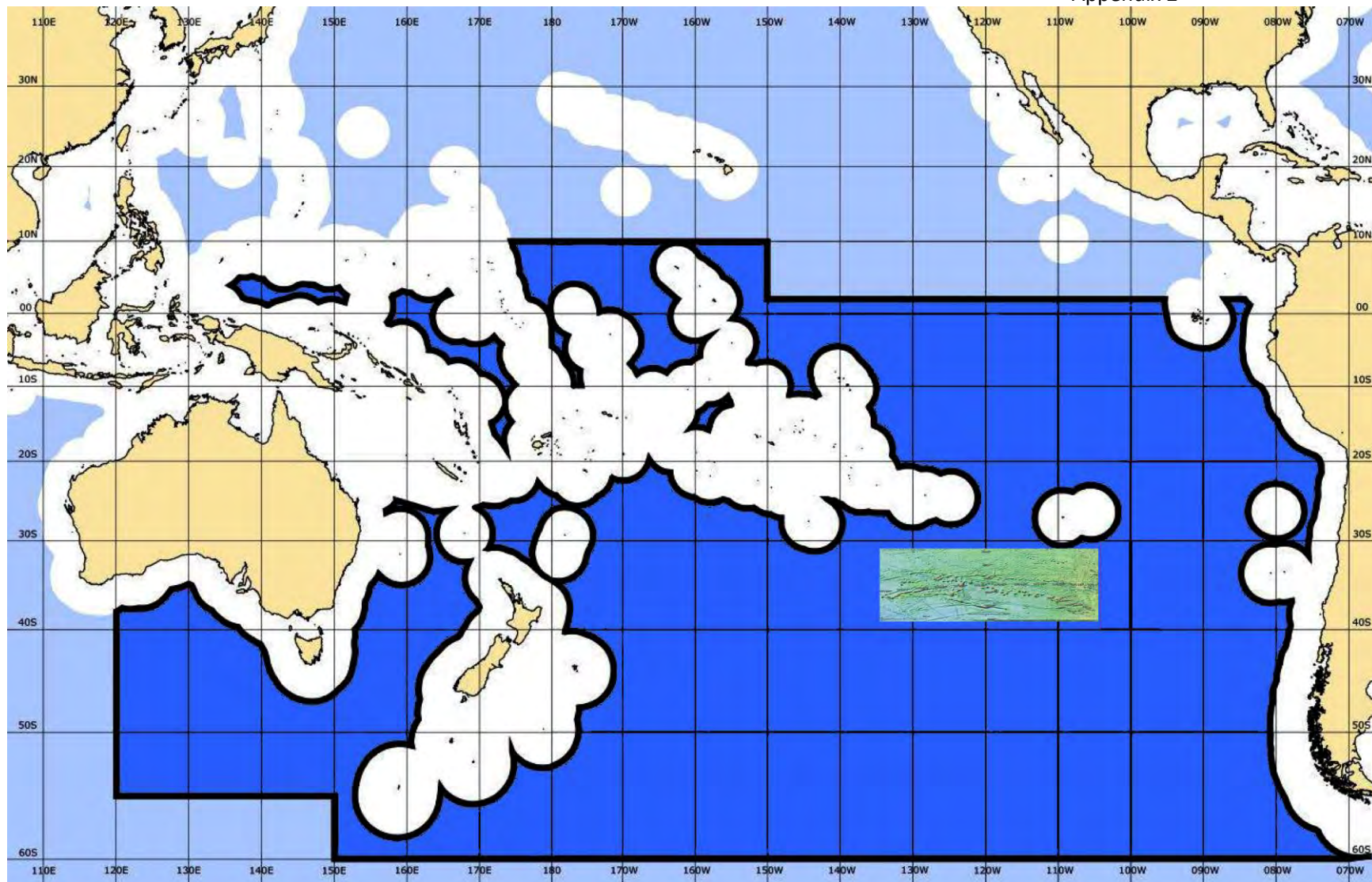
The company also was involved with the developing the snow crab fishery in Greenland by taking one of the Russian built vessels the company owned and relocating that vessel from the Russian Far East to Greenland. Again the company had experience in oversea fishing operations and the development of the fishery was completed.

In early 2003 Mr. Maring engaged in a scientific project in Alaska targeting snow crab research. There had always been some concerns in the way the Alaska snow & king crab fisheries were being evaluated to determine the harvest rates and the condition of the stocks. Along with a few other concerned partners they formed a group and started what is known today as the Bering Sea Research Foundation. This is the largest joint Government and industry scientific group in the USA and has a great track record working with Government bodies at the State and Federal levels. The Foundation today enjoys a great working relationship with most Government bodies and conducted some very important work in the field of crab science.

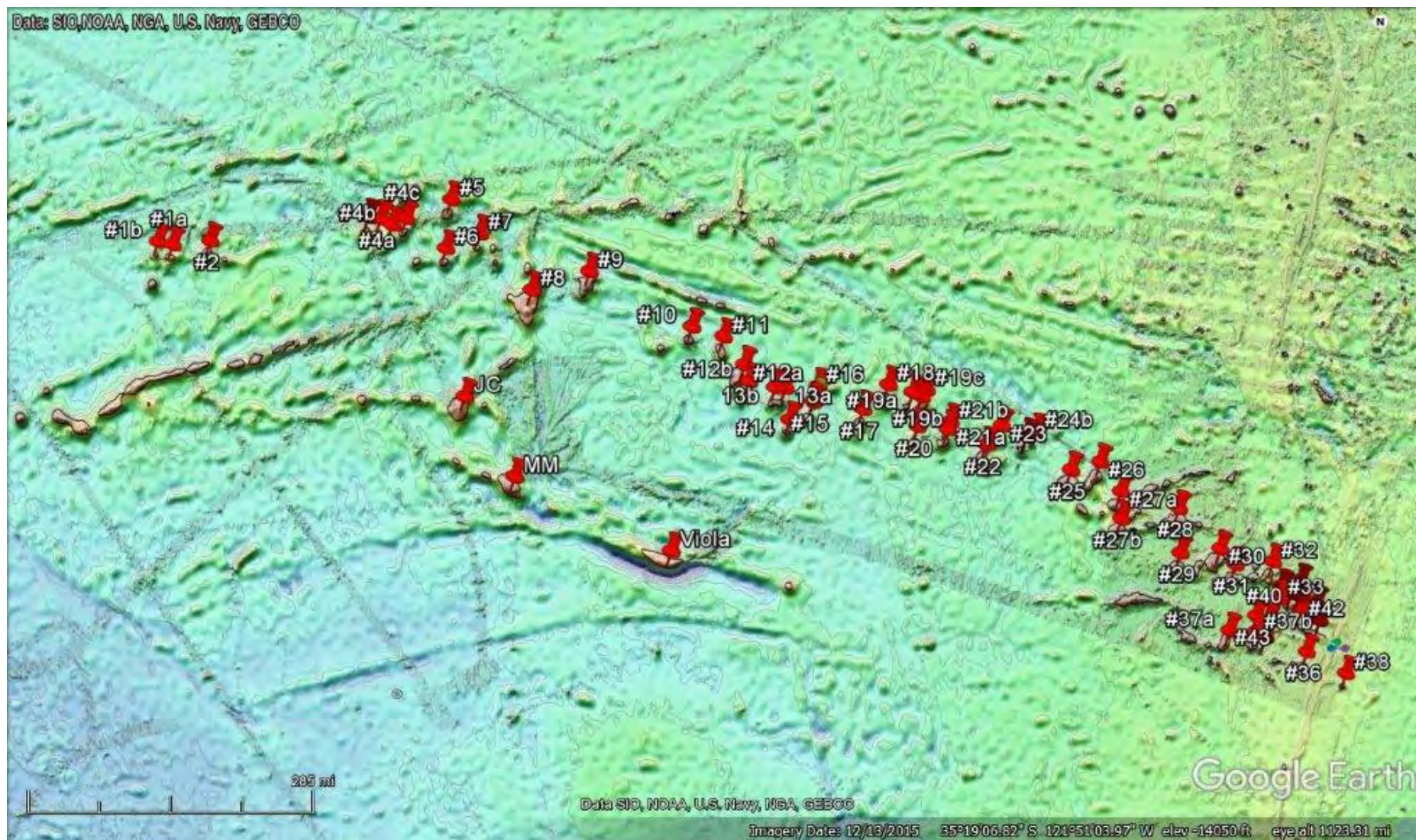
Around 2009 Mr. Maring engaged in a plan to develop a relatively unknown king crab stock in Argentina. This project involved working with the Government scientist in Argentina to confirm the base line of the stock and developed a two vessel fleet comprised of two 54 meter C/P's to operate in this fishery. This operation has performed well and the fishery seems to be stable and growing as the markets for these products have become internationally known.

As an overview Mr. Maring has been involved in fisheries, from Alaska, Russian Far East, Mexico, Greenland, Norway and Argentina during his career developing fisheries working with Government bodies and scientific partners. The operation was mainly focused on bottom trap fishing with some long line fishing, but the main direction has been in bottom trap fishing.

Appendix 2









Appendix 3



## Appendix 4

***Pro-Jasus spp* Lobsters**

The genus is represented by two species (*P. parkeri* and *P. bahamondei*), each living in widely separated regions of the Southern Ocean. It should be highlighted that both species of this genus have a circumpolar Antarctic distribution, between 15°S and 48°S. The spiny lobsters (family Palinuridae) possibly invaded the deep-sea from shallower rocky reef areas and then radiated, suggesting a southern hemisphere origin for the group. Subsequent diversification appears to have been driven by the closure of the Thethys Sea and the formation of the Antarctic Circumpolar Current (Tsang *et al.*, 2009; Palero *et al.*, 2009).

*P. parkeri* has been reported in the Atlantic Ocean: South-West Africa (Stebbing, 1902, 1910); Indian Ocean: south-east Africa and St. Paul Island; Pacific Ocean: southeastern Australia and New Zealand; at depths of 370 to 880 m.

Geographical distribution: this species is abundant on submarine ridges, especially east of Peru (Prosvirov, 1990; Rudjakov *et al.*, 1990; Parin *et al.*, 1997) where it has been commercially fished by industrial vessels (Parin *et al.*, 1997; Arana & Venturini, 1991). It is also found around the Desventuradas Islands and the Juan Fernández Archipelago (Dupré, 1975; George, 1976; Retamal, 1981, 1994; Andrade, 1985; Báez & Ruiz, 1985; Retamal & Arana, 2000; National Geographic-Oceana, 2014) and in the O'Higgins Seamount (39°55'S, 73°52'W), off the central coast of Valparaíso, Chile (Báez & Weinborn, 1983). This lobster was also recorded in the Juan Fernández ridge during exploratory fishing operations for orange roughy (*Hoplostetus atlanticus*), but was misclassified as *Sclerocangron atrox* (Lillo *et al.*, 1999).

The presence of *P. bahamondei* is wide spread, being registered sporadically in areas adjacent to the Chilean continental coast, approximately between Huasco (28°28'S) and Constitución (35°20'S) (Andrade & Baez, 1980; Andrade, 1987; Retamal, 1981, 1994) (Fig. 4), being caught mainly in trawl fishing operations targeting nylon shrimp (2008), the frequency of occurrence for the Chilean jagged lobster in 29 evaluation cruises for demersal crustaceans off the central Chilean coast was 27.6%.

Depth distribution: of this species has been recorded at depths between 225 and 2300 m Chilean jagged lobsters have been captured at depths on the South American continental slope the bathymetric range of this species is between 175 and 2300 m

**Environment**

Bottom morphology: of the dorsal or submarine Ridges constitute the most highlighted southwestern Pacific prominence. This ridge is made up of numerous seafloor elevations, extending towards the southeast-northeast for about 1100 km and is 200 km wide, being subducted under the South American plate off the coast of Peru. It includes several seamounts differing greatly in form, summit depth, degree of isolation and oceanographic conditions (Parin *et al.*, 1997). This ridge attaches to the Salas y Gómez Ridge, at around 83°W, running east to west up to the junction with

East Pacific dorsal, with Easter Island (27°08'S, 109°25'W) and Salas y Gómez Island (26°27'S, 105°28'W) as emerging peaks near the Nazca Ridge, are the Desventuradas Islands

The Nazca Ridge is of volcanic origin, by effect of eruptions recorded in the Easter hotspot and the displacement of the oceanic plate moving eastward at a speed of about 10-18 cm yr<sup>-1</sup>. The presence of this ridge divides the ocean floor in two basins; the Peruvian basin and the Chilean basin.

A detailed description of the seamounts is provided in this submission. According to Parin et al. (1997), the summits of the Nazca ridge seamounts show remnants of coral atolls,

suggesting that after the Miocene, these summits would have been 300-375 m higher than at present, so that many of the peaks would have formed islands. At present, several of these mountains possess the shape of guyots with vast flat summits, possibly caused by abrasion during the sinking process. In the central part of the ridge some of the mountains have summits at depths of 240-500 m and other at depths of 850-950 m, with depths of over 3500 m between them.

Based on the experience accumulated in fishing operations conducted on these mountains (Arana & Soto, 1994), it has been determined that the distribution of the Chilean jagged lobster is concentrated mainly on the edges of the guyots and their outer slopes towards greater depths, and not in the center of the plateaus where abundances proved to be significantly lower.

The Juan Fernández ridge consists of a long, narrow chain of seamounts of volcanic origin that extending perpendicular to the coast of South America, from about 84°W to the O'Higgins Seamount nears the edge of the Chilean Trench, somewhat north of Valparaíso (Chile) (Vergara & Morales, 1985). Emerging seamount summits of this ridge are the islands of Robinson Crusoe (33°37'S, 78°50'W), Santa Clara and Alejandro Selkirk (33°45'S, 80°45'W). The average depth of the seabed around this ridge is 4025 m, but some peaks rise up to depths of 225 to 425 m from the sea surface.

Some of these seamounts present a reduced summit, with one or two peaks, while others present a mild depression towards their center denoting the presence of ancient craters, followed by abruptly declining slopes which descend to the ocean floor (~ 4000 m).

The continental slope of South America exhibits characteristics of a subduction zone, with a narrow continental shelf and a steep slope descending to the Peru-Chile trench. The continental shelf and continental slope have a generally flat bottom with muddy sediments. Nevertheless, in certain places, there are irregular structures and slab formations that make it unfeasible to conduct bottom trawling. These places could possibly produce settlements of *P. bahamondei puerulus*, which would allow the development of this species in specific locations along the continental border.

Oceanographic conditions: in the southeastern

Vertical distribution

The vertical distribution and migratory behavior of the Chilean jagged lobster were investigated by way of visual observation from a Russian submarine. The vertical distribution of lobsters was determined on the basis of water oxygen concentration (Pakhorukov et al., 2000). The authors

observed uniform abundances of *P. bahamondei* at the top of the mountains, with the occasional presence of higher density local clusters, while this crustacean was found in more dispersed quantities on the continental slope.

As previously indicated, the summits of the guyots are bathed by the Peruvian Counter current (STW). When this current is intense, dissolved oxygen concentration may decrease up to 0.14 mL L<sup>-1</sup>, whereas when this current is

#### Species composition of the benthic community and ecosystem

Despite investigations conducted by U.S., Japanese, Russian (Parin et al., 1997) and Chilean ships the area of the South Eastern Pacific Ridge is still poorly studied and the composition of its fauna requires further analysis.

The catch (in weight) from traps deployed on the summits and slopes of the central seamounts of this ridge tends to be composed exclusively of Chilean jagged lobsters, whereas if the traps are deployed at greater depths (e.g., on the seamount slopes), golden crabs (*Chaceon chilensis*) constitute a higher proportion of the catch.

In the Desventuradas islands and Juan Fernández Archipelago the lobster *Jasus frontalis* is exploited by artisanal fisheries by means of traps deployed at depths of 0-200 m. In the former islands lobster extraction is a sporadic activity, whilst in the latter islands it is a permanent activity.

Due to the distribution of this species in the Southeastern Pacific, it is probable that phyllosomas are present in a vast area of this ocean, which is characterized by the existence of numerous eddies and various surface and subsurface currents. This would explain the possibility of settlements in places with appropriate floor depths and oceanographic conditions suitable for the habitation of this lobster far distant to the West on the Foundation Sea Mount Chain.

The Juan Fernandez crab (*Paromola rathbuni*) is distributed between 100 and 300 m and, below that depth, possibly down to 2000 m, the golden crab (*Chaceon chilensis*) (Retamal & Arana, 2000). Chilean jagged lobsters are occasionally caught while fishing for golden crab or on those occasions when lobster traps are set deeper than usual.

An industrial fishery for benthonic crustaceans by means of bottom trawls exists along the Chilean continental coast, between Huasco and Constitución. This fishery targets yellow squat lobsters (*Cervimunida johni*), red squat lobsters (*Pleuroncodes monodon*) and nylon shrimps (*Heterocarpus reedi*), although at greater depths, red royal shrimps or "gambas" (*Haliporoides diomedae*) and razor shrimps or "camarones navaja" (*Campylonotus semistriatus*) are also caught.

However, when trawling is conducted near slab stone or rocky seafloor, *P. bahamondei* specimens appear in the catch.

In fishing explorations for Chilean jagged lobster conducted off the coast of Valparaíso using Fathom Plus traps, the most abundant crustaceans in the by-catch were king crabs (*Glyptolithodes cristatipes*), nylon shrimps, spider crabs (*Libinia emarginata*) and deep-sea hairy crabs (*Trachycarcinus hystricosus*) (Arancibia, 2001).

## Biomass

According to Pakhorukov et al. (2000) the total biomass of *P. bahamondei* just on the Nazca ridge alone may range between 8,000 and 10,000 ton, providing a basic biomass around  $84 \pm 44$  kg ha<sup>-1</sup>.

The data used to estimate the biomass was from an experimental commercial fishing operation conducted over 6 months of fishing time. In the above-mentioned period, 187,669 traps were deployed with an average of 706 traps day<sup>-1</sup>. Of this total, with an average of 28,000 trap per month.

Within 6 months of actual production of Chilean jagged lobster reached 354.8 ton.

Upon analyzing the monthly catch per unit of effort (CPUE) it was determined The overall average CPUE for the period was 1.8kg per trap per day but peaking at periods to 2.7 kg trap<sup>-1</sup>, with frequent catches of 30-50 lobsters per trap.

In both areas the biomass was greater immediately over the western slopes of seamounts, probably because of local upwelling.

Bottom invertebrate communities of the seamount summits are characterized by strong dominance of a few species. At depths less than 400 m the spiny lobster *Projasus bahamondei* is dominant to the east. At greater depths shrimps are most abundant, in various combinations.

Bottom invertebrates were obtained on 22 seamounts at depths from 162 to 1900 m (Mironov and Detinova, 1990). One hundred and thirty samples of bottom invertebrates were collected; of these 54 samples were taken with shrimp otter-trawls, 39 with Sigsbee (Agassiz) trawls, 24 with baited traps, eight by bottom grabs and five by geological dredges.

Most stations were located on the flat tops of the guyots. Altogether more than 350 fish samples were collected, mainly by bottom trawls, from 22 seamounts, depths from 160 to 1600-2000 m. As in the case of bottom invertebrates, most samples were taken on the flat tops of guyots at depths of 160-580 m.

In seven out of the 37 most successful hauls the spiny lobster *Projasus bahamondei* strongly dominated by weight. These catches were obtained on the tops or upper slopes.

One group of widely distributed communities dominated by spiny lobsters, over 450 m. The communities also changed with increased depth: from dominance by spiny lobsters and shrimps, at depths of 350-400 m.

The composition of baited trap catches also demonstrates a change with the geographic position of a seamount (Mironov and Detinova, 1990) (Figure 3). The traps caught many spiny lobsters *Projasus bahamondei* and crabs *Chaceon chilensis* while further west catches consisted mostly of the crab

To evaluate the degree of stability in the size-weight structure of the populations of spiny lobster *Projasus bahamondei*, comparisons were made between sets of data obtained during September–October, 1980, February, 1982 and April, 1987 (Rudjakov et al., 1990). It was found that populations inhabiting the summits of seamounts consisted of animals of two size-weight groups, one approximately twice the weight of the other and 1.2–1.4 times as long. These two groups were treated as two subsequent stages in the moulting cycle.

#### Seasonality in lobster reproduction

It is possible that during February to April (the sampling period in 1982 and 1987) most lobsters have not yet reached the age of the animals in the dominant size group in October, 1980 (Rudjakov et al., 1990).

These modal sizes may correspond to possibly reaching maturity in 3 to 5 years, respectively

In this study no evidence was found of genetic isolation of lobster populations on individual seamounts and the authors concluded that the pelagic larval stage in *P. bahamondei* is long enough to overcome the distances between neighbouring

seamounts. This accords with existing data on the larval biology of related lobster. The communities of bottom invertebrates classified according to dominant taxa, carnivores, such as spiny lobsters *Projasus bahamondei*

Feeding in this group of animals requires further investigation.

Fedorov and Chistikov (1985), have shown that carnivorous animals form up to 99.9% of the biomass in the bottom communities on the summit of the Seamounts. To account for such a strong predominance of benthic consumers the following sequence of cause-and-effect features was proposed: the formation of quasi-stationary eddies over the summit, enhancement of productivity in these eddies, a high abundance of macroplankton and mesopelagic fish in the deep scattering layer (DSL), the concentration of macroplankton and pelagic fish in the vicinity of the bottom during the daytime descent of the DSL on to the flat top of the seamount, consumption of the DSL animals by demersal and benthopelagic fish, and consumption by the spiny lobsters of the remains of fish food.

Knowledge of the hydrodynamics and biology of the waters surrounding the Seamounts seems to support the ideas of Fedorov and Chistikov (1985). Current-topography interactions, including formation of eddies, local upwelling and closed circulation patterns called Taylor columns, are well known in various areas of the World Ocean and have a profound impact on seamount ecosystems (Darnitsky, 1979; Darnitsky et al., 1986; Boehlert and Genin, 1987; Boehlert, 1988). Over the Seamounts, stationary cyclonic and anticyclonic eddies identified as Taylor columns have been reported and the biomass of plankton near the western slopes of the mount was found to be two to three times higher than at a distance from the seamount (Grossman, 1978; Amarov and Korostin,

1981; Kolodnitsky and Kudryavtsev, 1982; Fedorov and Chistikov, 1985; Gevorkyan et al., 1986). The “settling” of the DSL on the summits has been observed on south-east Pacific seamounts.

Finally, the lower limit of the distribution of *P. bahumondei* on this seamount coincided with the daytime position of the DSL and the stomachs of these spiny lobsters contained the remnants of DSL animals, such as squids, shrimps and gonostomatid fishes (Fedorov and Chistikov, 1985). Thus, the prevalence of carnivores on the summit of these Seamounts is likely to be the consequence of the enhanced productivity of surrounding waters (Fedorov and Chistikov, 1985; Fedorov, 1990).

This interest in the biota of seamounts has several causes. One is that unusually dense concentrations of valuable fishes and invertebrates of great commercial importance are found on some seamounts. This richness is thought to be related in part to the occurrence of baroclinic perturbations above and around underwater rises (e.g. Hubbs, 1959; Borets and Kulikov, 1986; Uchida et al., 1986; Rogers, 1994)

Some seamounts are rare examples of relatively closed ecosystems in the open ocean whose populations have developed sophisticated adaptations to withstand the risk of propagules being lost by the currents (Rudjakov and Tseitlin, 1985; Parker and Tunnicliffe, 1994). Another reason for interest in seamounts, especially to biogeographers, is the great diversity of seamounts in summit depths, geomorphological features and degree of geographic isolation. The endemism of the fauna of some seamounts or underwater ridges is very high in comparison with other marine areas of the same size (Newman and Foster, 1983; Mironov, 1985b, 1994).

**Appendices 5, 6 & 7** – please see attached tables.



## Appendix 8

**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		3
CNIDARIA					
Anthozoa (class)					3
Alcyonacea (order)	SOC	Soft and runner corals	1		
Gorgonacea (oder)	GOC	Sea fans, sea whips	1		3
Scleractinia (order)	SIA	Stony corals	30		3
Antipatharia (order)	COB	Black corals	1		3
Pennatulacea (order)	PTU	Sea pens			1
Actiniaria (order)	ANT	Anemones			1
Hydrozoa (class)	HDR	Hydrochorals, stylasterids	6		3
ECHINODERMATA					
Crinoidea (class)	CRI	Feather stars			1
Brsingida (order)	BRG	Armless stars			1
Diversity Index					
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.					
Total VME score					

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 move 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 bycatch 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 at a later date.
- 6) At the end of trip provide the data to the Ministry of Marine Resources, 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:

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

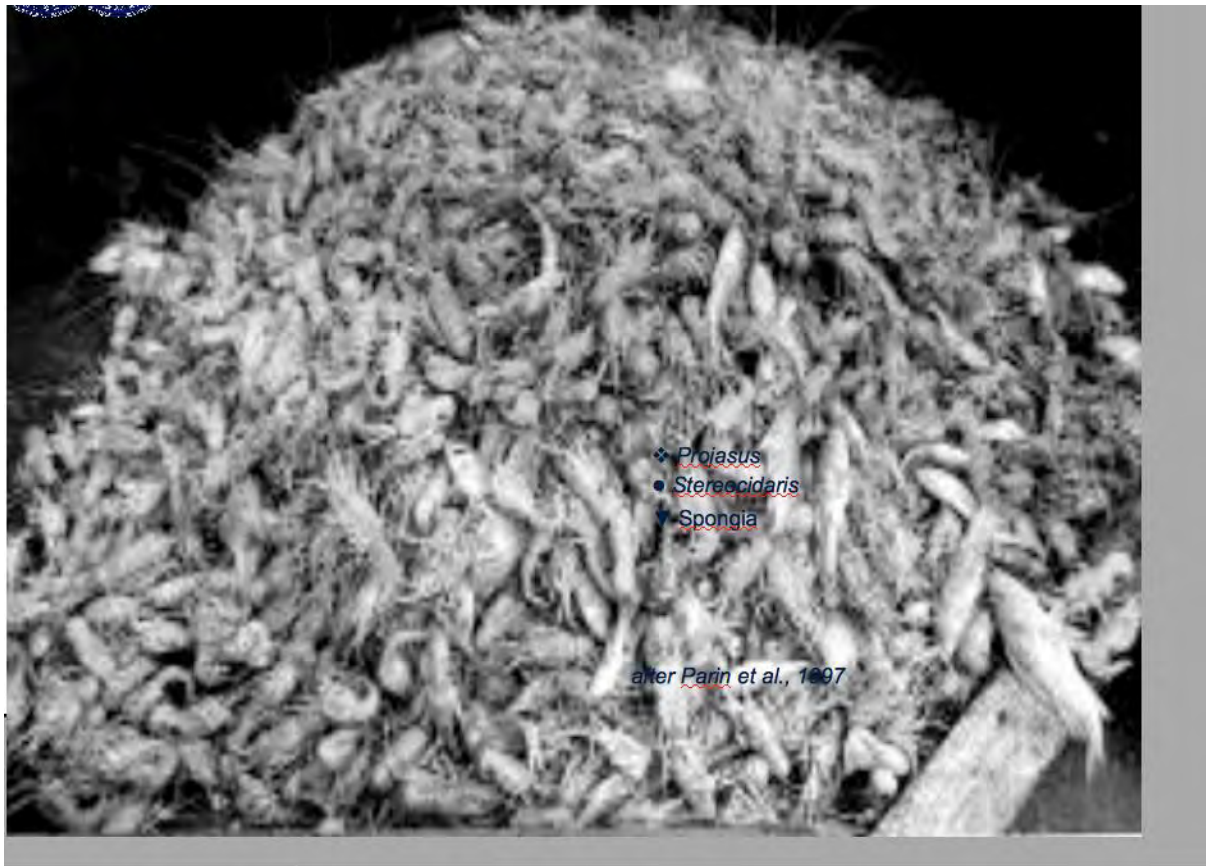
If samples or subsamples are retained, the following instructions should be followed.

### 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 9



Appendix 10

Please see attached Schematic of the vessel

## Foundation Seamount Calculations

Seamount No.	Seamount	Depth Range	Length Miles	Width Miles	Sq/Miles A 0-400M	B 400-600M	C 600-1,000	D 1,000-2,000	Description	Comments
1. #1A	Ampere a	1,500-2,000	6.00	3.00				18	2 Circular Structures	Scattered Cones
2. #1B	Ampere b	1,400-2,000	10.00	4.00				40	Linear Structure	Scattered Cones
3. #2	Archiminds	1,260-2,000	10.00	3.00				30	Linear Structure	Flat Uneven Summit
4. #3	Aristotelis	1,340-2,000	6.00	3.00				18	Linear Structure	Flat Summit
5. #4a	Avogadro a	1,460-2,000	6.00	4.00				24	Linear Structure	Flat Summit
6. #4b	Avogadro b	1,780-2,000	4.00	2.50				10	Linear Structure	Flat Summit
7. #4c	Avogadro c	1,060-2,000	7.00	4.00				28	Linear Structure	Steps on Flank
8. #5	Becquerel	600-1,000	6.00	4.50			27		Circular Structure	Flat Summit
		1,000-2,000	22.00	3.00				66	Circular Structure	Sharp Basement Line
9. #6	Bohr	1,060-2,000	8.00	6.00				48	Circular Structure	Smooth Flanks
10. #7	Bouguer	1,860-2,000	1.00	1.00				1	Elongated Volcanic Cones	Southern Flank
11. #8	Buffon	400-600	13.50	3.50		47			N-S Elongated Structure	Scattered Cones
		600-1,000	40.00	2.00			80		N-S Elongated Structure	Sharp Basement Line
		1,000-2,000	45.00	4.00				180	N-S Elongated Structure	
12. #9	Celsius	400-600	5.00	5.00		25			Star-like Structure	Flat Summit
		600-1,000	27.00	3.00			81		Star-like Structure	Gentle Slopes
		1,000-2,000	30.00	1.00				30	Star-like Structure	
13. #10	Curie	400-600	2.00	1.00		2			Seamount Structure	Flat Summit
		600-1,000	8.00	1.50			12		Seamount Structure	Smooth Basement Line
		1,000-2,000	8.00	1.00				8	Seamount Structure	
14. #11	Da Vinci	1,000-2,000	14.00	6.00				84	Conical Elongated Structure	Summit Cones, Gentle Slope
15. #12A	Darwin a	300-400	10.00	5.00	50				Elongated Structure	Flat Summit Plateau
		400-600	20.00	2.00		40			Elongated Structure	No Basement Line
		600-1,000	22.00	1.00			22		Elongated Structure	No Basement Line
		1,000-2,000	25.00	2.00				50	Elongated Structure	
16. #12B	Darwin b	1,000-2,000	5.00	5.00				25	Conical Structure	Summit Cones
17. #13a	Einstein a	600-1,000	2.00	2.00			4		Elongated Conical Structure	Summit Cones, Gentle Slopes
		1,000-2,000	18.00	2.00				36	Elongated Conical Structure	
18. #13b	Einstein b	1,340-2,000	6.00	6.00				36	Elongated Conical Structure	Summit Cones, Gentle Slopes
19. #14	Fahrenheit	940-2,000	4.50	4.50				20	Conical Structure	Sharp Borders
20. #15	Faraday	860-2,000	6.00	6.00				36	Conical Structure	Summit Cones
21. #16	Fermi	840-2,000	2.00	2.00				4	Conical Structure	Elongated Summit
22. #17	Fleming	600-1,000	4.00	4.00			16		Conical Structure	Circular Flat Summit
		1,000-2,000	20.00	3.00				60	Conical Structure	Smooth Basement Line
23. #18	Galilei	400-600	4.00	4.00		16			Conical Structure	Circular Flat Summit
		600-1,000	20.00	1.00			20		Conical Structure	Smooth Borders
		1,000-2,000	20.00	2.00				40	Conical Structure	
24. #19A	Herschel a	1,040-2,000	4.00	4.00				16	Conical Structure	With Fift Zones
25. #19B	Herschel b	1,000-2,000	8.00	8.00				64	Conical Structure	With Rift Zones
26. #19C	Herschel c	920-2,000	6.00	6.00				36	Conical Structure	With Rift Zones
27. #20	Hippocrate	600-1,000	4.00	4.00			16		Conical Structure	Gentle Slopes
		1,000-2,000	16	4				64	Conical Structure	
28. #21A	Hubble a	600-1,000	4.00	2.00			8		Elongated Structure	3 Summits, Gentle Slopes
		1,000-2,000	22.00	2.00				44	Elongated Structure	
29. #21B	Hubble b	840-2,000	6.00	4.00				24	Elongated Structure	3 Summits, Gentle Slopes

30. #22	Humboldt	400-600	2.00	2.00	4	28	52	Circular Structure	Flat Summit	
		600-1,000	14.00	2.00				Circular Structure	Smooth Borders	
		1,000-2,000	26.00	2.00				Circular Structure		
31. #23	Jenner	300-400	2.00	2.00	4	6	20	Elongated Structure	Flat Summit	
		400-600	6.00	1.00				Elongated Structure	Gentle Slopes	
		600-1,000	10.00	2.00				Elongated Structure	Smooth Basement Line	
		1,000-2,000	14.00	2.00			28	Elongated Structure		
32. #24a	Kelvin	600-1,000	1.00	1.00	12	32	90	Conical Structure	Elongated Summit	
		1,000-2,000	3.00	3.00				9	Conical Structure	Elongated Summit
33. #24b	Kepler	1,400-2,000	2.00	2.00				4	Circular Structure	Flat Summit
34. #25	Kopernik	180-400	4.00	3.00	32	90	64	Circular Structure	Scattered Cones	
		400-600	16.00	2.00				Circular Structure	Gentle Slopes	
		600-1,000	30.00	3.00				Circular Structure		
		1,000-2,000	32.00	2.00			64	Circular Structure		
35. #26	Lavoisier	400-600	6.00	6.00	36	20	60	Circular Structure	Flat Summit	
		600-1,000	20.00	1.00				Circular Structure	Smooth Basement, Lateral Cones	
		1,000-2,000	30.00	2.00				Circular Structure		
36. #27A	Linne a	600-1,000	6.00	6.00	16	28	72	Flat Summit Structure	Gentle Slopes	
		1,000-2,000	28.00	4.00				112	Flat Summit Structure	Gentle Slopes
37. #27B	Linne b	400-600	4.00	4.00				Circular Structure	Flat Summit	
		600-1,000	14.00	2.00	38	30	120	Circular Structure	Uneven Slopes, Rifts Zones	
		1,000-2,000	18.00	4.00				Circular Structure		
38. #28	Mendel	400-600	8.50	4.50				Elongated Structure	Flat Summit	
		600-1,000	30.00	1.00	12	24	50	Elongated Structure	Broad Volcanic Area	
		1,000-2,000	40.00	3.00				Elongated Structure		
39. #29	Mendeleiev	400-600	4.00	3.00				Circular Structure	Flat Summit	
		600-1,000	12.00	2.00	30	20	90	Circular Structure	Gentle Slopes	
		1,000-2,000	25.00	2.00				Circular Structure		
40. #30	Mercator	400-600	5.00	6.00				Elongated Structure	Flat Summit	
		600-1,000	20.00	1.00	5	10	60	Elongated Structure	Lateral Cones, Smooth Basement Line	
		1,000-2,000	30.00	3.00				Elongated Structure		
41. #31	Newton	400-600	3.00	1.50				Elongated Structure	Flat Summit	
		600-1,000	10.00	1.00	4	8	64	Elongated Structure	Broad Volcanic Area	
		1,000-2,000	20.00	3.00				Elongated Structure		
42. #32	Ohm	600-1,000	2.00	2.00				Circular Structure	Flat Summit, Broad Volcanic Area	
		1,000-2,000	20.00	2.00	4	40	16	Circular Structure		
43. #33	Pascal	1,160-2,000	3.00	3.00				Polygonal Structure	Gentle Slopes	
44. #34	Pasture	1,300-2,000	4.00	4.00				Circular Structure	Polygonal Shape	
45. #35	Pauling	1,600-2,000	15.00	2.50	4	8	64	Three Structures	Flat Summit, Two Craters	
46. N. Ridge	N. Ridge	1,500-2,000	12.00	3.00				Elongated Structure	Volcanic Ridge, Flat Summit, 6+ Cones	
47. #36	Planck	1,440-2,000	10.00	4.00				Elongated Structure	Flat Summit, Gentle Slopes	
48. #37a	Platon	300-400	2.50	1.50	4	8	64	Flank Structure	Rift Zone	
		400-600	4.00	2.00				Flank Structure	Rift Zone	
		600-1,000	16.00	4.00				Flank Structure	Rift Zone	
		1,000-2,000	24.00	6.00	9	28	9	Flank Structure	Rift Zone	
49. #37b	Richter	980-1,000	8.00	6.00				Elongated Structure	Flat Summit, Gentle Slopes	
50. #38	Rutherford	1,180-2,000	10.00	3.00				Circular Structure		
51. #39	Schrodinger	1,420-2,000	5.00	2.00	9	28	9	Polygonal Structure	Flat Plateau, Gentle Slopes	
52. #40	Volta	2,340/up	3.00	3.00				Circular Structure	Elongated Summit, Conical Shape	
53. #41	Watt	1,580-2,000	7.00	4.00				Polygonal Structure	Flat Summit, two higher areas	
54. #42		1,400-2,000	3.00	3.00				Polygonal Structure	Flat Summit, Gentle Slopes	

55. S. Ridge	S. Ridge	1,500-2,000	30.00	5.00			150		Elongated Structure	Flat Summit W/Crater & Gentle Slopes
56. #43		1,460-2,000	6.00	3.00			18		Polygonal Structure	Flat Summit W/Crater
57. #44		2,160/up	2.00	2.00			4		Elongated Structure	Flat Summit, Polygonal Shape
58. New #1	JC	400-600	6.00	6.00		36			Elongated Structure	
		600-1,000	9.00	6.00			54		Elongated Structure	
		1,000-2,000	33.00	3.00				99	Elongated Structure	
59. New #2	MM	150-400	9.00	6.00	54				Elongated Structure	Flat Summit with Cones
		400-600	12.00	2.00		24			Elongated Structure	
		600-1,000	24.00	1.00			24		Elongated Structure	
		1,000-2,000	36.00	2.00				72	Elongated Structure	
60. New #3	Viola	600-1,000	7.50	3.00			23		Elongated Structure	Flat Summit
		1,000-2,000	21.00	7.50				158	Elongated Structure	
Total Sq/Miles					124	377	980	2,600		
Total Sq/Km					321	976	2,537	6,735	10,568	

% of Area	3.03%	9.24%	24.00%	63.72%	100.00%
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**Foundation Fishing Summary**

Operator Name	Description	John Chadderton	Joe Cave	Jim Petersen	Total
<b>Year Fished Foundation</b>	<b>Year Fished</b>	<b>1988</b>	<b>1992</b>	<b>1995</b>	
1. Number of Pots Fished		15	50	120	<b>185</b>
2. Number of Days Fished		5	16	22	<b>43</b>
3. Number of Pots hauled		75	400	1,320	<b>1,795</b>
4. Number of pots hauled per/day		15	25	60	<b>100</b>
5. Lobster Catch (Tails)	<b>M/T</b>	4.50	6.60	19.80	<b>30.90</b>
6. Total Live Lobster Production	<b>KG</b>	13,636	20,000	60,000	<b>93,636</b>
7. Average Production per/pot	<b>LBS</b>	401	110	100	<b>115</b>
8. Average Production per/pot	<b>KG</b>	182	50	45	<b>52</b>
9. Production per/pot	<b>Weighted Average</b>	26.48	10.68	29.13	<b>66.28</b>
10. Average Size of Lobsters	<b>Weighted Average</b>	1,500	1,667	1,500	<b>1,536</b>
11. Number of Lobsters per/pot		121	30	30	<b>34</b>
12. Number of Lobsters per/pot	<b>Weighted Average</b>	17.65	6.41	19.42	<b>43.48</b>
13. Total Number of Lobsters		9,091	12,000	40,000	<b>61,091</b>
14. Percentage of Catch		<b>14.56%</b>	<b>21.36%</b>	<b>64.08%</b>	<b>100.00%</b>
<b>15. Bottom Contact</b>	<b>Sq/Meters</b>	<b>150</b>	<b>500</b>	<b>1,650</b>	<b>2,300</b>
<b>16. Pot Size</b>	<b>Sq/Meter Per/Pot</b>	<b>2</b>	<b>1.25</b>	<b>1.25</b>	<b>1.28</b>
<b>17. Catch Per/Meter</b>	<b>10</b>	<b>606</b>	<b>240</b>	<b>242</b>	<b>266</b>



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

[illegible]



# M.S. GREAT SOUTHERN GENERAL ARRANGEMENT

PRINCIPAL PARTICULARS	
LENGTH OVER ALL	70.18 m
LENGTH REG.	62.20 m
LENGTH BET. P.P.	60.10 m
BREADTH MLD	10.60 m
DEPTH MLD	4.25 / 10.0 m
DRAFT MLD DESIGNED	4.15 m
GROSS TONNAGE	243 t
MAIN ENGINE	1-Set diesel 1800 PS
SERVICE SPEED	13.4 kn
CAPACITY	
FISH HOLD (Bale)	1108.78 m³
FUEL OIL TANK	161.37 m³
FRESH WATER TANK	10.20 m³
LUB. OIL TANK	16.31 m³
COMPLEMENT	25 P

図面来歴

1. 11. 30  
SNO 1351  
当社に於て調製す

FRESH WATER TANKS				
ITEM	LOCATION	VOLUME	CENTER OF GRAVITY	
NAME	FRAME NO. SIDE	(m³)	LOG (m)	VCG (m)
F. W. T.	8-13 P	15.10	23.64	3.69
F. W. T.	8-13 S	15.10	23.64	3.69
TOTAL		30.20		
OFFSHORE	7-8 P	2.20	25.51	4.01
OFFSHORE	7-8 S	2.20	25.51	4.01
TOTAL		4.40		

SLUDGE TANKS				
ITEM	LOCATION	VOLUME	CENTER OF GRAVITY	
NAME	FRAME NO. SIDE	(m³)	LOG (m)	VCG (m)
SLUDGE T.	15-23 P	4.82	16.23	1.01

SMALL TANKS				
ITEM	LOCATION	VOLUME	CENTER OF GRAVITY	
NAME	FRAME NO. SIDE	(m³)	LOG (m)	VCG (m)
F. O. G. T.	7-8/4 C	0.99	25.41	5.85
L. O. T.	7-8/4 C	0.42	25.40	6.27
R. O. T.	7-8/4 C	0.42	25.40	5.37
E. O. T.	7-8/4 C	0.62	25.40	5.82
CHILLER COOLING WATER	15-16 C	0.33	20.65	7.75
CHILLER COOLING WATER	39/4-40 C	0.09	6.18	8.62
W.D. O. T.	94/4-95/4 S	0.46	-27.25	5.70
BOW T. O.P. AND O.T.	95/4-96 S	0.04	-27.37	6.47
W.D. O. STOR. T.	100/4-102 C	0.22	-30.65	7.68
L. O. T.	102-103 C	0.13	-31.37	7.67
FO. DRAIN T.	14-15 P	0.07	21.38	1.05

BALLAST WATER TANK				
ITEM	LOCATION	VOLUME	CENTER OF GRAVITY	
NAME	FRAME NO. SIDE	(m³)	LOG (m)	VCG (m)
B. P. T.	57-58 P	14.08	-29.52	2.20

LUBRICATING OIL TANKS				
ITEM	LOCATION	VOLUME	CENTER OF GRAVITY	
NAME	FRAME NO. SIDE	(m³)	LOG (m)	VCG (m)
LUB. O. T.	15-23 S	9.04	17.99	6.87
G.R. MIX. L. O. T.	15/4-17 P	0.55	19.80	3.67
G.R. MIX. L. O. T.	14/4-16 S	0.55	20.95	3.69
W.D. O. S. T.	15-21 C	4.42	19.25	0.62
G.R. L. O. S. T.	17-22 P	0.82	18.36	1.63
G.R. L. O. S. T.	17-22 S	0.82	18.36	1.63
TOTAL		16.31		

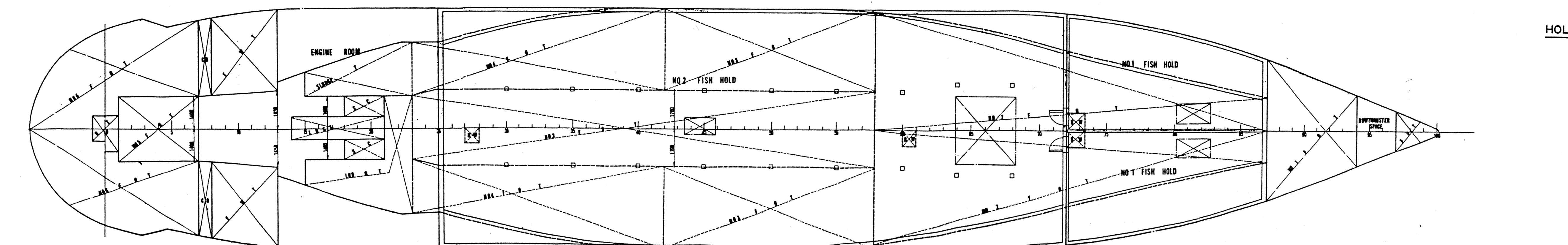
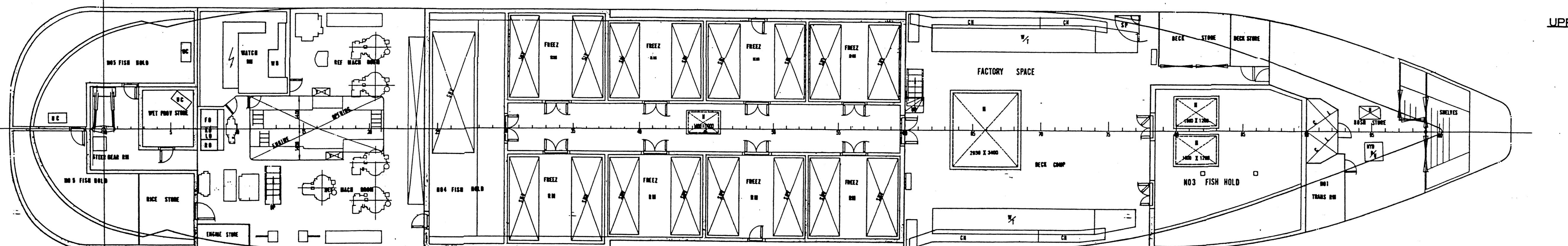
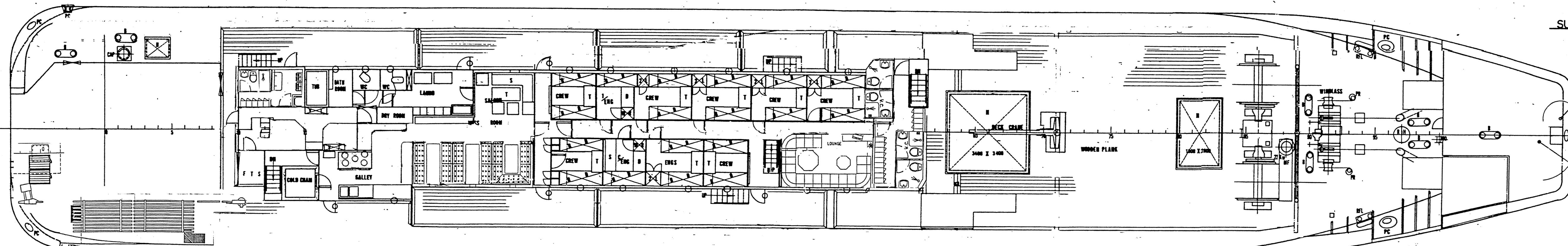
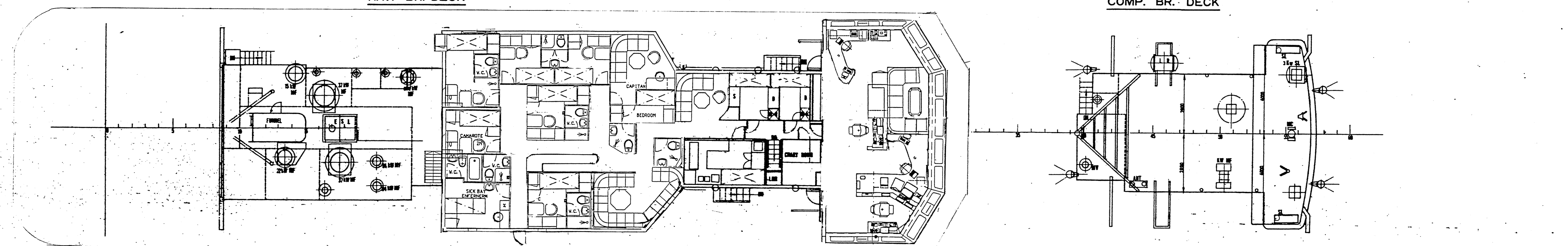
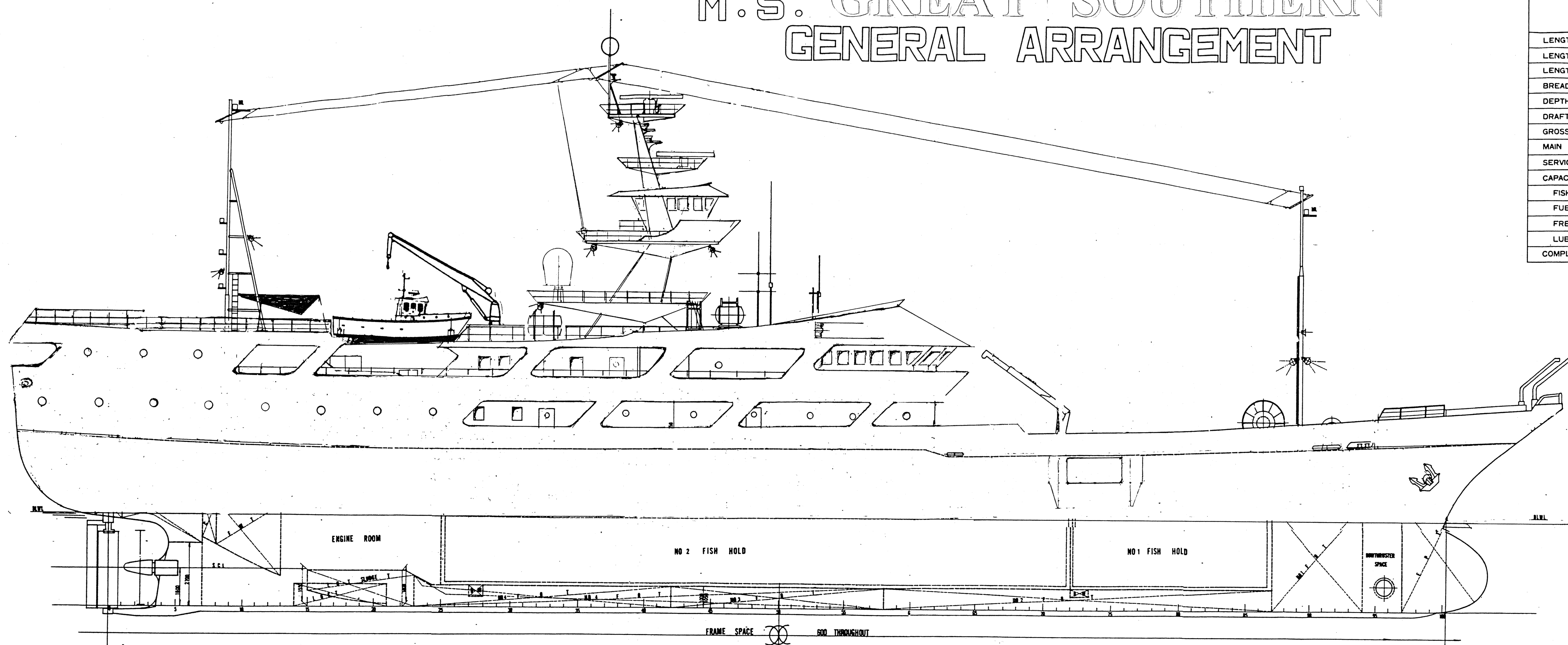
FUEL OIL TANKS						
ITEM	LOCATION		VOLUME (M <sup>3</sup> )		CENTER OF GRAVITY	
NAME	FRAME NO.	SIDE	NO.	% X	LOG (M)	VCG (M)
NO. 1 F. O. T.	87	94	60.41	57.59	-24.03	2.77
NO. 2 F. O. T.	58	87 P	43.94	42.18	-11.42	0.58
NO. 2 F. O. T.	58	87 S	43.72	41.97	-11.44	0.58
NO. 3 F. O. T.	42	58 P	26.41	25.35	0.06	0.61
NO. 3 F. O. T.	23	58 C	67.46	64.76	5.74	0.52
NO. 3 F. O. T.	42	58 S	26.41	25.35	0.06	0.61
NO. 4 F. O. T.	23	42 P	22.48	21.51	9.69	0.64
NO. 4 F. O. T.	23	42 S	22.48	21.51	9.69	0.64
NO. 5 F. O. T.	1	7 C	13.92	13.36	27.47	4.08
NO. 6 F. O. T.	AE	7 P	17.07	16.39	28.97	4.47
NO. 6 F. O. T.	AE	7 S	17.07	16.39	28.97	4.47
TOTAL			361.37	346.90		
NO. 1 FISH HOLD	72	87 P/S	172.97	166.05	-17.15	2.92
GRAND TOTAL			534.34	512.95		

		FISH HOLD				(UNDER DECK)				
ITEM	LOCATION		GRAIN				BALE			
	FRAME NO.	SIDE	VOL. (cu ft)	LOG (m)	VCG (m)	VOL. (cu ft)	LOG (m)	VCG (m)		
NO.1 FISH HOLD	72	— 87 P	88.60	-17.15	2.92	79.84	-17.14	2.83		
NO.1 FISH HOLD	72	— 87 S	87.50	-17.15	2.92	79.20	-17.14	2.83		
NO.2 FISH HOLD	25	— 72	—	799.59	0.85	2.65	743.63	0.85	2.65	
TOTAL			970.08			922.67				

		FISH HOLD				(ON DECK)			
ITEM	LOCATION		GRAIN			BALE			
	FRAME NO.	SIDE	VOL. (cu ft)	LOC (m)	VCG (m)	VOL. (cu ft)	LOC (m)	VCG (m)	
NO.3 FISH HOLD	78	— 90 S	70.00	-20.05	5.83	62.29	-20.05	5.83	
NO.4 FISH HOLD	24	— 30	70.65	13.58	5.71	61.69	13.58	5.71	
NO.5 FISH HOLD	AE	— 7 P	50.50	30.14	6.22	43.99	30.14	6.22	
NO.5 FISH HOLD	AE	— 2 S	34.31	31.63	6.25	30.14	31.63	6.25	
TOTAL			225.46			198.11			

FREEZING ROOM & WORKING ROOM										
ITEM		LOCATION		GRAIN				BALE		
NAME	FRAME NO.	SIDE	VL	(m³)	VCG	(m)	VCL	(m)	VCG	(m)
NO. 1 FREEZ. ROOM	52/4-60	P	37.41	-3.55	5.57	36.19	-3.55	5.57		
NO. 1 FREEZ. ROOM	52/4-60	S	37.41	-3.55	5.57	36.19	-3.55	5.57		
NO. 2 FREEZ. ROOM	45-52/4	P	37.67	0.83	5.57	36.44	0.83	5.57		
NO. 2 FREEZ. ROOM	45-52/4	S	37.67	0.83	5.57	36.44	0.83	5.57		
NO. 3 FREEZ. ROOM	37/4-45	P	37.89	5.31	5.57	36.65	5.31	5.57		
NO. 3 FREEZ. ROOM	37/4-45	S	37.89	5.31	5.57	36.65	5.31	5.57		
NO. 4 FREEZ. ROOM	30-37/4	P	41.10	9.78	5.57	39.72	9.78	5.57		
NO. 4 FREEZ. ROOM	30-37/4	S	41.10	9.78	5.57	39.72	9.78	5.57		
TOTAL				308.14		298.00				
WORK ROOM				30-60	76.67	3.06	5.45	73.80	3.06	5.45

PROVISION STORE									
ITEM	LOCATION			GRAIN			BALE		
	FRAME NO.	SIDE	VOL. (cu)	LOG (cu)	VCG (cu)	VOL. (cu)	LOG (cu)	VCG (cu)	
COLD CHAMBER	13½ — 16	9	2.89	21.35	8.17	1.87	21.35	8.17	
WET PROV. STORE	2½ — 7	C	11.65	27.20	6.41	10.21	27.20	6.41	
DRY PROV. STORE	19 — 23	C	6.48	17.45	8.19	—	—	—	
RICE STORE	2 — 7	P	16.19	27.05	6.15	13.87	27.05	6.15	



SUPER STRUCTURE DECK

UPPER DECK

HOLD PLAN

SNo. 1351

第五十八住吉丸

三九

トン型いか釣漁船

一般配置図

完成図

船体設計課

課長 係主任 担当

製図 平成 1 年 11 月 30 日

製図番号 船-1351

図面番号 B-02

尺 寸

株式会社 三保造船所

設計部

船体設計課

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