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Exploratory Potting Fishing Plan for *Jasus* spp and *Chaceon* spp in SPRFMO

Chile

Exploratory potting fishing plan for *Jasus spp.* and *Chaceon spp.* in SPRFMO Convention Area Rev3

Delegation of Chile, 06 October 2020

Abstract: Lobsters (*Jasus spp.*) and crabs (*Chaceon spp.*) on the high-seas region have been monitored by the South Pacific Regional Fisheries Management Organisation (SPRFMO) barely from the last year (2019), producing scientific data for making progress towards estimates of the structure populations and abundance estimates. This document outlook a new Chilean research plan which will complement the current state of scientific data and also helping overcome some detected issues.

1. Background

Catches of benthic crustaceans regulated by the South Pacific Regional Fisheries Management Organisation (SPRFMO) started 2019 triggered by a 2-year exploratory research programme proposed by Cook Islands along the Foundation Seamount Chain (CMM14b-2019, SC6-DW01 rev2). The result from the first two fishing trips showed successful operations targeting lobster (*Jasus caveorum* and *Projasus spp.*) and crabs (*Chaceon spp.*) using benthic traps around non-emergent seamounts (SC7-DW02, SC7-DW22). Similar to other rock lobsters and crabs distributed in temperate Southern Hemisphere waters (e.g., *Jasus frontalis* in Juan Fernandez and Desventuradas islands), outcomes from the exploratory fishing carried out by the Cook Islands, reveal a noticeable potential for a long-term fishery on the seamounts of Foundation region.

Consistently with the challenges to provide support for new fisheries (CMM 13-2020), the SPRFMO Scientific Committee (SC) has added relevant research items into the SC Multi-Annual Plan (COMM 8 - Report ANNEX 8a), with the primary goal to increase the scientific knowledge, for example, about spatial management and Vulnerable Marine Ecosystems (VME) considerations (CMM 03-2020), but also, to promote the development of assessment methods to estimate productivity for commercially exploited specie. Chile, aware of its responsibility to scientifically study species in the SPRFMO Convention Area and to make recommendations to its fishing sectors, and determined to contribute to potential new fisheries in southern oriental pacific waters, proposes a new and complementary exploratory fishing plan, which will provide fishing and biological data and analysis

from fishing operations targeting *Jasus spp.* (hereafter Lobsters) and *Chaceon spp.* (hereafter Crabs).

2. Objectives

The main objective of the proposal is to improve understanding the stock structure of Lobsters and Crabs in both high-seas seamounts and prospective fishing grounds in the South-East Pacific regions: *i)* the Foundation Seamount Chain and *ii)* Chile Rise. Secondary objectives are to determine the distribution of target species, to collect data on the spatial and depth distributions of by-catch species, and to explore electronic monitoring using video cameras. The rationale behind the abovementioned objectives is to provide a regular fishing-dependent data provision to help on the fulfilment of SPRFMO aims, in terms to:

1. collaborate with the deepwater stock structure analysis;
2. provide modelling and observation data to predict connectivity;
3. review the fishery potential impacts on dependent and related species;
4. collaborate with the scientific electronic monitoring regarding catching process and Vulnerable Marine Ecosystem (VME) indicators; and
5. improve the knowledge about the near-bottom and seabed marine ecosystems.

2.1. Core activities in support to SPRFMO

The fulfilment of the SPRFMO aims requires a combination of data collection and technical analysis, and likely, for those collected previously in the study area.

Whatever Lobsters/Crabs stock structure hypothesis intended by **Aim 1**, requires a recurrent collection of biological samples (length and weight, sex ratios) for carrying out growth analyses (cohort-length-based) and its linkage with both maturity and ecological traits. Contribution to a DNA signature database using the surveys proposed in this document could enable subsequent species identification, and thence the development of conceptual populations models based on genetic separation. DNA studies and tissue samples collected by other studies (SC6-DW01 rev2) could be used to identify an SPRFMO protocol for assess population connectivity **Aim 2** along of high-seas regions like Foundation Seamount Chain and Chile Rise.

The **Aim 1** also requires to collect fishery data (i.e. Catch, effort and specific samples) during the planned Fishery operational Plan (see Section 4). Data gathered will be used to describe the spatial-temporal distribution of Lobster/Crabs and its probable migratory processes. Besides, fishery data could generate comparative analysis, particularly with respect to temporal changes in CPUE, sex-ratio variations, depth strata distribution, concerning recent fishery data collected in the same area. A comparative analysis could also be used for the estimation of Lobster/Crabs status in a future stock assessment. In the case of both length and biological data (e.g. length, maturity and spawning state

on a sex-based scheme), the analyses would be aimed to provide clues about potential productivity traits of Lobster/Crabs in the proposed regions.

Compliant with the CMM 09-2017 and CMM 02-2020, each fishing set deployed under this exploratory fishing will be sampled to collect comprehensive by-catch data helping to meet the expectancies of the **Aim 3**. This objective intends to provide knowledge on the dependent and related species associated with the Lobster/Crabs fishery in the Foundation Seamount Chain and Chile Rise regions, to the most detailed taxonomic level possible and to define the relative global prevalence among species. Also, activities raised from this objective will help to reveal the spatial-temporal pattern of distribution and relative importance of main by-catch and VME species, as stated by the **Aim 4**. This information could help to determine the coherence of estimations over the fishing seasons, vessels, and fishing region.

Ancillary data collected by scientific electronic monitoring would help to improve the knowledge related to the VME indicator species and the seabed fishing impacts on benthic structure. The **Aim 5** seek to be tackled deploying a benthic video image monitoring system able to record continuous video footage and explore its potential to improve the knowledge of the marine ecosystems in explored regions.

The following sections provide background about research needs, relevant pathways for the exploratory potting fishing, and rationalisation to support the Fishing Operational plan. A vital aspect of this plan (Aims 1-4) is to provide with activities leading to a future estimate of the potential fishery yield for the studied regions, that allows the SC to plan and advice to SPRFMO Commission on future harvest and effort levels, and fishing gear restriction.

3. Fishing platform and operation

3.1. Fishing vessel

For this exploratory fishing plan, Chile endorses that characteristics of the fishing vessel Antarctic Bay (**Figure 1**) are adequate to perform the research plan described in the following sections. **Annex A** show the *FV* Antarctic Bay characteristics to accomplish with the Standard for Vessel Data, as requested by the Conservation Measures 05-2019 (Annex 1).

Antarctic Bay is a longline fishing vessel (*FV*) of 58,5 m overall length, a beam of 9,5 m, and a gross tonnage of 985 t. The proposed exploratory fishing survey will use similar longline trap gear settings (**Figure 2**) that used by Cook Islands (SC07-DW01) in previous surveys along Foundation Seamount Chain. This fishing gear comprises a main 26mm propylene line with positive buoyant to avoid contact with the seabed, 16mm propylene branch lines of 12m each sorted every 20-30m. A 90kg chain stabiliser and marked buoys shall be deployed at both ends of the line, using plastic orange-colour floats and low-frequency radio buoys for recovery purpose. According to the CMM

14b-2020, the fishing gear intended by *FV Antarctic Bay* shall deploy an average of 100 traps per string from a setting and hauling setup of 500 traps per day.



Figure 1: Fishing vessel Antarctic Bay.

FV Antarctic Bay complies with the CMM 05-2019 relating to licensing and inspection obligations of Chilean flag vessels operating in the SPRFMO Convention Area. The vessel layout allows the scientific survey head can monitor and control the fishing activities to ensure compliance with SPRFMO standards as indicated in CMM 02-2020, CMM 03-2020, and CMM 13-2020. Likewise, the vessel fulfills the requirements to:

1. provide safe facilities for two scientific observers, one from Chile and another from a Member/CNCP interested to participate;
2. perform properly the catch reporting monitoring (CMM 02-2020);
3. transport a Vessel Monitoring System (VMS) reporting to National Service, which meets the minimum standards for Automatic Location Communicators (ALCs); and
4. provide safe facilities for scientists.

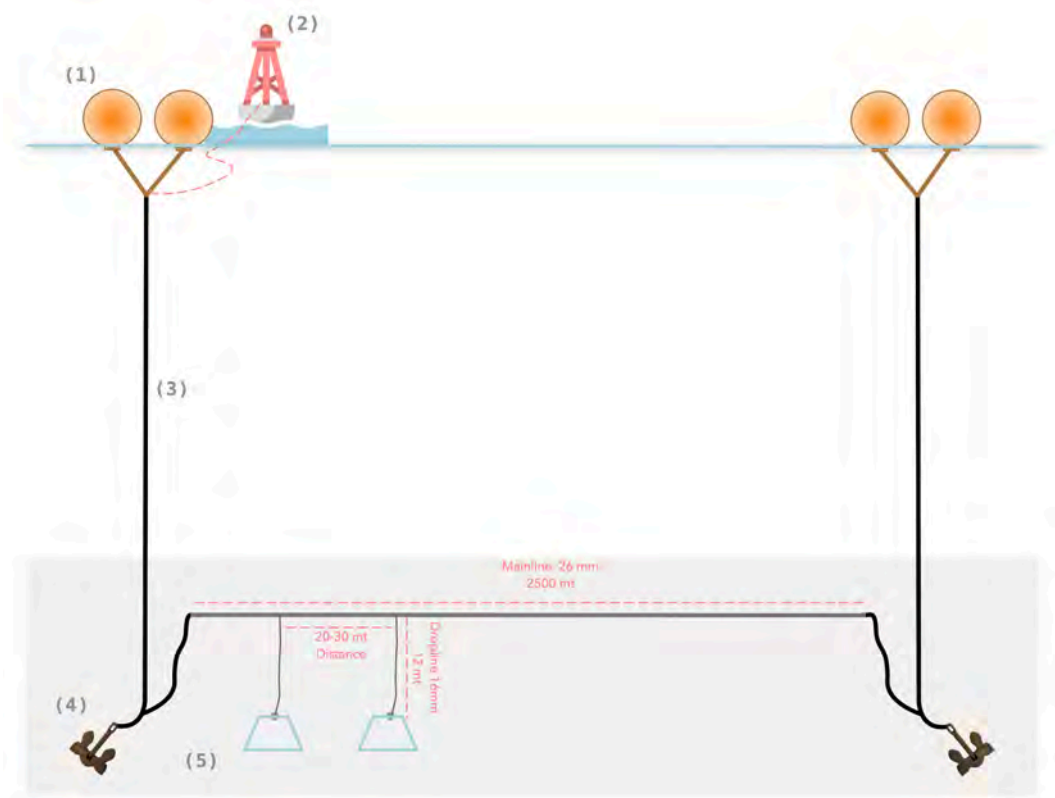


Figure 2: Longline layout proposed for deploy fishing research sets. (1) Double-buoy, (2) Radio buoy, (3) Anchoring rope, (4) Anchor, (5) trap.

3.2. Fishing gear

It is proposed to deploy a similar fishing gear that currently used by Cook Islands (SC7-DW02). For this purpose, semi-conical stackable pots of approximately 70 cm height, 127 cm diameter at the base and 60 cm diameter at the top, were constructed of a steel frame and covered with mesh (**Figure 3**). A collapsible funnel entrance has been situated on the top of the pot, tapering to the pot interior. A drawstring holding the bottom mesh together in the middle, allow pots to be emptied easily when hauled aboard and to be stacked on top of each other when not in use. A panel was sewn into pots using biodegradable string to ensure that lobsters/crabs could escape from gear lost during hauls. The trap carries two adaptable 5-10cm diameter bycatch reduction device (BRD), which allow for escapement of the small organisms (details provided in **Annex B**). The traps shall be baited with hake heads and squid, protected from isopod and amphipod predation (a usual problem in many crustaceans traps fisheries) through the enclosure in a mesh. This mesh allows the odour to escape and attract the target species.



Figure 3: Design of traps proposed to be used during the Chilean exploratory potting fishing.

3.3. Bycatch and encounters with Vulnerable Marine Ecosystems

It is recognised that bottom fisheries are to avoid significant adverse impacts on Vulnerable Marine Ecosystems (VME) in order to maintain the ecological structure and function of deep-sea benthic habitats. The challenge for new fisheries, like Lobsters and Crabs in the Foundation Seamount Chain, is to achieve this requirement even though there are (a) few data on which to determine the distribution and abundance of different benthic bycatch habitats in the deep waters or their current status and (b) almost no knowledge on what is required to maintain the ecology and function of these habitats.

In the case of the proposed fishing regions (see Section 2 and 4), the exploratory potting fishing seems the most cost-effective way to gather and report any evidence of VME indicator species. In this context, this exploratory fishing will provide information on bycatch species composition, abundance, life history characteristics and trophic linkages. Besides, information regarding mapping distribution and relative abundance of VME indicator taxa will also be collected and summarised. Effects of the proposed research on bycatch species will be limited because of the low physical trap-contact with the seabed, the low number of sets and their spatial separation. However, In accordance with conservation and management measure in force (CMM 03-2020), the FV Antarctic Bay will take the next precautionary steps:

- Recording, to the extent possible, the mid-point of each line segment and the quantity of VME-indicator units recovered, if any;
- Restricting the lines to 100 pots on small seamounts and as far as possible keep line sets on flat ground where the likelihood of encountering a VME is reduced;
- Catches (kg) of VME indicator taxa will be recorded for each longline string deployed;
- VME indicator taxa bycatch will be summarised and compared with that observed in the nearest locations fished with similar gear types by the Cook Islands.
- Any lost, tangled, or otherwise unusable set will still be counted toward the allocated effort limit, meaning that all catches will be monitored for VME indicator taxa bycatch.
- If total bycatch in specific fishing areas increase notably (e.g., bycatch for a fishing day location exceeded 5% of the weight of lobsters/crab) the vessel will move on to another fishing spot.

In compliance with the protocols in CMM 03-2020 and the Bottom Fishery Impact Assessment sections (BFIAS), all bottom fishing performed by the *FV Antarctic Bay* shall be subject to assessment by SPRFMO SC to determine if such activities have some adverse impact level on VME.

Particularly, structural components asked by SPRFMO, such as

1. Identification of objectives, assets, hazards and risks using a hierarchical risk assessment approach;
2. Identification and assessment of impacts;
3. Identification of mitigation, management and monitoring measures relevant to impacts and residual risks;
4. Iterative and adaptive review (i.e. periodic reassessment and improvement),

shall be considered to propose the improvements we regard as appropriate when and where this proves necessary concerning the risk assessment approach.

3.4. Interaction with marine mammals and seabirds (CMM 09-2017)

Interactions between/with predators, marine mammals, seabirds and fishing vessels, if any, will be recorded under scientific observer scheme. During each fishing set, the scientific observer will record seabird and marine mammal entanglements and incidental mortalities. If significant interactions occur, the vessel will move on to another seamounts or safe fishing area.

Regarding the seabirds incidental mortality, in each fishing operation streamer lines will be used during setting and hauling of the longline. The *FV Antarctic Bay* will use two (2) identical in configuration. One on the portside and one on the starboard side. The streamer lines measure 166 m in length and are made from green coloured polypropylene twine, 8 mm in diameter. The attachment heights are 7 m at the stern end of the vessel. The attachment points are 2.20 m from the sides of the vessel. Each streamer is made up of 4 vertical streamers. Dimensions are 25 mm wide and 3 mm thick. The vertical streamers are orange in colour and made from durable plastic. The streamer maximum length is 7 m closest to the stern end of the vessel, and minimum length 2 m to-

wards the tension device end. All the streamers reach the surface of the sea. Attached to the end of the streamer lines are the tension device. The average Aerial extent coverage was 40 m. Also, the streamer position can be adjusted to maximise coverage depending on the direction of the wind.

3.5. Bathymetric data collection

Currently, bathymetry data used to estimate fishable habitat in the Foundation Seamount Chain is based on areas defined by contours from fishing vessel input (SC7-DW01 rev2) and other data source such as the high resolution bathymetrical multinational survey (SC8-DW01 rev1). Information requirements for the spatial management of potential Lobster/Crab fisheries and spatial stock assessment models include understanding fish distribution in relation to depth or bathymetric features. For these reasons, bathymetric data are very important components to the sustainable management in the SPRFMO convention area.

To collect information on bathymetry in the Foundation Seamount Chain and the Chile Rise regions and to characterise fishable habitat, Chile proposes mapping the fishable area using vessel-based acoustic and recorded at a rate of at least one-minute intervals during the exploratory fishing. Because the bathymetry data could collect using different vessels bathymetry charting and recording software, the Chilean vessel commits to provide bathymetry as a minimum is an ASCII file of latitude, longitude and depth for the all visited seamounts.

4. Fishery Operational Plan

The objectives achievement is optimal beneath a three-year fishing schedule (2021, 2022, and 2023), with fishing activities that will take place in the Foundation Seamount Chain and Chile Rise regions in deeper waters no beyond 1000 depth meters. The rationale for the Fishery Operational Plan suggests a different Fishing strategy approach for each region.

4.1. Target species

Exploratory fishing will target two groups of crustaceans. The primary target-group shall split in two lobster genus, *Jasus spp.* and *Projasus spp.* Fishing surveys carried out by Cook Islands during 2019 on the Foundation Seamount Chain mainly caught *Jasus caveorum*, and secondarily *Projasus spp.* inhabiting deeper waters than lobster. Therefore, it is likely that lobster catches will focus on *Jasus caveorum*. The fishing know-how from the Cook Islands will be taking into account to improve the fishing efficiency and the sample recording. The second target-group will focus on crabs *Chaceon spp.* occupying deep-waters far away from lobsters fishing grounds. Moreover, it is assumed that the distribution of crabs could be detected along of frontal zones due to the encounter of water masses with different properties (temperature, salinity, etc.), as should happen in the Chile Rise region.

4.2. Fishing strategy in Foundation Seamount Chain

The proposed fishing strategy shall agree with the Conservation Measures currently adopted by the SPRFMO Commission, such as CMM 14b-2020 (Cook Islands). According to this conservation and management measure, fishing for lobsters and crabs along the Foundation Seamount Chain shall be conducted on no more than 15 seamounts out of 62 documented.

The Foundation Seamount Chain is a large area (612,000 square nautical miles) contained between 134°W to 100°W and from 31°S to 40°S, where, at best, scarce fishing and biological data are available to support the sustainable development of new fisheries. This concern has been recognised by the SPRFMO Commission. Considering this vast region, the Cook Islands noted that only eight (8) seamounts were visited totalising an average of 10% traps sampled (from 13,476 traps deployed) for biological analysis purpose (SC07-DW02). It was further noted that there were no research activities more than two consecutive trips (one calendar year) even though the SC has agreed that research fishing should be conducted such that it results in an assessment of the long term fishery potential (CMM 14b-2020).

These limited research activities cause a problem to assess the lobster and crabs fish stocks in the Foundation Seamount Chain. Therefore, Chile promotes that it is necessary to conduct complementary fishing research in this extensive area to gather more information. Chile proposes a Depletion CPUE experiment that consists of three (3) Steps to be conducted in every one of the first two fishing trips and along a three-year fishing period.

Step 1 is an exploratory regime where fishing effort is artificially distributed over six blocks (numbered B1 through B5, **Figure 4**) and continues until a maximum of 30% of approved TAC is attained. During Step 1, the vessel is allowed to search and fish in any manner consistent with the current Conservation Measures (e.g. CMM 14b-2020) or any further set by the Commission. For this Step, the fishing vessel must expend its 100 traps per string (average) from a setting and hauling setup of 500 traps per day, along the eight blocks delineated along the east and west of the Foundation Seamount Chain. Fishing sets based on blocks regularly spaced could be considered useful when there was no a priori information available about the distribution of the resource. The stratified approach based on fishing blocks has distinct advantages because it allows the concentration of sampling effort into regions of highest abundance. At Foundation Seamount Chain the exploratory fishing has been divided into several seamounts based on the depth range and surface fishable. During Step 1, the exploratory fishing shall explore the presently known seamounts located between blocks B1 and B5 avoiding any interaction with another exploratory fishing activities carried out by any other SPRFMO member.

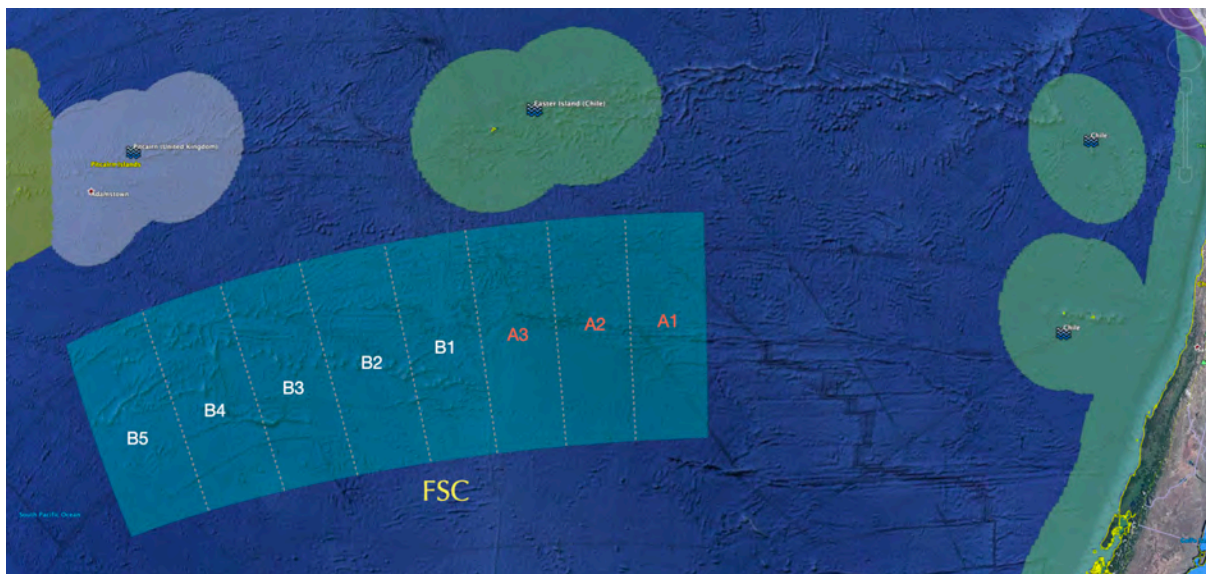


Figure 4: Fishing blocks in Foundation Seamount Chain.

If the vessel must return to port before Step 1 has been completed, the search and fishing strategy could be completed when the vessel returns from Blocks B1-B5 and before left the Blocks A1-A3. Since Step 1 artificially distributes fishing effort over a large spatial area, it is possible that the distribution patterns of target species could be mapped and the location of any centres of aggregation can be defined. Multiple vessels entering the fishery blocks at different times might also allow members of the SC to use change-in-ratio methods for evaluating, for example, rapid depletion CPUE experiments. However, for the Depletion CPUE experiment proposal by Chile, the vessel is required to complete each phase without cooperation from any other participant in the fishery.

In Step 2, the vessel is required to deplete four (4) local areas or seamounts previously mapped. The depletion experiments occur at the start of the second bunch of pots deployment, again, followed by a period of normal operation in areas distinct where depletions experiment were performed. Chile will communicate to SRFMO Secretary the four (4) selected areas or seamounts where the Depletion CPUE experiments shall be performed, to avoid that other fishing vessel interfering in the experiments. Regarding the period of normal operations, it will continue until the vessel returns to port or the TAC is attained and SPRFMO closes the fishery for that particular year.

For Step 2, each of the eight blocks delineated in Step 1 was divided into feasible fishing grounds, and the vessel master is responsible for selecting the four local areas or seamounts. The vessel must fish continuously (except in emergencies or foul weather conditions) within each local area or seamount until the average catch per pot has been reduced to 40% of its initial value from Step 1 or until a precautionary CPUE limit of 302kg/km² for areas above 500m (SC8-DW02, SC08-DW01rev1). The vessel must attempt to distribute fishing effort throughout the entire seamount and not fish the gear in the same location on every set. This experiment allows to set a 40% CPUE limit reference point and also estimate the time to reach the CPUE limit in each fishing ground. In this instance, the initial catch rate for a particular local area or seamount is defined as the average catch

per pot calculated from the first five sets made in that seamounts. Soak times for these initial sets should be at least 12 hr.

Length sampling during Step 2 also allows exploring how the catch rates are impacted by observed shifts in the length-frequency distribution, likely because of the movement pattern of target species. In fact, if movement behaviour is explaining the depletion of CPUE, then catch rates in the seamounts should decrease during the depletion experiments (Step 2) and increase when vessels return to these seamounts during Step 3. Although the four (4) depletion experiments should allow replicates to estimate uncertainty, vessels cannot join their efforts to complete Steps.

In Step 3, the vessel must return to the four seamounts it depleted during Step 2 and expend the remain TAC in equal proportion avoiding surpass the CPUE limit reference point. Step 3 will require a maximum of catch and after completing the four depletion experiments, each vessel can begin operating in a normal fashion. During normal operations, the vessel should not be required to fish certain places at certain times.

Conservation and Management Measure 14b-2020 and the current exploratory fishing proposed by the Cook Islands outline a maximum lobster and crab (combined) total allowable catch (TAC) of 300 tonnes per fishing year, a finally CPUE limit of 4 kg per trap for Kopernik Seamount, and a proposed CPUE limit of 302kg/km² for areas above 500m. The CPUE depletion experiments are proposed following these precautionary references for all set deployed on the selected local areas or seamounts. The Depletion CPUE experiments proposed by Chile in the Foundation Seamount Chain fosters the research activities of the Scientific Committee Multi-Annual Plan (COMM 8 – Report ANNEX 8a).

4.3. Fishing strategy in Chile Rise

The Chile Rise is an oceanic ridge, a tectonic divergent plate boundary between the Nazca and Antarctic plates. Its eastern end is the Chile Triple Junction where the Chile Rise is being subducted below the South American Plate in the Peru-Chile Trench. It runs westward to a triple point south of the Juan Fernández microplate where it intersects the East Pacific Rise.

No fishing actives have been carried out by the vessel in the Chile Rise region. The exploratory fishing region fairly extends over vertices 42°10'S-86°30'W and 45°45'S-76°W, covering a box area of 101929 square nautical miles (**Figure 5**). The intent of this exploratory fishing is to propose a specific management scheme for learning about the dynamics of target species and set precautionary reference point. An experimental exploratory fishing should have two characteristics: i) the potting set deployment should be designed to answer some apriori question about stock dynamics, and ii) the deployment should be realistic by allowing the prosecution of a profitable fishery.



Figure 5: Map of the Southeast Pacific Ocean and South American continent shows the Chile Rise spreading center. Icon: Fishing ground suitable for deploy fishing sets.

The fishing strategy presented for Chile Rise is designed to answer questions raised by the exploratory surveys carried out by the Cook Islands in Foundation Seamount Chain, as well as similar questions arose from the depletion experiments described in this proposal (section 4.2) but for species inhabiting Chile Rise. The results obtained from exploratory fishing in Chile Rise should help the SC to detect rapid CPUE depletion areas and suggest a range of appropriate precautionary reference point. The proposal in this region attempts to answer two apriori questions:

1. what are the large-scale distribution patterns of target species around Chile Rise; will this pattern change during the course of the fishery; are there local centers of aggregation, if so, where are they located?
2. how do local areas recover after an intense depletion episode; do the season (between trips) size frequency shifts represent recruitment via movement or dynamics in catchability?

The precise placement of fishing along the Chile Rise depends on both bottom topography and character, and other technical fishing considerations to evaluate during the fishing survey. However, vessel master apriori had identified a fishing ground suitable for deploy fishing sets (see fish-icon in **Figure 5**). During the fishing sets strategy, the vessel master is required to distribute their effort over a large spatial area from the identified fishing ground.

5. Data collection and further analysis

During the exploratory fishing in both regions, data and samples will be recorded according to the related conservation and management measures (CMM 02-2020). For each fishing trip deployed by *FV Antarctic Bay*, the scientific observers will carry out the following tasks summarised below:

- Record the details of the vessel operations. For every longline deployment, date, time, weather, geographical positions, soak time, depths, the number of traps, and catch of lobsters/crabs and by-catch.
- Record catches of target species and effort data on an un-aggregated (set by set) basis;
- Take representative samples of the catches to determine the biological characteristics;
- Record length and biological data by target species caught for a predetermined subset of traps (app 10% similar to coverage offered by Cook Islands);
- Record observed by-catches, quantity and biological data;
- Record the procedure by which declared catch weights are measured;
- Assist if requested by the Captain of the vessel in catch recording and reporting procedures;
- Record and report factual data on all sightings of unidentified vessels and illegal, unregulated and unlicensed (IUU) vessels;
- Collect information on waste disposal (lost, discarded, or retained) to include offal and fishing gear;
- Assessment of the mitigation systems in place and the efficiency of said systems.

5.1. Catch and effort data

Lobsters/Crabs catches, and effort data will be recorded and reported on a set-by-set basis. Further, all individuals in the catch will be sorted into species and weighed on electronic scales which resolved to about 10 gr. In each station and where possible, finfish (e.g., teleosts), corals (e.g., hydrocoral), and crustaceans (e.g., crabs) by-catch will be sampled and identified to a species level. Other macro-benthic fauna could also be sampled to a subsequent taxonomic description. Species able to survive will be all released alive (e.g., crabs). Unidentified organisms will be collected and froze for subsequent identification ashore.

5.2. Biological samples

Data collection plan (CMM 02-2020, Standard for Observer Data, Annex 7) for the biological observer sampling require collecting measurements when fishing sets are deployed in the SPRFMO Area. The proposed exploratory fishing (Section 4) will be focused on collecting Lobsters/Crabs samples of carapace length, tail width, whole weight, and tail weight (at a species basis and for all collected samples). Additionally, samples of tissues will be taken. These data could help to imple-

ment ontogenetic and migration studies, and also genetic researches based on stable isotope and DNA analysis.

Sample size will be based on the Observer sampling requirements as noted by SPRFMO protocols (CMM 02-2020). Scientific observer daily activities are subject to change depending on oceanic conditions. Despite this, a more considerable sampling effort will be applied to improve the biological data collecting framework following the next outline by fishing set:

- The retained catch will be count and sampled for individual weight, carapace length, sex, maturity and spawning stage
- Weight and sex - 10% of traps containing lobsters/crabs or not less than 5 traps.
- Specific samples (e.g. tissues) - 3% of traps containing lobsters/crabs or not less than 2.
- Bycatch fin-fish/crustaceans species - Length, weight, sex, gonad stages, stomach contents, otoliths - all individuals or not less than 10 specimens.

Given the incomplete knowledge about the life history and population traits of both target groups (see Section 4.1), it is expected that outcomes from this exploratory fishing should provide information about the cumulative impact of fishing activity on the target species, associated or dependent species. Particular attention will be taken to describe any detrimental impacts on benthic communities, and protection measures for VMEs in the SPRFMO convention area (see Section 3.3), including the move-on rule for vessels if a VME taxon is caught as bycatch, will be used.

5.3. Underwater observation

Electronic monitoring in fisheries, a system of video cameras and sensors capable of monitoring and recording activity on fishing vessels or underwater, is increasingly being recognised and implemented as an efficient method of assisting reliable reporting.

Chile is interested to improve the collected data during the exploratory fishing activities. For undertaking this task, a Benthic Camera System (BCS) will be developed to monitoring the seabed during the fishing activities. Particularly attention will be put in the VME encounter spots, areas with high and anomalous CPUE, sensitive bycatch zones, and potting gear issues. To test the feasibility of collecting video images from the macro-epifauna, underwater video images will be gathered and analysed from almost a reasonable number of fishing set during the first trip. Successful analyses of this first video footage should drive to improvement (e.g., fishing sets deployed with camera) of the sample plan in the next research trips.

The BCS will be attached to observational traps, which will be deployed on a regular basis to enhance the data collecting process. Broadly, the BCS is a modular system relatively inexpensive, compact, user-friendly and autonomous. The system being comprised of a video camera, solid-state lighting, and an electronics pod (containing controlling electronics, solid-state memory and a battery pack). These components are housed in pressure casings and are assembled in robust polypropylene crash-frames for deployment with longline traps.

6. Proposed catch limits

Catch limits for the Foundation Seamount Chain and Chile Rise regions, should be advised by the SC during the annual meeting 2020. Until today, few measures to allocate catches for Lobster/Crab have been developed by the SPRFMO Commission.

To assist with the implementation of the Conservation and Management Measure, the Chilean exploratory trips shall adopt an annual fishing closed season for the spawning period (from July through to September each year), a limited total allowable effort (TAE) of 80 days per trip, a 40% CPUE limit reference based on the Cook Islands experience on the Kopernick seamount (SC7-DW01 Rev2), and a CPUE limit of 302kg/km² for areas above 500m (SC08-DW01rev1). The selected seamounts shall be classified by block (B1-B5, see **Figure 4**) and it is expected have substantial amounts of fishable area between 150 and 500 m in depth.

There is considerable concern about management of SPRFMO Lobster/Crab fisheries given the absence of high quality data. The general concept behind depletion CPUE experiments as proposed by Chile (Section 4.2 - 4.3), is to examine how removals of individuals (by regular or experimental fishing) influence the relative abundance (CPUE, other abundance index) of Lobster/Crab remaining in the total stocks or in a designated local area or seamount. The depletion experiments might also allow the SPRFMO SC to make estimates of local abundance, and study the dynamics of catchability. These experiments require that fishing strategies (separately in Foundation Seamount Chain and Chile Rise) must be economically feasible so that the vessel owner will participate in the exploratory surveys, and also allow the SPRFMO SC to collect information without making the fishery unbalanced between capital costs and the data collection. Therefore, the fishing strategy is designed to be adopted within the framework of an overall total allowable catch (TAC) for the fisheries in Foundation Seamount Chain and Chile Rise.

The exploratory fishing activities should be aimed at providing guards in order to prevent overlapping on features and areas, which could compromise the development of current experiments carried out by the Cook Islands and those proposed by Chile. Chile is open to delivery a Fishing Plan which explicitly separates fishing areas within the Foundation Seamount Chain avoiding cross over between exploratory activity.

The experiments proposed (Section 4.2 - 4.3) in this document makes several demands on the vessel use. However, it is still capital costs feasible under a conservative annual TAC of 300 tonnes allocated for Foundation Seamount Chain and Chile Rise. In this regard, the fishing strategy Step 1 (the vessel is allowed to search and fish in any manner consistent with the current Conservation Measures) provides a mechanism where the vessel master can use to locate the most effective capital cost during the fishing sets. Also, fishable area for the main seamounts as reported by Cook Islands (SC8-DW01rev1, Table 1) scaled to the maximum CPUE limit (4Kg/pot) rate, enable a TAC consistent with the planned fishing strategy.

In the case of Chile Rise (**Figure 5**), the global annual TAC of 300 tonnes will allow selecting the fishing grounds that the vessel depletes, which will serve their capital costs to make effective searches during the journey to the Foundation Seamount Chain. Indeed, Chile Rise (where most of

the expected fishing grounds should be located inside the Exclusive Economic Zones, EEZ) is an opportunistic region because is located in the vessel route to Foundation. While the fishing strategy proposed for Chile Rise does not explicitly consider methods for learning about the depletion CPUE behaviour, the fishing strategy in this region could support the questions outlined in Section 4.3.

7. Research capability

Scientific staff in charge of planning and coordination of the research:

- Mr Juan-Carlos Quiroz (Phd (c), MSc)
jc.quirozespinoza@gmail.com | +56 9-4429-5027
Fisheries analysis and advice consulting
Valparaíso, Chile

8. References

- CMM 09-2017. Conservation and Management Measure for minimising bycatch of seabirds in the SPRFMO Convention Area
- CMM 14b-2018. Conservation and Management Measure for Exploratory Potting Fishery in the SPRFMO Convention Area
- CMM 05-2019. Conservation and Management Measure for the Establishment of the Commission Record of Vessels Authorised to Fish in the Convention Area. (Supersedes CMM 05-2016)
- CMM 14b-2019. Conservation and Management Measure for Exploratory Potting Fishery in the SPRFMO Convention Area
- CMM 02-2020. Conservation and Management Measure on Standards for the Collection, Reporting, Verification and Exchange of Data. (Supersedes CMM 02-2018)
- CMM 03-2020. Conservation and Management Measure for the Management of Bottom Fishing in the SPRFMO Convention Area. (Supersedes CMM 03-2019)
- CMM 13-2020. Conservation and Management Measure for the Management of New and Exploratory Fisheries in the SPRFMO Convention Area. (Supersedes CMM 13-2019)
- CMM 14b-2020. Conservation and Management Measure for Exploratory Potting Fishery in the SPRFMO Convention Area. (Supersedes CMM 14b-2019)
- COMM8. 8th SPRFMO Commission Meeting. Port Vila, Vanuatu, 14-18 February 2020
- SC6-DW01. Cook Islands Fisheries Operation Plan for an Exploratory Potting Fishery in the SPRFMO Area Cook Islands. 6th Meeting of the Scientific Committee. Puerto Varas, Chile, 9 - 14 September 2018

- SC7-DW01 Rev2. Cook Islands revised Fisheries Operational Plan for an Exploratory Potting Fishery in the SPRFMO Area. Cook Islands
- SC7-DW02. Cook Islands Exploratory Lobster Trap Fishing in the SPRFMO Area Trips 1 and 2. Cook Islands. Including observer reports for the first 2 trips. 7th Meeting of the Scientific Committee. La Havana, Cuba, 7 - 12 October 2019
- SC7-DW22. Exploratory lobster trap fishing: Analyses of the biology of *Jasus caveorum*. Cook Islands. 7th Meeting of the Scientific Committee. La Havana, Cuba, 7 - 12 October 2019

Additional material

Annex A

A.1. Vessel, equipment and facilities

- Current vessel flag: CHL
- Name of vessel: Antarctic Bay
- Vessel call sign: 725004140
- Registration number: 3165
- International radio call sign (if any): CB9738
- Fishing Identifying Mark, IMO number: 9092240
- Port of registration: Valparaiso Chile, 2616.
- Type vessel: LL - WOP
- Type of fishing method(s): LLS - FPO
- Length vessel: 58,5 m (LOA), 51 m (LBP)
- Year of Build: 1987
- Net Registered Tonnage: 329 m³
- Gross Registered Tonnage: 985 m³
- Power of main engine: 1400 PS 410 RPM
- Hold capacity: 581 m³
- Freezer type: Freezer longliner
- Number of freezers units: Six (6) tunnels
- Freezing capacity: 50 t/day
- VMS system details: 2 device, brand FURUNO (Models GP-31 and SC-50)
- Target species: lobster (*Jasus spp.*) and crabs (*Chaceon spp.*)
- Gear configuration and deployment: longline trap gear
- Name of owner: Antarctic Sea Fisheries S.A.
- Address of owner: Avenida Carlos Ibañez del Campo, Km 5,5. Punta Arenas.
- Estimated dates of entering SPRFMO Conservation Area: From March each year
- Opportunity for inviting scientists from other Members: Yes, one scientists.
- Commitment that the proposed fishing vessel(s) and nominated research provider(s) have the resources and capability to fulfil all obligations of the proposed Exploratory Fishing Plan: See Section 4 of this proposal.

Annex B

B.1. Details of potting gear

Dimensions:

- Top ring: 24 inch
- Height: 24 inch
- Bottom ring: 50 inch
- Bar diameter: 12 mm x 7 units
- Escape ring: 4 inch x 2 devices
- Blue winding rope: 10mm
- Cover get rope: 6mm - yellow
- Lead rope: 12 mm - black
- Netting: 3mm braided, 30 x 30 mm mesh - black/green



Figure B1: Trap measurements



Figure B2: Traps store and stack