SPRFMO
South Pacific Regional Fisheries Management Organisation

8TH SCIENTIFIC COMMITTEE MEETING REPORT

3-8 October 2020

New Zealand – Held remotely

SPRFMO SC8 Report 2020

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SPRFMO SC-8 REPORT EXECUTIVE SUMMARY

The 8th Scientific Committee Meeting (SC8) of the South Pacific Regional Fisheries Management Organisation (SPRFMO) took place from 3-8 October 2020 and was held as a virtual meeting and chaired by Dr Jim Ianelli (USA) with New Zealand as the host.

Over 140 participants (scientists from 14 SPRFMO Members, representatives from 6 NGOs, 2 IGOs, one invited expert and the Secretariat), reviewed and assessed over 70 working papers. The Scientific Committee (SC) provided recommendations (Annex 1) on a wide diversity of issues.

Due to the COVID-19 pandemic an in-person meeting was not possible, so the meeting was held remotely, across 16 different time zones. Three sessions of approximately two hours were held per day, scheduled to ensure that all participants had maximum opportunity to engage during normal waking hours in their time zone. Because of the limited time available to present and discuss papers, seven pre-SC web meetings were held, where a great deal of material was covered before the formal opening of SC8 on Saturday 3 October 2020. A Deepwater Workshop to discuss bottom fishing issues was also held remotely over four sessions pre-SC8. Reports and recordings of presentations from these meetings were made available to meeting participants.

Annual Reports were received from Australia, Chile, China, Cook Islands, Ecuador, European Union, Korea, New Zealand, Peru, Russian Federation, Chinese Taipei, United States of America, and Vanuatu.

The estimated biomass of Jack Mackerel in the southeast Pacific increased from 2019 to 2020 and is now estimated to be well above the interim B_{MSY}. Therefore, the SC noted that Jack mackerel has been rebuilt to the third tier of the harvest control rule within which catches should be limited to a fishing mortality of F_{MSY}. This would be expected to result in catches in 2021 just below 1,500 kt. However, according to the accepted rebuilding plan ("Adjusted Annex K") a maximum change in the catch limit of 15% applies. Hence the SC recommended a 15% increase in 2021 catches throughout the range of Jack mackerel to a level at or below 782 kt.

In conformity with the approach by the SC since 2012, a comparison was made between the 1-stock and 2-stocks model configurations. Both models showed similar trends with an increasing overall biomass, high recruitments in recent years, and low fishing mortality. Under the two-stock hypothesis model, the northern stock is estimated to have stable and low biomass levels over the past decade with an increase in the last few years. The combined single-stock model resulted in slightly lower recruitment and biomass estimates than the summed 2-stock model. The advice for catch limits in 2021 does not depend on the stock hypothesis that is used.

In Paragraph 28 of CMM 01-2020 (*Trachurus Murphy*i) the Commission specifically requested advice from the SC regarding the possible impact of the national measures adopted on the *Trachurus murphyi* fishery. The SC noted that due to the tight schedule in the online meeting format, it was not possible to fully address this question. However they did note that in 2019, the sum of realised catch of Jack mackerel was higher than the maximum recommended by the SC. Due to the estimated abundance, apparent low fishing mortality and recovery of the stock, the SC was unable to detect if this overcatch made much difference to the stock status of Jack mackerel. However, any catch higher than that recommended by the SC is outside of what has been evaluated as part the current rebuilding plan. In the longer term, it is necessary to evaluate the potential structural impacts of national measures on the *Trachurus murphyi* fishery. This would best be carried out as part of the Management Strategy Evaluation. This would require a precise specification of the type of national measures that should be considered.

Management Strategy Evaluation work is continuing, and it has been agreed that three different stock structure hypotheses will be tested: a single stock, two separate stocks and a hybrid stock structure assumption in which there is exchange of individuals between two stocks. The need for a workshop at the next Commission meeting not scientific in nature, but rather focused on management strategy advice was agreed upon.

Orange roughy stock assessments for two Tasman sea stocks (Northwest Challenger and Lord Howe Rise) were presented. Noting that the Northwest Challenger stock is estimated to have a stock status between 46 and 81%

of unfished biomass, the SC **recommended** that the median yield estimate of 396 tonnes be set as the annual catch limit for 2021, 2022 and 2023. Noting that the Lord Howe Rise stock is estimated to have a stock status between 29 and 93% of unfished biomass and taking into account the higher uncertainty in this stock assessment, the SC **recommended** that 0.75 of the median yield estimate of 348 tonnes, being 261 tonnes, be set as the annual catch limit for 2021 and 2022. Noting that the West Norfolk Ridge stock is estimated to have a stock status between 19 and 84% of unfished biomass and taking into account the high uncertainty of the stock status estimate and the higher risk of low stock status, the SC **recommended** that 0.5 of the median yield estimate of 108 tonnes, being 54 tonnes, be set as the annual catch limit for 2021 and 2022. The SC recommended that these Orange roughy catch limits apply for no more than 2 years (or 3 in the case of Northwest Challenger) and that a more precautionary approach should be taken if insufficient advancement is made in data collection to support stock assessments in that time.

They also noted that the Commission may set lower catch limits in consideration of the potential impacts of increased fishing effort on VME status. With regard to the review of **VME taxa** the SC agreed that the proposed lists of VME taxa could be used to evaluate the potential implications of using habitat suitability models for higher-level taxonomic groups for assessing the performance of spatial management measures and to develop VME indicator taxa identification guides. However, a proposed process for the SC to implement when it reviews encounters with potential VMEs, focussed on the requirements specified in CMM 03-2020 (Bottom fishing), was not accepted. Concerns were expressed about the appropriateness of encounters being reviewed for expectedness given the uncertainty demonstrated in the modelling and a need for additional thinking on how to review encounters and benthic bycatch data more generally, pending review of the CMM.

The SC **recommended** that, in its review of CMM 03-2020 (Bottom fishing), the Commission may wish to consider additional precautionary management measures for areas and taxa at higher risk from bottom trawl fisheries to address uncertainty and provide additional confidence that the CMM will meet its objective. Further, the SC **recommended** that the Commission provides guidance to the SC on the level of protection, structure, or function of VMEs it requires to assure that Significant Adverse Impacts on VMEs are prevented, or requests advice on this in the multi-annual workplan.

The second phase of the **FAO Areas Beyond National Jurisdiction Deep Sea Fisheries Project** (ABNJ DSF) will support the implementation of an ecosystem approach to fisheries, with a focus on data-poor stocks, significant adverse impacts on VMEs, and deepwater shark. SPRFMO's expertise in these matters is expected to make a strong contribution. The SC requested the Secretariat to assist and coordinate activities during the planning phase. FAO also requested SPRFMO involvement in a proposed research collaboration on the use of Automatic Identification System (AIS) data technology to improve monitoring of high seas fisheries. The SC agreed that Secretariat support would help to determine required resources and clearer development of the aims of the project.

New Zealand and Australia presented a joint **Bottom Fishery Impact Assessment** which the SC agreed represents the best science available to the SC at the current time, provides a sound basis for formulating management advice to the Commission and meets international standard and complies with the SPRFMO BFIA Standard.

With regards to **Jumbo flying squid**, the SC progressed several pieces of work in preparation for the full implementation of CMM 18-2020 on 1 January 2021. The SC agreed that the proposed Squid Monthly Catch and Effort template was appropriate for annual reporting of catch with monthly resolution as required by CMM 18-2020. The SC also accepted a draft Squid Jigging Observer Data Template with minor modifications and agreed on a maturity schedule for the submission of consistent squid gonad maturity data on the Observer Data Template.

Several SC8 participants drafted a recommendation in relation to an **effort limit** for the squid fishery. After lengthy discussions it was apparent that there was broad support for establishing effort limits based on the precautionary approach. However, several Members expressed concerns that the recommendation of a specific limit needs to be based on more comprehensive scientific research and more complete discussion among Members.

In the **Habitat Monitoring** workstream there was wide interest in the use of acoustics data from fishing vessels. A subgroup to discuss the advantages and biases of analysis methods was suggested. A second subgroup was proposed to organise the classification of the fishing fleet with regards to acoustic data collection. The SC **recommended** that Members encourage participation of scientists interested in habitat modelling at large (e.g. from the Deepwater group) to be involved in these subgroups so as to increase cross collaboration on similar issues.

Chile has offered to host a **Symposium on the State of Art Habitat Monitoring**, covering habitat monitoring research for multiple species and habitat types. This symposium, ideally to be held in January 2022, is to be supported by funding from the SC. A steering committee has been asked to prepare a detailed plan for approval by COMM9.

Three **exploratory fisheries proposals** were considered. The SC accepted the latest version of the Cook Island's Fishery Operation Plan (FOP) for **trap fishing** in the Foundation Seamount Chain. This FOP draws on the findings of the formal sampling programme outlined in the previous FOP. The Total Allowable Effort (TAE) fishing day limit is proposed as 80 days per trip, setting and hauling no more than five lines of 100 traps per day, and a global Total Allowable Catch (TAC) of 300 tonnes across exploratory areas. An extension to the fishing area is proposed, east of Chile's Easter Island Region EEZ. It is proposed that global TAC and TAE limits will apply in the area with replacement of seamount number limits with feature specific limits.

The SC also discussed a proposal from Chile for an exploratory fishery for ***Jasus* sp. and crabs** on the Foundation Seamount Chain and Chile Rise. The SC noted a number of significant concerns, including a need for more rationale for the calculation of proposed catch limits and consideration and analysis of the cumulative impacts that may result from there being two exploratory fisheries in the same area. The SC **recommended** that work extend intersessionally.

The SC accepted a new proposal from the European Union for an exploratory **toothfish fishery** in the George V Fracture Zone Research Block south of Australia, after discussion about the need for further mitigation and the importance of tagging data from the fishery.

The SC discussed the **checklist** for Exploratory Fisheries Proposals and agreed that updating the checklist with additional detail to guide users would be beneficial. The SC also identified a potential need to develop a template for Fisheries Operation Plans to assist proponents to meet the requirements of CMM 13-2020 (Exploratory Fisheries) particularly where there is little prior information.

The SC requested that the Secretariat coordinate a small intersessional working group to develop the **work plan** prior to COMM9. The SC recognised that due to the COVID-19 pandemic, three items had been delayed from the 2020-21 financial year, including a squid workshop, a Jack mackerel workshop, and the Habitat Monitoring symposium.

The SC agreed that a **data workshop** for Jack mackerel would be planned for late in the 2020-2021 financial year, and there would be support for independent experts and associated costs for this workshop. If it is not possible to run the workshop, then the SC will request that the Commission make an exceptional decision to allow excess SC funds to be carried over to the 2021-22 financial year.

SPRFMO SC8-REPORT

Report of the 8th Meeting of the Scientific Committee

New Zealand (held remotely), 3 to 8 October 2020

Adopted 8 October 2020, 11:28 pm (NZDT)

1. Welcome and Introduction

1. The Scientific Committee (SC) Chairperson, Dr Jim Ianelli (USA), opened the meeting and proceedings.

2. Mr Dan Bolger, Deputy Director-General of Fisheries New Zealand, welcomed delegates to the 8th SC meeting via a video recording.

3. The Acting Executive Secretary, Mr Craig Loveridge, thanked New Zealand for their welcome and SC participants for their engagement both in the pre-SC web meetings and the 3rd Deepwater workshop (SCW10).

4. Heads of Delegations (HoDs) were asked to introduce themselves and their delegations. A list of participants is included in Annex 2.

1.1. Adoption of agenda

5. The Chairperson sought proposed changes to the Provisional Agenda and related documents (SC8-Doc01_rev1). After discussion, the final agenda was adopted (Annex 3).

1.2. Meeting documents

6. Meeting documentation, location and access was presented. The posted document list (SC8-Doc03_rev3) and annotated agenda (SC8-Doc02) were made available and referred to throughout the meeting.

7. There were 8 late papers that were considered and were all accepted by the meeting.

1.3. Nomination of rapporteurs

8. Rapporteuring was supported by New Zealand, the European Union, Chile and the Secretariat. Tiffany Bock, Shane Geange and Jan Geert Hiddink offered to cover Deepwater sessions, Tiffany Bock covered Squid sessions, Marco Milardi covered Habitat Monitoring sessions, and Niels Hintzen, Marco Milardi, and Aquiles Sepulveda covered Jack mackerel sessions.

1.4. Meeting programme and schedule

9. The indicative meeting schedule (SC8-Doc04_rev3) was introduced and made available.

2. Annual Reports Discussion

10. Annual reports were received from Australia, Chile, China, Cook Islands, Ecuador, European Union, Korea, New Zealand, Peru, Russian Federation, Chinese Taipei, United States of America, and Vanuatu. Summaries for these reports are in Annex 4. The annual reports were taken as read and time was made for clarification questions. Several questions were posed and addressed leading up to and during SC8.

11. Vanuatu noted that Peru reported that the 2019 JJM far north assessment model developed at SC7 was updated with data to the end of 2019 and then used to project various levels of fishing mortality and catch to provide a basis for setting the 2020 Total Allowable Catch (TAC) in Peruvian waters. It was then asked if in its risk assessment of different levels of catch for 2020 whether projections were made of the likely catches of the Northern Chilean and Ecuadorian fleets and were these catches taken into account in this process?

- Peru responded that the catches from Northern Chile are all considered as made by Fleet 1 (N Chile) for all assessments. Only catches of Fleet 3 (Far North) are considered as being part of the Peruvian or Far-North stock. Therefore, catches from northern Chile have not been considered in the assessments or projections presented in SC8-Doc24. Catches from Ecuador are part of Fleet 3 and have similarly been taken into account in the assessment presented in SC8-Doc24. In the catch projections used in the risk assessment it has been assumed that catches by Ecuador would have been very similar to those obtained by Ecuador as part of Fleet 3 in recent years, which have been very low (23 t in 2018 and 0 t in 2019).

12. Chile posed a number of questions based on the Jack mackerel part of the Peruvian annual report with responses (in bullets) from Peru as follows:

a. How does Peru make the updating procedure carried out in December compatible with the technical assistance procedure carried out by the SC?

- The updating of the JJM model done in December 2019 is fully consistent with the final JJM model developed for the Peruvian or Far-North stock under the 2-stocks hypothesis in the SC7 Final report. It is exactly the same model with the only difference being that the estimated/forecasted data for July-December 2019 used during the SC7 in October 2019 has been replaced/updated with the actual observed data updated to December 2019;

b. Does a harvest control rule apply in this procedure?

- No harvest control rule is used in the JJM assessment updating procedure. A harvest control rule in many ways is consistent with the one used by the SC and has been used by Instituto del Mar del Peru (IMARPE) in advising the Peruvian Government on the Peruvian Jack mackerel catch quota in Peruvian jurisdictional waters Peru, although the one used by Peru is specific for the case and perceived assessment of the Peruvian or Far-North stock. The harvest control rule used by the SC is generally conceived for the case and perceived assessment of the much larger southern stock under the 2-stock hypothesis and/or the single stock under the 1-stock hypothesis that, basically, aims at the recovery of a depleted stock by maintaining an Fstatus quo and limiting any upward or downward interannual adjustment of the TAC to 15% of that in the previous year. Peru's control rules allow for broader and shorter time adjustments of the TAC based on the results of our regular monitoring of the Peruvian Jack mackerel stock and fishery, which are more detailed and closer to real-time than what could be possible for the Jack mackerel throughout its range within the framework and mechanisms of the SC and the SPRFMO Commission. Nevertheless, it is noted that both harvest control rules share the common objective of setting for the TAC advice, levels of fishing mortality (F) that produce a very low risk that the projected biomass estimated for January 1st in next year be lower than that estimated for January 1st in the current year, with a high enough probability that the spawning biomass will increase to and/or will continue to be greater than that needed for the Maximum Sustainable Yield (MSY) in the short, medium and long terms. Furthermore, since 2002 Peru passed a law though which catches of Jack mackerel in Peruvian waters can only be used for

direct human consumption (the use of Jack mackerel for the production of fish meal and oil is prohibited) using vessels with appropriate refrigeration capacity on board, and sets a minimum mesh size of 35 mm for the purse-seine fishery (the use of the 13 mm commonly used in the Peruvian anchoveta fishery is strictly prohibited when fishing for Jack mackerel in Peru). These are additional factors that contribute to further protect the stock by significantly limiting the fishing pressure that can be applied in the Jack mackerel in Peruvian waters;

c. Does the recruitment projection apply a penalization process such as H1?

- The steepness used for the recruitment projections in the December 2019 Peru updates is 0.6, which is slightly lower (more conservative) than the 0.65 used during the SC7 for the 1-stock and 2-stock hypotheses. Also, as noted in the 2-regime S/R plots for the northern stock in the 2-stock hypothesis, recruitment projections are heavily penalized in the case of the JJM assessments and projections for the northern stock JJM by using the mean recruitment values estimated from the S/R relationship corresponding to the low abundance regime;

d. What are the changes of regimes applied by Peru?

- The two regimes being considered for the Peruvian or Far-north Jack mackerel stock are those exemplified in figure 20 of paper SC8-Doc24. As described in the text, the high abundance regime is for the years 1970-1996 and the low abundance regime is for the years 2001 to present, with 1997-2000 being a period of change from one regime to the next;

e. There is concern about the variability of recruitment and its impact on sustainability.

- Yes, there is some concern about the variability of recruitment and the impact it has or may have on sustainability, but more than concern there is a high sense of awareness that to a great extent this is a natural environmentally-driven variability with which we just have to deal with when managing the Peruvian Jack mackerel fishery, as well as other important marine fish stocks and fisheries in the Peruvian marine environment. That's why we have a more adaptive approach when it comes to setting and adjusting TACs, coupled with a more detailed and closer to real-time monitoring of the Peruvian fish stocks and fisheries;

f. In past assessments and SC meetings there has been a conclusion that the 1-stock hypothesis is more precautionary in providing advice.

- Peru disagree with the suggestion that the stock assessment model based on the 1-stock hypothesis is more precautionary. The fact that the JJM model under the H1 may give TAC estimates that may be lower than the sum of the TACs derived from the JJM models under the H2 doesn't make the H1 or the model configuration for the H1 more precautionary, even if in line with the precautionary approach the SC takes the lowest of the two numbers for its global advice to the Commission. With respect to the so called peer review, it is worth noting that the input data and the outputs and results of the runs of the three JJM models (one for H1 and two for H2) used every year since 2012 (9 years now) have been available for review by any member of the Scientific Committee and every single year you have had the occasion to examine them and I'm sure some of your colleagues have done, since in more than one occasion we have had the occasion to discuss them.

13. For the Peruvian squid fishery, catch, effort and CPUE trends operating in the high seas appear in the annual report (SPRFMO area). However, such information is missed in Peru annual report for the national waters. The SC asked if Peru could report information on the squid jig fishery in the national jurisdiction in the future. Peru responded that estimated catch, effort and CPUE trends from the Peruvian artisanal jig vessels fishing for Jumbo flying squid (*Dosidicus gigas*) in the SPRFMO area for years 2012-2019 (with no catches in 2019) were in fact reported in our annual report SC7-Doc33 regarding Peruvian fishing activities in the SPRFMO Convention area. This was done to comply as much as possible with the SPRFMO CMMs regarding the supply of data and information in the SPRFMO Convention area. As noted in this year's report (SC8-Doc23), Peru had no fishing activities to report for 2019 and the first part of 2020 with respect to the Convention area. With

respect to Conservation and Management Measures (CMMs) and reporting on fishing activities our national jurisdictional waters it is also noted that Peru has not given the express consent contemplated in Article 20 (4) (a) (iii) of the Convention and, therefore, the decisions and CMMs adopted by the SPRFMO Commission, including reporting obligations and requirements, are not applicable to activities within Peruvian jurisdictional waters.

14. It was noted that for some squid fishery data the length frequency and biological information were based on few samples. Chinese Taipei responded that they are establishing their sampling programme and expected to have more data from the fishery next year.

15. Peru noted, in relation to the annual report of Korea (SC8-Doc18) that DNA metabarcoding is a useful technique for studying diet composition from gut contents, but some aspects need to be clarified. Firstly they asked about the gene(s) region used for the analysis, and secondly they asked about the comparative efficiency of the two methods (DNA compared to classical morphological analysis) for detecting differences of species composition for the three different size classes. Korea planned firstly, to obtain a large set of reference sequences of prey species, they will use a universal primer targeting the long COI barcodes (~1kb). This primer set was designed to apply for the PacBio sequencing system. Unfortunately, many prey species of *D. gigas* have not been clearly identified by morphological studies as well as metabarcoding studies mainly due to the loss of morphological characteristics or the lack of reference sequences for the regional species in the database. Therefore, they will first establish a reliable reference database using the long barcode sequencing. Once the reference database is established, it will be much easier to make a correct species assignment for the prey items using the minibarcodes targeting the COI region (~ 300 bp). Accurate species identification is highly important to understand the ecology for *D. gigas*, which has a wide distribution and many regional morphotypes. Unfortunately, although there have been several diet studies of *D. gigas*, there have been no previous studies clearly identifying the species of prey items. If they identify any regional characteristics in the prey species, they will have a better understanding of the relationships between the different morphotypes and regional diet profiles. Korea agreed that they also have a great deal of interest in comparing the morphological and molecular analyses. They think it is too early to begin the quantitative analysis at this time because they believe it would not be possible to compare those two results without having a good reference database. For instance, there are many unknown molluscs, lanternfish, and light fish in the stomach of *D. gigas*, so only correct species (or haplotype) identification would be able to reflect the characteristics of a regional food web, in order to provide the precise information about diet in each regional habitat. They consider that it will take at least two or three years to establish a reliable reference database by PacBio. After that, they can advance to the quantitative analysis. As many scientific committee members may know, *D. gigas* is a generalist predator, which reflects the ecosystem of their habitat. Since the prey item numbers of individual squid are approximately 5-8 species, qPCR technique can be directly applied only if there is a database with a high amount of reference sequences in each region. This would be more reliable than estimating the quantity by the metabarcoding analysis.

16. Peru noted that it will be interesting to consider the use of PCR blocking primers due to self-contamination and the high predominance of the species in gut content, which may be overestimated due to the fishing gear used. The use of a mock community as a positive control (of a known composition species) could be useful for a direct correlation between the number of reads and the number of organisms in gut samples analysed. Korea explained that it had also considered adopting the blocking primer, but notes that it is important not to ignore the cannibalism of the squid. Therefore, they are not planning to adopt the blocking primer. The contamination of self DNA can be lowered so long as the specimen is deep-frozen after the catch and stored frozen until dissection. Korea has enough previous experience to handle these samples. They also appreciate the advice to use the mock samples for quantitative analysis. They plan to use the mock for the quantitative analysis in two or three years. They expect that the numbers of prey species in each region may not be too high to adopt qPCR methods, and believe that there would be more time in a couple of years for the quantitative analysis. However, as commented above, they would like to concentrate efforts on the qualitative analysis as the immediate task.

3. Commission guidance and intersessional activities

3.1. SC multi-annual workplan

17. The draft 2021 SC multi-annual workplan was posted as SC8-Doc05. The SC considered the reprioritisation discussed at the second 2020 web meeting as well as the additional items requested by the Commission at COMM8. The SC noted that there were several items discussed during this meeting which should be reflected in an updated workplan.

18. The SC **requested** that the Secretariat coordinates a small intersessional working group to develop the workplan prior to COMM9.

3.2. Review of intersessional work to highlight "reduced" workplan

19. SC8-Doc06_rev1 is a compilation of reports of the seven web meetings held prior to the SC. It was agreed that this document is a good source for content for the SC report. SC8-Doc08 was introduced by the Secretariat and the SC **noted** the status of previous SC recommendations.

3.3. Secretariat SC-related activities

20. The Acting Executive Secretary presented SC8-Doc07, which reports the Secretariat SC-related intersessional activities and how the objectives of the Organisation have been progressed. The paper also reports on projects managed or coordinated by the Secretariat. Annex 1 of SC8-Doc07 particularly describes a project funded by a European Union grant to increase the spatial data capability of the Secretariat. The Secretariat has identified several issues that could be addressed with improved spatial management capability and some potential solutions and the SC **requested** volunteers to self-appoint to provide expert input into the project.

4. Deepwater

4.1. Review of intersessional activities

21. Delegations were invited to report on any intersessional activities. There were no interventions, and it was noted that all intersessional activities were reported to the Deepwater Workshop (Annex 5).

4.2. SPRFMO Orange roughy assessment data review and evaluation (NW Challenger and Lord Howe Rise)

22. Paper SC8-DW10 was presented to the 5th pre-SC8 web meeting (refer SC8-Doc06_rev1) and the main points are summarised below.

23. New Zealand presented updated Orange roughy stock assessments for two Tasman Sea stocks: Northwest Challenger (NWC) and Lord Howe Rise (LHR), including estimates of virgin biomass (B_0), current stock status (ss2020), and long-term yield.

24. A Bayesian stock assessment was presented for NWC using age frequency data collected in 1993 and 2013, and 2018. The maturity parameters and year class strengths estimated for NWC were then used in a catch-history based assessment for LHR (for which no age frequencies are available). For both stocks, current stock status is estimated to be higher than in the 2017 stock assessment. For NWC this is because the previous assessment contained no data other than the catch history. The addition of the age frequencies has greatly reduced the estimated probability of low B_0 and associated low stock status. There is also qualitative evidence

from the fishery that current stock status is not seriously depleted as catch rates have been maintained or slightly increased since a low point in 2005.

25. For LHR a new catch history was used which, compared with the previous catch history, has a large spike in catches in the first year of the fishery. The previous catch history comprised catches reported to SPFRMO, excluding early catches by Japanese and Norwegian vessels which were not reported to SPRFMO. This change in the catch history is responsible for the higher estimates of B_0 and current stock status.

26. Although current stock status for each of the stocks is quite uncertain, it is likely that NWC is currently above 40% B_0, while LHR is likely to be above 30% B_0. Based on the 2017 assessment, the West Norfolk Ridge stock is likely to be above 20% B_0. The base model estimates of B_0, stock status in 2020 and the long-term yield for these stocks are given below.

27.

	B_0 (000 t)		ss_{2020} (% B_0)		Long-term yield (t)	
Stock	Median	95% CI	Median	95% CI	Median	95% CI
NW Challenger	33	19-43	68	46-81	396	228-516
Lord Howe Rise	29	11-75	72	29-93	348	132-900
West Norfolk Ridge	9	4-21	63*	19-84*	108	48-252

*: 2015 stock status, noting that the yield estimate for WNR differs from that given in SC5-DW14 based on application of the 1.2% B_0 calculation.

28. DSCC made a statement that they do not support any increase in catch limits for Orange roughy. DSCC notes that there are no agreed precautionary reference points for Orange roughy as required by Article 10 of the Convention. The current measures do not prevent Significant Adverse Impacts (SAI) on Vulnerable Marine Ecosystems (VME) by applying the measures called on by UNGA resolution 61/105 and subsequent resolutions, including closing areas that are known or likely to contain VMEs. Any increase in fishing would only increase impact on VMEs. Any decision to increase TACs should only come after CMM 03-2020 (Bottom fishing) has been reviewed by the Commission and no change until SPRFMO adopts agreed reference points. DSCC also notes that in their view there are currently no measures in place to protect bycatch species as bycatch and target catch limits are lumped together in country catch limits for all species other than Orange roughy.

29. Based on this assessment, the SC:

- **Accepted** the updated assessments for the Northwest Challenger and Lord Howe Rise Orange roughy stocks and agrees that they provide a suitable foundation for the formulation of advice to the Commission;
- **Noted** that the Northwest Challenger stock is estimated to have a stock status between 46 and 81% of unfished biomass.
- **Recommended** the median yield estimate of 396 tonnes be set as the annual catch limit for 2021 and 2022 and 2023 for the NW Challenger stock.
- **Noted** that the Lord Howe Rise stock is estimated to have a stock status between 29-93% of unfished biomass and taking into account the higher uncertainty in this stock assessment and status estimate.
- **Recommended** that 0.75 of the median yield estimate of 348 tonnes, being 261 tonnes, be set as the annual catch limit for 2021 and 2022 (unless an updated assessment is done in this time) for the Lord Howe Rise stock.

- **Noted** that the West Norfolk Ridge stock is estimated to have a stock status between 19-84% of unfished biomass and taking into account the high uncertainty of the stock status estimate and the higher risk of low stock status.

- **Recommended** that 0.5 of the median yield estimate of 108 tonnes, being 54 tonnes, be set as the annual catch limit for 2021 and 2022 for the West Norfolk Ridge stock.

- **Noted** that these catch limits would combine to a total Tasman Sea annual catch limit of 711 tonnes.

- **Recommended** that these Orange roughy catch limits apply for no more than 2 years (and 3 in the case of NWC), noting that a more precautionary approach should be taken if insufficient advancement is made in data collection to support stock assessments including acoustic surveys for the relevant stocks in that time.

- **Noted** that the Commission may set a lower catch limit in consideration of the potential impacts of increased fishing effort on VME status, particularly in areas where status is already unfavourable or where the estimated proportion of suitable VME habitat protected is concerning.

4.3. VME encounters and spatial management

30. As required by the SC workplan, New Zealand presented SC8-DW11 reviewing VME taxa known from the Evaluated Area of the SPRFMO Convention Area. 281 genera and 231 species were identified as meeting FAO VME criteria and therefore can be considered candidate VME taxa. The paper proposes that these taxa could be used to develop VME indicator taxa identification guides for use by observers on bottom fishing vessels as well as to evaluate the potential implications of using habitat suitability models for higher taxonomic groups for assessing the performance of spatial management measures. The paper also identifies several ways the list of known VME taxa could be further refined, including determining how FAO criteria are best combined to identify VME taxa, linking VME taxa to specific types of habitats, and updating lists to include new information on life-history characteristics of taxa and records from locations outside the evaluated area.

31. Australia thanked New Zealand for the work and suggested that the first recommendation be amended to recognise the reliance on resources to implement the recommendation.

32. New Zealand clarified that the key tasks to do next include testing how well the habitat suitability modelling captures the variation of taxa within the broad groups that are currently used (e.g., how well the model for Stylasteridae reflects individual variation in the distributions of the 30 species within that group).

33. They also confirmed that the VME taxa that are included in CMM 03-2020 (Bottom fishing) are identified in the paper, and noted that it would be a simple exercise to confirm which of those have a weight threshold and which are included as part of the biodiversity threshold.

34. Korea emphasised the importance of VME identification manuals and noted that there are VME lists in other RFMOs (e.g., in the North Pacific) and suggested that a manual be developed for SPRFMO.

35. The European Union queried the final recommendation regarding determining how FAO criteria should best be combined to identify VME taxa, and in particular what the approach for achieving this would be. New Zealand responded that it could be added as item on the work plan for next year, although noted that it should be collaborative across the SC (not New Zealand in isolation). The Secretariat identified that the FAO would be presenting later in the meeting on the ABNJ project and there was an opportunity to progress cross-RFMO work of this nature.

36. The SC **agreed** that an assessment of how ID guides could be developed should be added to the work plan and if funds are needed, they could come from the SC budget. The SC also **requested** that the Secretariat investigate if this type of work could be coordinated through the ABNJ project.

37. After considering SC8-DW11, the SC:

- **Agreed** that, as resources permit, the draft lists of VME taxa could be used to evaluate the potential implications of using habitat suitability models for higher-level taxonomic groups for assessing the performance of spatial management measures;
- **Agreed** that the draft lists of VME taxa could be used to develop VME indicator taxa identification guides for use by observers on bottom fishing vessels;
- **Agreed** that analysis of co-occurrence would be useful to link VME taxa to specific types of habitats;
- **Agreed** that the lists of VME taxa should be updated as required to consider areas in which existing or new exploratory fisheries are operating;
- **Agreed** that the lists of VME taxa should be reviewed periodically and updated as necessary when better information on the life-history characteristics of VME indicator taxa become available;
    - **Requested** Members and CNCPs to begin compiling information they hold on VME groups that can contribute to updates to the list;
- **Agreed** to add the question of how the FAO criteria should best be combined to identify VME taxa to the work plan.

38. As required by CMM 03-2020 (Bottom fishing) and the SC workplan, New Zealand presented SC8-DW13, a summary of recent bycatch data from New Zealand trawl and line vessels bottom fishing in the SPRFMO Convention Area. There were no catches of benthic invertebrates in 2019 by New Zealand bottom trawl vessels that triggered the encounter protocol. Consequently, assessments of the consistency of encounters with habitat suitability models were not undertaken. However, the paper proposes a review of all benthic bycatch data to determine if there are meaningful within or between year trends, clusters or triggers in benthic bycatch that suggest bycatch is unexpected based on the relevant VME habitat suitability models, and using such a review alongside the review of encounters to evaluate the effectiveness of the spatial management measures.

39. Australia noted that they did not submit a similar paper as there was no trawl fishing by Australian vessels in 2018 and the observer data from the 2019 fishing year were not available in time to submit a paper. Australia provided a brief update that there were a small number of records of 'benthos' in 2019, but they were of low weights and noted their support for a related recommendation on reporting.

40. Australia also noted their concerns with the consideration of the benthic bycatch being considered in the context of expectedness in relation to the habitat modelling, however the discussion was deferred to later in the agenda (discussion of paper SC8-DW12).

41. The HSFG clarified that New Zealand trawl vessels now carry two observers on all trips in the Convention Area (as opposed to one as was done in years up to 2019).

42. In response to a query from DSCC, it was clarified that the bycatch of VME indicator taxa that exceeded the weight threshold in table 2 of the paper occurred in an area open to bottom trawling that was not subject to a move-on rule at the time, and that the rows in tables 3 and 4 of the paper where bycatch exceeded biodiversity thresholds were for only a single VME indicator taxa within a tow and that the encounter protocol is only triggered when three or more VME indicator taxa in a single tow exceed the biodiversity thresholds. It was also clarified that the information in appendix I of the paper is where information on the amount of benthos caught in bottom trawls can be found and finally that the conclusion that the CMM may have increased separation or changed fisher behaviour relates to the reduction in fishing effort.

43. The SC **noted** that observer coverage in the bottom longline fisheries (measured in hooks) is variable and is higher than the required 10% in some years.

44. The presenter clarified that the small amount of benthic bycatch in 2019 and 2020 relative to the previous few fishing years is likely to be due to the reduction in effort.

45. After consideration of SC8-DW13, the SC:

- **Noted** that Members should have flexibility as to whether to describe benthic bycatch interactions in specific papers or in their annual reports.
- **Noted** that, for the 2019 fishing year and the 2020 fishing year through to 19 May, no catches of benthic invertebrates reported by scientific observers on New Zealand bottom trawl vessels triggered New Zealand's encounter protocol under the CMM in place at the time.
- **Noted** that, for the 2019 fishing year and the 2020 fishing year to date, only a small amount of benthic bycatch was reported by scientific observers on New Zealand bottom line vessels operating in the SPRFMO Convention Area in 2019, which is consistent with the assumption that the impacts of bottom line are likely orders of magnitude smaller than those for bottom trawling.
- **Noted** that no trawl fishing took place by Australian vessels during 2018 and observer data for trawl fishing by Australian fishing vessels during 2019 was not available in time to submit a paper, but that preliminary examination of the data indicates that a small number of records of interactions with 'benthos' were reported in 2019 and that no thresholds specified in the relevant CMMs were exceeded.
- **Agreed** to include in their workplan the development of a process to review all recent and historical benthic bycatch data to determine the ongoing effectiveness of the spatial management measures, and an annual update of that analysis using the most recent bycatch data.

46. Building on the components agreed by SC7, New Zealand presented paper SC8-DW12. The paper proposed the adoption of: a process for the SC to implement when it reviews encounters[1] with potential Vulnerable Marine Ecosystems (VMEs) in bottom fisheries at its annual meeting each year; and a checklist that the SC could use to screen information provided by Members for completeness. The paper does not go into detail on all matters that the SC might consider relevant in reviewing encounters or the likely effectiveness of management measures but, rather, focuses on the requirements specified in CMM 03-2020 (Bottom fishing).

47. New Zealand noted that there were broader conversations to be had around the 'expectedness' angle of the required considerations and suggested separating the explicit requirements of the CMM from that wider discussion. This paper focuses on how to look at encounters through the lens of 'expectedness' which is the current requirement under CMM 03-2020 (Bottom fishing). A checklist has also been developed to determine if the Member has provided all the required information.

48. The European Union noted concerns with the process being dependent on whether encounters are considered expected, and noted that the resulting action if an encounter was considered unexpected was to close the area locally, but that such a result would suggest a problem with the models that would have implications for the models that underpin the entire CMM and consequently the estimated effectiveness of the measure.

49. In response, it was noted that the approach was taken from the requirements of the current CMM, and that a single encounter event is not necessarily indicative of a need to disregard the whole suite of models and the management measures based on them. Repeated events and/or clusters of events that do not trigger the protocol is the type of new information that would indicate a need for a more comprehensive review of the models.

[1] "Encounter" means catch of one or more VME indicator taxa above threshold levels as set out in paragraph 28 of CMM 03-2020 (Bottom fishing).

50. The SC queried what event would trigger a review of the models. The presenter clarified that data are being collected as an ongoing exercise and that ideally the models would be updated/reviewed regularly to account for that new data regardless. The most recent testing of the models using two years of new, independent data suggested that the models are performing well, and this new information has been incorporated to updated models. It was also noted that uncertainty in relation to an unusual event is part of the criteria for consideration of an event, as shown in the examples in the document.

51. One Member expressed a preference for an explicit trigger to be documented that would lead to a review of the habitat suitability models.

52. Australia noted that, in their view, it may not be possible to review the expectedness of an encounter in the context of the current habitat suitability index (HSI) modelling. Such a process essentially requires a decision on the significance of a measure of abundance (i.e. the thresholds) against HSI models that provide an indication of a broadly suitable environmental envelope. Based on this, as well as uncertainties in the HSI models and HSI-abundance relationships noted in the BFIA, Australia considers that it would be very difficult to determine whether or not encounters were expected.

53. Australia further noted that, in their view, an encounter review process should be based around determining whether all interactions with VME indicator taxa, including encounters over particular thresholds, constitute evidence of a VME and SAIs on VMEs, not just their expectedness in the context of the HSI models. In accordance with the relevant UNGA Resolutions, such evidence of VMEs should require consideration of whether these areas should be closed. Australia also noted that the Commission may wish to consider these issues in its review of CMM 03-2020 (Bottom fishing).

54. New Zealand noted that in their view the uncertainty in the science is overstated and that the habitat suitability models have been tested recently and found to be robust. New Zealand recognises the concerns and clarified that the uncertainties identified are why the proposed process suggests the SC should take a qualitative approach rather than quantitative. The presenter noted that the CMM does not require the SC to adopt a process and that the SC could consider any future encounters in an *ad hoc* fashion. It was acknowledged that the requirements of the CMM may change by then, but that cannot be predicted at this point.

55. It was noted that there may be benefits of having a plan for when the SC needs to review an encounter.

56. The European Union noted that it would be possible to review the encounter quantitatively at a local scale. It was suggested that the robustness of the expectedness model to the addition of new data could be tested by bootstrapping to get a bandwidth on the HSI estimates for different species. This could become a fully quantitative assessment but would take account of the uncertainty and link all aspects of the science being done to provide advice based on the best available science.

57. New Zealand noted that the approach suggested by the European Union would require a lot of work and would likely result in very wide confidence bounds but could be done if required.

58. Australia was not comfortable accepting the recommendations as drafted, and noted the need, in their view, to review qualitatively for now and consider whether the encounter represents possible interactions with VMEs or possible SAIs on them. They also noted that the level of certainty required to implement the European Union proposal is probably a long way off.

59. There was some debate about the acceptability of the proposed protocol, with concerns being expressed about the appropriateness of encounters being reviewed for expectedness given the uncertainty demonstrated in the previous modelling, countered with the view that the proposed process does not limit the ability of the SC to consider encounters in other contexts, but is intended to support the SC consideration of encounters in the context of the explicit requirements in the CMM.

60. DSCC considers that the SC would do the Commission a disservice if it did not observe difficulties with the science. They note that difficulty is fundamental, the UNGA resolution 64/72 specifically calls on RFMOs to

design encounter protocols and take measures to prevent SAIs on VMEs. They consider that this proposal equates to being asked to throw out the UNGA resolution 64/72 and to go against the tide of other RFMOs and what the UNGA says to do. In their view this is clear in the first example provided in the document where 260 kg of corals could be caught and fishing carries on and that if that much has been caught, tonnes of corals have been destroyed. They consider that a focussing on unexpectedness dismisses what the UNGA resolutions are calling for (SC8-Obs03).

61. New Zealand noted that in their view, the measure is predicated on the spatial regime being the primary mechanism to avoid SAI on VMEs at relatively broad scales, and in that context, the encounter protocol is consistent with the guidelines. If we want to change the measure and the context, that is for the Commission to decide, although the SC can provide some recommendations to the Commission.

62. New Zealand clarified that the CMM currently does not specify a particular timeframe for reviewing encounters, noting that it places the onus on the relevant Member to compile and provide the information to support the SC review of the encounter. The concerns of the HSFG were acknowledged that in other RFMOs and in the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) encounters do not get reviewed and generally areas just remain closed.

63. Australia expressed a view that advice should be formulated that reflects a need for additional thinking on how to review encounters and benthic bycatch data more generally pending review of the CMM.

64. After consideration of SC8-DW12, the SC:

- **Noted** that a geodatabase of standardised and approved GIS layers has been developed and will be deposited with the Secretariat including habitat suitability predictions for the 10 modelled VME indicator taxa at a 1 km spatial resolution, including corresponding naturalness and uncertainty layers;
- **Did not adopt** the proposed process for reviewing encounters at this time.

4.4. Bottom Fishery Impact Assessment

65. The draft Bottom Fishery Impact Assessment (BFIA) was made available and comments received were incorporated into a revised version (SC8-DW07_rev1). Paper SC8-DW17 describes the key changes that occurred in the rev1 version of the BFIA.

66. DSCC wished to express its view that the BFIA provided by New Zealand and Australia does not provide a sound basis for formulating management advice to the Commission; meet international standards (such as the FAO Deep-Seas Guidelines) or comply with the SPRFMO BFIA Standard, principally because it does not, as currently drafted, including identified uncertainties, aim to prevent significant adverse impacts on vulnerable ecosystems by applying the measures called on by UNGA resolution 61/105 and subsequent resolutions, including closing areas that are known or likely to contain VMEs, and suggests that it be revised after the review of CMM 03-2020 (Bottom fishing).

67. New Zealand presented SC8-DW14, a summary of information available on interactions with marine mammals, seabirds, reptiles, and other species of concern in bottom fisheries to meet the requirements of CMM 03-2020 (Bottom fishing). For the period 2007-2019, 27 records were held by the Secretariat on 29 reported interactions with marine mammals, seabirds, reptiles, and other species of concern, including 1 sea snake and 1 turtle, 12 sharks, 14 seabirds and the decomposing remains of a whale (which should not be considered as a capture of a marine mammal in the fishery). Of these 27 records, eight (30%) were found through detailed inspection of Australian or New Zealand records to be erroneous or potentially misleading, suggesting that processes for verification of records and updating of databases need to be strengthened. It was suggested that periodic exchanges of information held in SPRFMO databases with Members who submitted the data would assist in the maintenance of an accurate database.

68. The SPRFMO Secretariat thanked New Zealand for the paper and noted their agreement with the recommendations in the paper as they pertain to updating the information held by the Secretariat (as reported in SC8-Doc11_rev2).

69. The European Union disagreed with the recommendation in SC8-DW14 that no further action was required, noting that the BFIA shows what the bycatch species are and how uncertain the information on interactions with those species was. They noted the Productivity-Susceptibility Analysis (PSA) and Sustainability Assessment for Fishing Effects (SAFE) analyses showed some species were very vulnerable and putting together the uncertainty in interactions and the high vulnerability of some species, it does not seem appropriate to have no further action required.

70. The presenter noted that captures should be considered in the context of the population size and ability of those populations to sustain the additional fatalities from fishing and agreed that consideration of further management action would be a more appropriate recommendation.

71. There were some suggestions of possible actions that could be recommended, e.g. move on rules for bycatch or increased observer coverage in the bottom longline fishery to reduce uncertainty, but rather than decide now, the recommendation will note the need for consideration of additional management actions.

72. After considering SC8-DW14, the SC:

- **Agrees** that monitoring of the implementation and effectiveness of mitigation approaches should continue, including periodic review of mitigation measures applied by other RFMOs and CCAMLR or as advised by ACAP, to ensure best practice and consistent or complementary arrangements;
- **Agrees** that periodic exchanges of information held in SPRFMO databases with Members who submitted the data would assist in the maintenance of an accurate record of captures of marine mammals, seabirds, reptiles or other species of concern in fisheries in the SPRFMO Convention Area;
- **Agrees** that information collection and checking should continue with a view to including information from SPRFMO bottom fisheries in the Southern Hemisphere Seabird Risk Assessment.

4.5. Advice to the Commission on Deepwater

73. The SC:

- **Agrees** that the cumulative BFIA provided by New Zealand and Australia represents: the best science available to the SC at the current time; provides a sound basis for formulating management advice to the Commission; meets international standards (such as the FAO Deep-Seas Guidelines) and complies with the SPRFMO BFIA Standard and, consequently, **accepts** the BFIA (SC8-DW07_rev1).
- **Agrees** that the impacts of bottom fisheries on target and non-target fish stocks are appropriately assessed under the SPRFMO assessment framework noting:
  - for Orange roughy, stock assessments have been undertaken that indicate all stocks are likely above limit biomass reference points and several are above target biomass reference points used elsewhere for the management of this species
  - for other target species caught in SPRFMO demersal fisheries, workplans are being developed for stock structure delineation studies, which may inform future assessment and management
  - for non-target and bycatch (discarded) species, ecological risk assessments have been undertaken to categorise these species into the SPRFMO stock assessment framework and prioritisation of species estimated to be at high and extreme relative risk from fishing has been undertaken.
- **Agrees** that captures of marine mammals, seabirds, reptiles and other species of concern are rare in midwater trawl for bentho-pelagic species and bottom trawl fisheries and appears to be rare in

bottom line fisheries but **requests** bottom fishing Members to collaborate to develop a framework for providing precautionary advice on such captures;

- **Agrees** that, with respect to impacts on benthic fauna and VMEs, that:
  - The habitat suitability models have high statistical skill in classifying suitable VME taxa habitat. However, there is great uncertainty in translating model outputs to estimates of abundance of VME taxa on the seafloor, as well as issues of potential model over-prediction leading to over-optimistic estimates of protection for some taxa.
  - the estimated footprints of midwater trawls for benthopelagic species and demersal line gears are orders of magnitude lower than those for demersal trawl gears and are thought to represent a low risk to VME status and habitat protection.
  - the equilibrium status of most VME indicator taxa in most areas is qualitatively favourable across a range of sensitivity analyses, although there is a high level of uncertainty.
  - The proportion of suitable VME indicator taxa habitat protected is uncertain but qualitatively favourable at most scales assessed. However, there are a number of areas at smaller scales (Fishery Management Areas) where the level of suitable habitat protected for some VME taxa is less favourable including Northwest Challenger, Central Louisville and Southern Louisville.
  - Suitable habitat for VME indicator taxa deeper than 1400 m is unlikely to be impacted by fishing (which essentially ceases at 1250 m). If a depth cut-off of 1400 m is applied, the proportion of suitable habitat for a subset of VME indicator taxa including stony corals unlikely to be impacted increases on the Central and Southern Louisville Ridge and becomes qualitatively favourable, but the core depth distribution of many other VME indicator taxa likely overlaps with fishable depths in these areas.
- **Agrees** that, although the appropriate scale to assess and manage impacts on VMEs has not been defined in SPRFMO, the smaller scale of the Fishery Management Areas is likely to be a more biologically appropriate scale at which to assess and manage these impacts than larger scales.
- **Notes** that there is currently a lack of a scientific underpinning for defining ecologically appropriate reference points for VME status or protection.
- **Notes** that, in the absence of SPRFMO-agreed reference points for assessment and management of VME status and/or the proportion of suitable habitat protected, it is not possible for the SC to provide a quantitative interpretation of the BFIA results against such reference points.
- **Notes** that the SC will update its multi-annual workplan to guide work to reduce uncertainties in risk assessments for benthic habitats and VMEs.

74. In addition, the SC:

- **Recommended** that in its review of CMM 03-2020 (Bottom fishing), the Commission may wish to consider additional precautionary management measures for areas and taxa at higher risk from bottom trawl fisheries to address uncertainty and provide additional confidence that the CMM will meet its objective.
- **Recommended** that the Commission provides guidance to the SC on the level of protection, structure, or function of VMEs it requires to assure that Significant Adverse Impacts on VMEs are prevented, or requests advice on this in the multi-annual workplan;

5. Jack mackerel

5.1. Intersessional activities

75. The Jack mackerel catch history and predicted 2020 catches (SC8-JM01) had been presented at the fourth SC web meeting (refer SC8-Doc06_rev1) and populated with expert Member estimates of predicted 2020 catches. The one exception was for the Russian Federation figures, as the Russian Federation was not present at that meeting. All the catches (excluding figures from the Russian Federation) were accepted by that meeting. The Secretariat briefly summarised the latest revision to paper (Annex SC8-JM01_rev2), subsequent to the pre-SC web meeting. It was noted that a figure of CJM catches had been received from the Russian Federation, and it was raised to an end of year figure using the usual methods as agreed.

76. European Union presented paper SC8-JM03 "PFA Self sampling report for SPRFMO 2020". The presentation described the results of the Pelagic Freezer-trawler Association (PFA) self-sampling programme 2015-2019 in the SPRFMO Area. The self-sampling programme delivers information on spatial and temporal evolution of the fishery, species and length compositions and ambient fishing conditions (temperature and depth). Catch distributions and length compositions by quarter and division are presented for Jack mackerel, chub mackerel, and southern ray's bream. As of 2019, age sampling for Jack mackerel was included in the self-sampling programme. Reports on age sampling have been reported as age length keys (ALK) by quarter, and worked up age distributions by quarter. While most of the data presented in this report were already included in the 2019 submission to SPRFMO (SC7-JM07), the current report encapsulates the complete data for 2019 and some further analyses. No PFA fisheries were carried out in the SPRFMO Area in 2020, due to the COVID-19 pandemic.

77. The length compositions of the offshore Jack mackerel catch in the southern area (FAO fishing area division 87.3.3) show a bimodal distribution in 2015. Thereafter the median length increases by year from 29.2 cm in 2016 to 42.5 cm in 2019. This appears consistent with the recruitment of a strong cohort to the fishery in 2015. In the northern area (FAO fishing area division 87.2.6) two recruitment pulses appear: one in 2015 and the other in 2019, the latter of which is a strong one. Catch rates of Jack mackerel, defined as the average catch (tonnes) per fishing day were highest in 2015 (160 ton/day), substantially lower in 2016, until 2018 (77-110 ton/day), and close to the 2015 value again in 2019 (142 ton/day). The spatial distribution of the main offshore fishing grounds has shown considerable changes over time. More extensive westward fishing explorations were conducted in 2015, 2018, and 2019. The northern areas were mostly fished in 2017 and 2019.

78. The SC Chairperson asked whether the self-sampling data has been used at all in the assessment so far. The European Union clarified that it has not been used. A clarification was also brought forward from the SC Chairperson and China that gaps in data (e.g. missing quarters) are common in observer sampling programmes, similar to what is reported from the self-sampling programme. Korea noted that their vessels fish in a later part of the season, which might be relevant in capturing the late-season length frequency data. The SC **noted** that this is part of the terms of reference for the benchmark activities (the data workshop) and encourages that it be considered for future assessment applications.

79. European Union presented paper SC8-JM04 "Comparison of PFA self-sampling with EU observer data". The pelagic freezer-trawler fleet (PFA) has been carrying out a self-sampling programme on the freezer-trawler fleet since 2015. During self-sampled trips, the crew member will generally take a random sample of around 20 kg from the catch of each haul (or the majority of hauls), separate them into the different species and measure the length compositions of each of the subsamples. During some of the self-sampled trips, the vessel was joined by a scientific observer. For those trips, the species and length compositions from the scientific observer were compared to the self-sampling data. Within the fishery for Jack mackerel in the South Pacific, the PFA self-sampling programme was carried out on all trips. The scientific observer programme for that fishery targets coverage of at least 10% of the effort. Over the years 2015-2019, the analysis showed that around 42% of the catch was covered by scientific observers. During the same period, 12 trips were covered

by both self-sampling and scientific observers. The overall number of length measurements between the self-sampling and observer trips is comparable. However, the self-sampling programme samples fewer fish per trip but covers more (all) trips while the observer programme measures more fish but on fewer trips. Comparisons of the cumulative catch per trip show close correspondence between the two sampling programmes, as does the species compositions. Length compositions per sampled trips and hauls are generally comparable. A comparison of the overall annual length compositions derived from both sampling programmes demonstrated that the self-sampling covers a wider part of the fishery (season, area). This explains some of the differences between the two data sources. Self-sampling provides a substantial improvement in the coverage of the fishery and therefore a more realistic length composition for use in the assessment of Jack mackerel. The combination of self-sampling and observer trips allows for quality control of both programmes, while still ensuring a wide coverage of the fishing season. It is suggested that, in the benchmark workshop of Jack mackerel in 2021, the use of the self-sampled length distributions may be considered as the basis for the European Union catch data used in future assessments.

80. Chile presented paper SC8-JM07 "Catch-at-age structure of Jack Mackerel for the period 1990-2018 using a new ageing criterion". New criteria of age allocation based on the results of the validation (refer paper SC8-JM09) made it possible to obtain a revised ageing structure for Jack mackerel. These results were characterised by a shift of the catch age structure towards younger age groups, assigning them with mean sizes and weights greater than those assigned by the historical criteria of age allocation. The new allocation will likely affect both the selectivity of younger individuals for the fleets, as well as the assessment model's estimates of recruitment. Chile suggested that age-determination laboratories of SPRFMO Members conduct cross matching of otolith readings including the new criteria.

81. The European Union asked whether this analysis included the review of old otoliths, and it was clarified that samples were not re-read microscopically, and historical records simply involved adjusting the data to reflect the new criteria related to the number and pattern of increments.

82. The SC asked to what extent the new age determinations were also affected by reader variability, and whether this should be introduced into the model. It was clarified that cross validation was planned for the next intersessional period. This includes international cross validation, which could involve the sharing of methods and samples.

83. The SC therefore **agreed** using SC resources to develop a programme for such an exchange of samples and convene a meeting to allow analysts to compare and test methods. Chile was also asked whether the next iteration for the benchmark would include sample sizes, and they clarified that all information about sample size was retained. More details will be included in an updated working-paper for the next SC. It was finally suggested that research on the geographic variability of ages could be pursued as well (e.g., North-South trends, or nearshore versus offshore).

84. Peru noted that the new age structure is more consistent with ages in the Peruvian area and observed that most of the change affects younger fishes. It was clarified that the new growth pattern was closer to data collected by Peru, the European Union and Russian than the old one had been.

85. It was clarified that these changes were not implemented in this year's model, but, with guidance, they could feed into next year's benchmark. More otoliths could possibly also be reviewed before next year.

86. The SC:

> **recommended** that intersessional work on comparison of protocols and exchange of otoliths between Members take place, including a possible intersessional workshop. The Jack mackerel working group chair volunteered to help initiate this activity.

87. Chile presented paper SC8-JM09 "CJM Validation of Daily Growth Microincrements in Otoliths". The work aimed to validate the first annulus in Jack mackerel age estimation, which is of great relevance for life history parameters and, ultimately, stock assessment outputs. The otoliths of wild-caught individuals were marked

with alizarine red and kept in rearing tanks to analyse daily growth rings. Another mark was made after 46 days, so that the microincrements between the two lines could be analysed. Alizarine red marks a line visible using a transmission microscope. This allowed researchers to estimate that the first translucent zone might be formed at 180 and a second at 300 days, which might be mistaken for annulus rings. The first year of life is reached at mean lengths between 21.2 and 21.8 cm FL and the period of birth corresponded to the period of highest Gonadosomatic Index (GSI) in the wild (between August and January).

5.2. Management Strategy Evaluation

88. The European Union presented paper SC8-JM05 "Summary of MSE project". The European Union has undertaken a study in order to: 1) investigate Jack mackerel management targets and potential management plans, and 2) define a generic framework to study the Jack mackerel habitat. On aspect i, four online meetings were held, with much discussion. The first decision made during the online meetings was to define hypotheses on stock structure to be used in the Management Strategy Evaluation (MSE). It was concluded that three different stock structure hypotheses should be tested: a single stock, two separate stocks and a hybrid stock structure assumption in which there is exchange of individuals between two stocks: one in the South and one in the North. In addition, it was concluded that two different growth assumptions should be evaluated as well as two different assumptions regarding productivity. Combining these aspects resulted in 12 different scenarios.

89. The spatial heterogeneity of the Jack mackerel stock is then included in the MSE (aspect i). This will be done by including different sources of uncertainty such as variability in selectivity patterns of the different fleets, weight at age, and the migration rate of individuals under the hybrid stock structure assumption. The final conclusions on the spatial heterogeneity will be made by the MSE group of the SPRFMO SC.

90. It is anticipated that these conclusions will be made shortly after the 2020 SC-8. A simple management strategy (aspect iii) has been implemented in August 2020 for illustrative purposes. In collaboration with the SC as well as the Commission, other management strategies will be developed in early 2021. A separate study has focused on aspect iv, in which the behaviour of the fishing fleets under changing environmental and or quota conditions was examined. For this aspect, La Niña and El Niño events were investigated and how these affect landings by the four different fleets. Final results on this aspect will be reported in December 2020. The final evaluation of management regimes described under aspect v, will take place after consultation with the Commission. The technical framework however is already designed and implemented which makes it possible to test different management regimes. It is however not a task of the SC to decide on management regimes. Reporting on each of these aspects will be finalised in December 2020 and will includes all progress made until that point.

91. In the part of the study in which an attempt was made to define the Jack mackerel habitat, two explorations were undertaken. The first of these related to data evaluation in which a standardised approach to download environmental data relevant for the distribution of Jack mackerel was developed. This was completed by January 2020 and included analysis of industry data. A statistical model was also developed to evaluate the impact certain environmental conditions have on the distribution of Jack mackerel. To be able to report on the appropriateness of this model more data is needed at this stage for which a request is pending with different Members of SPRFMO. It is expected that by December 2020 final results will be able to be presented.

92. The Chairperson reminded the meeting that, while evaluating the MSE and pending the benchmark, the current management procedure is still in force.

93. A workshop at the next Commission meeting, not scientific in nature, but rather focused on management strategy advice was proposed and **agreed** upon. Further details, including the selection of a suitable Chairperson to lead the workshop, should be discussed, and agreed upon intersessionally. The Chairperson furthermore suggested that a series of leading meetings might be needed to achieve a meaningful workshop at the Commission meeting.

5.3. Assessment data review and evaluation

94. European Union presented paper SC8-JM02 "CPUE standardization for the offshore fleet fishing for Jack mackerel in the SPRFMO area". Prior to 2018 two offshore CPUE series were used in the assessment of Jack mackerel: the standardised Chinese CPUE and the nominal offshore fleet CPUE (European Union, Vanuatu, Korea, Russia). During the benchmark assessment of 2018, the nominal offshore CPUE was converted into a standardised CPUE series, following the same methods as used for the Chinese CPUE. During SC7, a fully combined and standardised Offshore CPUE index was calculated that was based on the haul-by-haul data of China, European Union, Korea, Vanuatu and Russia as contained in the SPRFMO database. This analysis was updated for SC8. Permission to utilise that information was granted by the respective Members. The standardisation procedure is identical to the procedure as agreed during SC7. The final Generalised Additive Model consists of a number of discrete factors (year, vessel, month and El Niño Effect) and a smoothed interaction between latitude and longitude.

95. Chile presented paper SC8-JM06 "CPUE Analysis CJM purse seine fishery center-south Chile 1994-2020", which provides a relevant set of data for Jack mackerel stock assessment to be considered by the SPRFMO. Historically, the standardisation of fishing operations of the Chilean fleet for a CPUE analysis uses catch data at the level of fishing trip. Since fishing trips may hide resolution on fishing operations and its strategies, an integration of information was conducted to develop a catch per set database for the 1994-2020 period. This database was used to apply a standardised statistical model that includes a distribution of compound probability describing the joint probability of success and a catch per set fishing. The estimated average values of catch per set are subject to interpretation in terms of fishing milestones and the annual index allows the traceability of the CPUE trend. This new model predicts similar results to the standardised CPUE that Chile annually contributes to the SPRFMO. However, some precautions shall be noted on the differences detected.

96. The SC noted that the new CPUE index presented was based on sets rather than trips and it seems to have changed historical CPUE trends. This is shown in figure 6, where the new CPUE (only for 1994-2020) suggests that the stock and the fishery trend was relatively flat prior to the establishment of the SPRFMO and, moreover, had an increasing trend between 1994 and 2007, which is contrary to what was known and to the observations which justified the interim CMMs adopted by the SPRFMO. The SC noted that the index merits a careful review anticipated to occur at the planned data workshop and subsequent benchmark.

97. There was a request for clarification regarding the choices made in modelling CPUE, including the choice of CPUE rather than catch as the variable to be modelled, the lack of environmental variables, and the way spatial variables were incorporated, and asked for more model diagnostics to be integrated into the paper. It was noted that there seems not to be a vessel effect (e.g. as a random effect) included which should be investigated. A suggestion was made to include a variogram to see if there is spatial correlation, because with this high density of data, correlation may be an issue. Spatial correlation could be one of the reasons for the difference in trends given that the number of sets is probably highest in the 1995-2005 period.

98. The SC inquired whether the number and type of vessels was consistent through the years. It was clarified that change in vessels isn't necessarily an issue, as long as you have vessels that participated for at least a couple of years but could be a problem if vessels are in the fishery for only one year.

99. Chile acknowledged that further work was required on the model and suggested that it be further developed for the benchmark workshop, and this was agreed. The SC notes that this CPUE analysis using set by set data is promising work but that these results should not be used in this year's assessment until further consideration by next year's benchmark workshop.

100. Chile presented paper SC8-JM08 "Space-time variability of the Jack Mackerel fishery off central-south Chile in 2020 compared to 2017-2019". In 2020 (January-July) fishing activity on Jack mackerel (*Trachurus murphyi*) mainly occurred in the coastal strip within 60 nautical miles of the coast and were distributed between 29°40'S and 40°00'S, where 99% of the total industrial landings were landed. This was permitted by: (a) the high level of commercial aggregation presented by the near-coast Jack mackerel shoals; (b) the high recurrence of shoal

watching areas throughout this strip; c) the high abundance of shoals, largely caused by the presence of thermal gradient zones, high biological productivity sectors in retention zones caused by the presence of mesoscale eddies, and (d) because the specimens captured this year largely met industry requirements (length and quality) for the production of by-products for human consumption. All this caused a low interest in the fleet to search for new fishing areas and attempt to expand its operation into the oceanic region, as recorded in previous years.

101. When surveys were carried out in the ocean area for commercial and research purposes towards the end of autumn, they did not yield successful results. It is noteworthy that the continuity of the fishing activity throughout 2020 in the coastal sector, which, while representing the highest point of a more coastal operating trend observed in recent years, breaks in part with the traditionally recorded space-time dynamics, in which commercial shoals were observed migrating into and outside the EEZ during June and July, which was registered in previous years by both the national fleet and the international fleet.

102. The dynamics of the Jack mackerel size structure indicated that in recent years there has been the entry of modal groups of 25 to 28 cm LH in the central-south sector as a second group of importance, migrating between the north and south centre. This was observed in 2020 with the modal group 27 cm FL, in which a North to South displacement was recorded in summer and then in autumn a return to the North. From January to May it was characterised by the presence of a bimodal structure with a group of 27 cm LH present from January to May and modal groups greater than 33 cm LH. And from June onwards by the presence of a modal group of 40 cm LH present throughout the range of the fishing operation. A low presence of below legal minimum size (BTML) specimens was highlighted which did not exceed 4% per month. It is relevant to continue monitoring the fishing operation in the coastal region and to establish whether this high concentration of the operation caused by a high availability of resource in this strip will be consistent in the coming years considering the quota regime to be delivered by the SPRFMO.

103. Historically during the 1980s the Jack mackerel fisheries developed in a small area strongly associated with the coastal sector inland from 30 nautical miles in front of the Eighth Region of Chile. It is likely that in the state of recovery apparently found in the Jack mackerel population (moving from the contraction phase to the expansion phase), it will use different space-time structuring strategies that will allow it to increase its expansion potential, as is to be strongly added in the coastal sector where biological productivity is higher than in the ocean region, as it would have done in the 1970s and part of the 1980s.

104. The SC noted that there were high catches in April 2020 in the North but that these fish were not reflected in the acoustic survey that took place one month earlier that year. Chile responded that, based on fleet movement following fish concentrations, this was due to fish movement from the central area. The fish size composition in the fishery was consistent with this perceived movement pattern.

5.4. SPRFMO Jack mackerel assessment

105. The meeting verified that each interested party had double-checked the data submitted for the assessment, and that all data were entered correctly in the model.

106. A short introduction on the assessment was held for the Members, underlining the parallel run of both the single stock (H1) and two stocks (H2) hypotheses. The preliminary results from the assessment runs and its sensitivities were discussed. Results are identical to last year's model when using the historical data, and not greatly different when just the 2019 data is added. Model 1.00 has the same structure and assumptions as Model 1.00 from last year, except that the model was updated to allow for selectivity changes and recruitment to 2020. As always, the modelling process was very open to all participants and all changes or steps were documented on GitHub.

107. It was noted that the weighting on catch-at-age for the northern Chilean fleet (Fleet 1) in 2020 is very low and that there is a lot of variability in the Chilean North catch-at-age data generally. As agreed, the last data point for 2020 age-composition data has been entirely down-weighted because of the low sample size. It is

suggested that the benchmark workshop make use of the sample information that is presented in the templates to provide sample size settings in the assessment model.

108. Traditionally, assessments have always been conducted using both the one- and two-stock hypotheses, but an explicit comparison between the two hypotheses has not been made in previous reports. However, as it is important for the SC to understand the differences between the 1 and 2 stock models they have been described in a Table, including for example differences in regimes of stock-recruit relationships, growth rates, natural mortality and selectivity (Annex 6).

109. In previous years, the lower bound of the confidence interval of the most recent recruitment estimate was used in the projections, but for this year it was decided to use the recruitment estimate and not the lower bound. Now that there are more data about the strength of the incoming year-class, it was noted that such an uncertainty adjustment may no longer be needed.

110. Four future scenarios have historically been used for projections. Future scenarios included with either an optimistic (steepness parameter 0.8) or a pessimistic (steepness parameter 0.65) choice of stock recruit parameter, and either a long (1970-2015) or a short (2000-2015) time-series of recruitment indices, reflecting a change in regime.

111. The SC **agreed** that Model 1.00 would be used as the basis of the final accepted assessment of Jack mackerel.

5.5. Advice to the Commission on Jack Mackerel

112. The SC was tasked with giving advice on the status of Jack mackerel. Advice on Jack mackerel stock status at this meeting was based on stock assessments conducted using the Joint Jack Mackerel (JJM) statistical catch-at-age model as developed collaboratively by participants since 2010. The Jack mackerel stock(s) in the southeast Pacific show(s) a continued recovery since the time-series low in 2010.

113. An overview of the advice provided by the SC, the management decisions by the SPRFMO Commission and the estimated catch by year has been compiled in Annex 7. This Annex demonstrates that the advice from the SC has been taken up by the Commission and the catches have mostly been at or below the intended catches.

114. Because of the difficulties introduced by the COVID-19 pandemic, it was agreed that this year's assessment would be based on a simple update of last year's assessment model and applying the harvest control rule ("Adjusted Annex K").

115. In conformity with the approach by the SC since 2012, a comparison was made between the 1-stock and 2-stocks model configurations. Both models showed similar trends with an increasing overall biomass, high recruitments in recent years, and low fishing mortality. Under the two-stock hypothesis model, the northern stock is estimated to have stable and low biomass levels over the past decade with an increase in the last few years. The combined single-stock model resulted in slightly lower recruitment and biomass estimates than the summed 2-stock model.

116. Estimated biomass increased from 2019 to 2020 and is now estimated to be well above the interim B_{MSY}. Therefore, the SC noted that the Jack mackerel has been rebuilt to the third tier of the proposed harvest control rule (COMM2 Annex K). Within the third tier of the harvest control rule, catches should be limited to a fishing mortality of F_{MSY} rather than the lower status quo fishing mortality applied under the previous tier of the Jack mackerel rebuilding plan. Fishing at F_{MSY} would be expected to result in catches in 2021 just below 1500 kt. However, according to the directive of the Commission to the SC (described in COMM6, Annex 3) the "adjusted Annex K"; a maximum change in the catch limit of 15% which would be based off the 2020 TAC should apply.

117. In line with the accepted rebuilding plan ("Adjusted Annex K") and because the Jack mackerel biomass is estimated to be above 100% of B_{MSY}, the SC:

recommended a 15% increase in 2021 catches throughout the range of Jack mackerel- at or below 782 kt. This advice for catch limits in 2021 does not depend on the stock hypothesis that is used.

118. Summaries and technical discussions related to the Jack mackerel assessment are detailed in Annex 8.

119. The delegation of Chile expressed its disagreement with the SC's decision to present scientific advice which includes results from the two hypotheses on stock structure (H1 and H2) in parallel. Doing so implies that they have been given the same level of review. In addition, at this meeting several questions on aspects of the H2 configurations were raised. Due to time constraints, the SC has compiled these to go with issues to be addressed at the next benchmark assessment review (Section 5.6). In Chile's opinion, H1 and H2 should not be treated as equivalent. It is the view of the Chilean delegation that the two-stock hypothesis has only been subjected to limited review over the years, even in the most recent (2018) benchmark. Therefore, the Chilean delegation notes that including H2 in the provision of catch advice is inappropriate for guiding the Commission's decision process.

120. The Chilean delegation also expressed concern that scientific advice aimed at defining the TAC based on catch limits derived from the two different hypotheses, is confusing regarding the relevance of the two hypotheses behind the models implemented. They expressed concern that this will create confusion for the Commission. Unlike previous years, the SC is reporting in greater detail on the results of the H2 model this year. However, for reasons noted (and addressed for the future benchmark) the Chilean delegation wishes to state that this does not imply that this model should be considered for recommending catch limits.

121. The delegation of Peru finds the position of our Chilean colleagues expressed in paragraphs 119 and 120 appalling and scientifically unfounded, in addition to trying to detract and go against what was decided and how we have been working since 2012. It is stressed that, as stated in paragraph 115 above, the models for the 1-stock and the 2-stock hypothesis have been incorporated in the assessments and formulation of the advice to the SPRFMO Commission since the 11th meeting of Science Working Group (SWG) that preceded the formation of this Scientific Committee, when the SWG met in Lima, Peru, in October 2012, and that's what this Committee has been doing with respect to the Jack mackerel assessment and advice all these years. The agreement in the 2012 meeting was that all the assessment and advice to the Commission would be based on the analyses with the JJM model applied to the both, the 1-stock hypothesis and the 2-stock hypothesis. And that's something this SC has been adhering to closely and diligently, irrespective of the relatively negative stand that occasionally has been taken by some members of the Chilean delegation participating in our previous 8 meetings (i.e. one SWG11 and seven SC1-SC7 meetings). We find that trying to wipe-off all that work by this Committee though the statements in paragraphs 119 and 120 above is unacceptable. With respect to the past reviewing (or lack of it) of the JJM models as applied to the 2-stock hypothesis it needs to be stressed that all the data, runs, results, etc., of the JJM for the H1 & H2 runs, including those for the Peruvian or Far-north stock and the Chilean or southern stock under the 2-stock hypothesis (H2) have been widely available to all members of the Scientific Committee since 2012, and our Chilean colleagues and others have had ample opportunity to undertake an in-depth analysis of all in real time or immediately after each SC meeting. The inability or unwillingness of some delegations to do so, or their inability to come out with sound comments in favour or against those results is not a scientifically sound argument to try to eliminate all the work done by Peru and/or by this Committee with respect to the assessments under the 2-stock hypothesis.

122. Paragraph 28 of CMM 01-2020 (*Trachurus Murphyi*) states that "At its next annual meeting, the Scientific Committee will assess the information received and provide advice to the Commission regarding the possible impact of the national measures adopted on the *Trachurus murphyi* fishery."

123. The SC **noted** that due to the tight schedule in the online meeting format, it has not been possible to fully address this question as part of the SC agenda.

124. The SC also **noted** that an overview is presented of the past scientific advice, the catch limits adopted and the resulting catches over the years 2011-2021 (Annex 7). In 2019, the sum of realised catch of Jack mackerel has been higher that the maximum recommended by the SC. Due to the estimated abundance, apparent low

fishing mortality and recovery of the stock, the SC was unable to detect if this overcatch made much difference to the stock status of Jack mackerel. However, any catch higher than that recommended by the SC is outside of what has been evaluated as part the current rebuilding plan. In the longer term, it is necessary to evaluate the potential structural impacts of national measures on the *Trachurus murphyi* fishery. This would best be carried out as part of the management strategy evaluation. This requires a precise specification of the type of national measures that should be considered.

125. The Commission also requested that the SC explore the consequences of carrying over allocations of the TAC. The SC **noted** that this will be handled as part of the MSE in 2021.

5.6. Suggested terms of reference for a data workshop and benchmark workshop of Jack mackerel

126. The most recent benchmark assessment of Jack mackerel was held in 2018. Since then, several new sources of information and new assessment issues have come up, that warrant a new benchmark assessment of Jack mackerel.

127. The SC:

recommends that a Jack mackerel data workshop (3-4 days) be held in early/mid 2021 to address *inter alia* some of the following topics (a final terms of reference will be developed prior to COMM9):

- Collate an overview of the number of samples per quarter and fleet related to total catch taken in the length and age sampling data;
- Fully consider the new ageing method developed by Chile and the implications for associated parameters (growth, maturity, natural mortality) and the assessment. Carry out a comparison of age length keys of different Members, including looking at sample sizes. It would be good to have all the Chilean age data from all years available for the benchmark. If this is not available, lengths may need to be used for some of the earlier years;
- Look carefully at diagnostics and model structure of the new Chilean set-based CPUE index;
- Consider whether the self-sampled length distributions should be used for the European Union catch data in future assessments.

128. In addition, the SC:

recommends that a Jack mackerel benchmark workshop (minimum of 4 days) be held in 2021, conditional on a successful data workshop being held, to address *inter alia* some of the following topics (a final terms of reference will be developed prior to COMM9):

- Evaluate how the age data affect other model assumptions, namely natural mortality and weight-at-age variability over time;
- Explore the impact of the first age in the assessment. Currently the assessment starts at age 1, but recently there have been some age zero fish turning up in the catch, and the benchmark should consider how these should be treated;
- Review the single stock and two-stock hypothesis implementations of the JJM assessment model, projections, environmental regimes and reference points;
- Review the methods used to carry out projections and, if needed, explore alternatives. Ensure documentation and options are up to date;
- Improve model diagnostics and upgrade the graphical display of model results, potentially more fully incorporating FLR tools (since that has been used for the MSE and has largely been adapted).

6. Squid

6.1. Review of intersessional activities

129. The Secretariat presented SC8-SQ01_rev1 Squid information held by the Secretariat, which identifies and describes Jumbo flying squid datasets held by the SPRFMO Secretariat. The paper includes a comparison between the data in the datasets held by the Secretariat and the data in the FAO data series. It also provided information on fishing effort over time (number of vessels and gross tonnage) and the draft data collection templates that were discussed in the pre-SC web meetings.

130. The comparison between data held by SPRFMO and the FAO was developed with the full time series of catch from the FAO database compared with what has been submitted to SPRFMO. The Secretariat noted that there remain discrepancies in the historical data for Japan and Ecuador. Japan has been contacted on several occasions to try to resolve the discrepancies, and the annual report for Ecuador (SC8-Doc29) indicates that this data is not available. The Secretariat therefore requested feedback from Members on whether the FAO figures should be used where no other information is available.

131. Chile noted that the figures provided in the Peruvian annual report are not official figures and therefore may not be included in the FAO statistics, in particular relating to the catch on the high seas compared to within the EEZ. The Secretariat clarified that all numbers used have been provided by the relevant Member, and Peru in particular confirmed that the correct statistics are used in the table. They further clarified that the totals in the table correspond with the official statistics and the division between high seas and within-EEZ catch is based on sampling that is scaled up by IMARPE and therefore represents the best available information on the distribution of the catch to be used by the SC.

132. China noted that their catch data in the table has been modified in rev1 of this document to reflect updated information and that the 305 700 tonnes for 2019 is based on their estimated catch data. It was noted that data from around 500 vessels is included, but data for around 40 vessels is not yet available as they have not come to port to provide their logbooks.

133. Korea made a commitment to check and confirm the information in table 1 for Korean catch data.

134. The SC **agreed** that while criticisms could be made of the FAO information, it does represent the best available information and it is subject to a standard process of collection, checking and balancing, and that it could be used where other information is not available.

135. The SC **requested** that the Secretariat update the Japan and Ecuador catch figures prior to 2014 using the information contained in the FAO database so that SPRFMO has a more complete historical record for Jumbo flying squid captures.

136. Additionally, the SC:

> **recommended** that Members check the catch data contained in tables 1 and 2 of SC8-SQ01_rev1 and liaise with the Secretariat in cases where significant discrepancies exist.

137. There was discussion on tables 3 and 4 in the paper which provide historical records of active vessel numbers by Member in the squid fishery since 1990 and for the most recent six years, gross tonnage of active vessels. It was noted that the table documenting tonnage has a shorter history because the Secretariat does not hold information on specific active vessels (and hence gross tonnage) prior to 2014. Members were asked for feedback on whether the information in tables 3 and 4 was helpful and the SC **agreed** that it was.

138. The SC supported the continued collation of this information noting that this information is critical to understand the fishing power in this area and encouraged Members to provide the latest information to the Secretariat. They also noted that this information will provide a good starting point to discuss fishing power in the squid workshop next year.

139. Members agreed that it would be useful to discuss further details that might be useful to provide/include in future at the next workshop and that Members could provide detailed reports and papers with suggestions of information to be provided to that workshop.

140. The SC **requested** that the number of vessels (and gross tonnage) for vessels that fished in the squid fishery in the SPRFMO area by flag State and Year continue to be documented and presented to the SC. These data are already provided to the Secretariat.

141. China presented SC8-SQ02 which is a short summary of information that was presented at the pre-SC web meetings. There were no comments or feedback received from other Members, so tabled the paper for further discussion. China suggested a recommendation that a 4-stage maturity protocol should be used by all Members for squid in the Convention Area.

142. There was lack of agreement initially due to the way groups were aggregated. Furthermore, for evaluations and recommendations of the reproductive condition it is very important that both stages can be differentiated, as proposed in the scale of (Perea et al. 2018)[2] which is also histologically validated.

143. It was also noted that there is no scientific evidence of the existence of the post-spawning phase for *Dosidicus gigas*. The fact that in other ommastrephids this phase has been determined or is proposed, is not a technical argument that in giant squid it should exist. Furthermore, this scale of gonadal maturation is specific to the species; it is not a scale adapted to the resource, and the recommendation of Kjesbu et al. (2003)[3] is followed for its elaboration.

144. In the case of males, the three stages or phases identified (Perea et al. 2018) for *Dosidicus gigas*, group the clearly differentiated macroscopic characteristics of the testicle, which are supported microscopically (histological validation). The three stages or phases described show the entire reproductive process differentiable for males, where the mature stage (III) is broad. Due to the dynamics of the maturation process, spermatophores are formed that can be visualised inside and/or outside the spermatophoreal sac, not producing microscopic differences in the testicular structure, so these characteristics also correspond to the mature stage.

145. Peru expressed a view that any proposal regarding the scale of this species should be supported by technical information focused specifically on *Dosidicus gigas*.

146. Chinese Taipei noted that Members have developed the appropriate maturity scale for their squid samples and have processed it for a long time. They suggested to develop a Common Scale, which is the intersection of all maturity scale and could be the minimum criteria for submission to the SPRFMO and Member may aggregate their data into the common scale easily.

147. After consideration of SC8-SQ02, the SC:

> **recommended** that the maturity schedule be finalised via email and **requested** that the Secretariat make the form for classification schemes for Jumbo flying squid available for Member use.

148. The SC **noted** that colour photographs of the gonadal stages be developed to help with assigning stages to squid and **requested** that Members and CNCPs provide guidance and also provide the guides in the respective languages.

[2] Perea, A, Sánchez, J, Buitrón, B. (2018) Gonadal maturity scale of the jumbo flying squid *Dosidicus gigas* (d'Orbigny, 1835) (Cephalopoda: Ommastrephidae). *Bol. Inst. Mar. Peru 33(2): 137-152*.

[3] Kjesbu, O. S., Hunter, J. R., & Witthames, P. R. (Eds.). (2003). Report of the working group on: Modern approaches to assess maturity and fecundity of warm-and cold-water fish and squids. Havforskningsinstituttet.

6.2. Genetics overview

149. The squid working group chair noted the range of ongoing work across Members looking at genetics of Jumbo flying squid, including work by China, Korea and Peru who are all using different techniques.

150. It was suggested that reaching an updated agreement on consistent approaches to genetic analyses could be added to the SC workplan for next year.

151. Chinese Taipei agreed with China's goal to develop a consistent method of genetic analysis for squid and noted they have not started relevant research in this field yet but are evaluating the possibility of beginning research on genetic analysis, including funds, the priority among the working items and participating scientists.

152. Members noted the previous agreement to a genetic data collection protocol at the 2018 meeting of the SC and agreed that it was not the intention to agree a new protocol now but that updates in technology and methods should be reviewed to confirm if the protocol is still appropriate.

153. There was some discussion on the various methods available for genetic analysis, including mtDNA analysis and two methods of evaluating SNPs. It was noted that the 2018 data collection protocol primarily supported mtDNA analysis, but that more Members are becoming capable of analysing using SNPs.

154. It was also noted that mtDNA can detect stock extensions on a long time frame (millions of years), but that SNPs can detect stock evolution on a shorter timeframe (100 years), so SNPs may be more appropriate to explore stock structure and detect genetic diversity. This difference means that the two methods may be used as complementary approaches to address different questions, the first about historical stock structure and the second about current structure and genetic diversity.

155. Members noted that there are a number of studies that have been completed using a variety of methods, and there was a suggestion at SC7 for SPRFMO to move to use SNPs evaluated by GBS and RAD-Seq, and that Korea has also completed some studies with other technologies that they can report on in future.

156. The SC agreed that Members should continue data collection as per the protocol agreed in 2018, and noted that some Members are also using SNPs methodologies as well as the corresponding restriction enzymes (GBS with TaqI and MseI and RAD-seq with SbfI and EcoRI). When GBS / RAD-seq were used, Members should use RAD-seq / GBS to test few samples as supplement (at least ten squids for each phenotype) and that it will be useful to discuss genetic approaches and potentially update the data collection protocol in a workshop in the next year.

6.3. Assessment data review and template development

157. The draft data collection templates that had been previously discussed at pre-SC web meetings were provided in SC8-SQ01_rev1 for agreement by the SC.

158. CMM 18-2020 (Squid) requires a template be developed for annual reporting of catch with monthly resolution. A template was developed by the Secretariat (Squid Monthly Catch and Effort data template). This would be provided once per year, but information would be at monthly resolution and would not significantly increase the reporting burden for Members. It was clarified that this template is intended to meet the requirements of the CMM and not for scientific purposes.

159. Members generally agreed that having data reported with weekly resolution would be preferable for scientific purposes and noted that a revised template requiring weekly resolution should be developed at a future time.

160. The SC:

> **agreed** that the Squid Monthly Catch and Effort data template in SC8-SQ01_rev1 was appropriate at this time and **recommended** that it should be used to collect this type of data from the squid fishery.

161. A template for the collection of observer data was also developed (Squid Jigging Observer Data Template) by the Squid Working Group Chairperson (Dr Gang Li) and the Secretariat confirmed that it had completed consistency checks with other observer data collection templates as well as CMM 02-2020 (Data Standards) and also the transhipment measure CMM 12-2020 (Transhipment). The version presented included tabs for vessel, observer, effort (fishing activity/jigging), length frequency (mantle length), biological data collection (mantle length and statolith collection) and transhipment activities.

162. In relation to the fishing activity (Jigging) data collection, the SC noted that Column I (light power) needed a measurement unit for consistency of reporting and suggested kilowatts. The SC noted that Column K (jigging machines) required more information as there are two types of jigging machines that a vessel may have (single/double), and that the catch rates differ between the two in a non-linear way, making it important to know how many of each machine are on board. In addition, the SC noted that freezing capacity (blast freezing throughput, t/hr) should also be added into the template. The SC noted that the bycatch mitigation field was optional since there is no clear information available on squid jigging mitigation measures.

163. There was some discussion on the possibility of adding commercial size categories into the template to improve the representativeness of Length Frequency data. The SC noted that the data templates were for longer term use and that a key to convert commercial categories to length frequencies would be required, and this may require a targeted sampling regime. Some Members also noted that information on the tab related to transhipment would require further consideration, especially considering the different deadlines associated with data submission.

164. The Chair reiterated that Members should be aware of other monitoring approaches such as EM and ensure that comparable data is able to be gathered by other means. Korea confirmed that they are already using EM to collect biological data in the Squid fishery.

165. The SC **accepted** the Squid Jigging Observer Data Template with the understanding that the Secretariat would make the updates referred to in Paragraph 162 and also remove the transhipment tab pending a possible future CTC discussion on the merits of its inclusion into this specific template.

166. A Squid Biological Sampling Data Template was presented. This template was intended to support the provision of biological data collected either in port or at sea, allowing for measurements of squid from unknown locations. It is similar in concept to how the Chilean purse seine data is collected, where much of the data is collected in port.

167. There was some discussion about the template and how information about sampling done in port or at sea could best be collected. Chile noted that it is important to make a clear distinction between sampling on board and in ports. In the case of Chilean artisanal fishing, most of the information is from in port sampling and it is important to define the difference in the sampling types.

168. The SC **noted** that this information could also potentially be provided using the standard observer template and just completing fewer fields. The SC also **noted** that this template is not required by the CMM and would be a voluntary provision.

169. The SC **agreed** that provision should be made for sampling location (i.e. port) and **requested** that the Secretariat investigate the possibility of using the original observer template, in part to avoid the need for extra funds and due to the minor suggested differences.

170. A fourth template was discussed which allows for the collation of squid stock assessment data by month with provision for scaled up biological information from observer data (catch by age and/or catch by length class) and effort (days for all vessels) to be provided by a Member on a monthly (or potentially weekly) basis. This is similar in function to the collection of ALK information for the Jack mackerel assessment.

171. The SC **noted** that this basically extracts data from a database so you can bring it into a format that could be used in future in an assessment and also noted that some of the columns were optional and this could depend on the type of data available.

172. The SC **noted** that the template was likely to be important for the forthcoming squid assessment and warranted further consideration but did not agree to accept it during this meeting.

173. A "Depletion model data template" was presented for identification of area, pulse or mini-cohort, catch, and mean weight to transform into catch by numbers to evaluate survival, and underlines the need to have relative indices of abundance. The template includes all the metrics you would need to run a depletion model and would require information collected by the earlier templates. The SC **noted** that the use and design of depletion models and any associated template needs more discussion, and it was suggested that these discussions occur during the next squid workshop.

6.4. Other business/Statements

174. CALAMASUR, an organisation of multi-national stakeholders in the squid fishery, made a statement which is included in Annex 9 of this report.

175. Ecuador thanked and recognised the efforts of all Members to support sustainable exploitation of the Jack mackerel and squid fisheries, through information that is reviewed in the SC and Commission meetings. Ecuador appreciated the statement made by CALAMASUR and supports the limitation of fishing effort in the Jumbo flying squid fishery, through reviewing or limiting the registration of industrial vessels from distant waters, without renouncing the legitimate right that coastal countries have to develop and be active participants in the fishery. Ecuador also supported raising the observer coverage percentage for industrial vessels and prohibiting transhipments on the high seas.

176. Some Members disagreed with Ecuador's suggestions and reinforced their position that these types of discussions should be referred to the next Commission meeting. Others noted that observer coverage should follow the provisions in the CMM and should be re-evaluated over time as that CMM's provisions come into force.

6.5. Advice to the Commission on Squid

177. Several SC8 participants drafted a recommendation in relation to an effort limit for the squid fishery based on information provided by the Secretariat on effort in terms of active vessel numbers and gross tonnage. After lengthy discussions detailing many aspects of the status of the squid stock(s) and potential measures to advise the Commission (see Annex 9), the SC could not reach consensus. **In summary**, there was broad support for establishing effort limits based on the precautionary approach, but several Members expressed concerns that the recommendation of a specific limit needs to be based on more comprehensive scientific research and more complete discussion among Members, including *inter alia*, a discussion on the relative merits of active versus listed vessels.

7. Habitat Monitoring

7.1. Report to the SC on intersessional activities

178. Peru presented the paper SC8-HM03 "Synthesis on the observed changes in the distribution and abundance of Jack mackerel (*Trachurus murphyi*) and Chub mackerel (*Scomber japonicus*) in the Peruvian current between 2011 and 2020". Since 2011, the National Fisheries Society (SNP) has carried out annual workshops for the diagnosis of Jack mackerel and other species in order to contribute to fisheries and ecological research on these species. During a decade a series of information has been compiled which was obtained during fishing seasons of the Peruvian industry. That data is being used by the scientific community to deepen the study of the habitat of Jack mackerel and chub mackerel in order to contribute to its sustainable exploitation. The presentation outlined a synthesis of the environmental conditions observed in the Peruvian current from 2011

to 2020, with the aim to relate the variability of oceanic conditions to the availability of Jack mackerel and chub mackerel. The fishery and acoustic data used were only related to the Peruvian jurisdiction in the northern region of the Humboldt Current System. Positive mean thermal anomalies of surface temperature and large sea level anomalies were negatively linked to the distribution and density of Jack mackerel, with El Niño-like events providing unfavourable conditions for Jack mackerel. Strong El Niño-like effects were definitely negative, milder events (or onset phases) seems to have the opposite effects. Warmer years seemed to favour chub mackerel instead of Jack mackerel.

179. Following a question, it was clarified that fishing permits allow the catch of both mackerel species, and that fishermen target both species indiscriminately, depending on the provided fishing quota and specific regulations annually updated by the government.

180. Peru presented paper SC8-HM05 "Changes in the habitat of Jack mackerel (*Trachurus murphyi*) and chub mackerel (*Scomber japonicus*) in Peruvian jurisdictional waters between 2018 and 2020". During summer 2020 the presence of Jack mackerel and chub mackerel has occurred concurrently in oceanic waters with relatively high temperatures, in surface subtropical water masses, which is unusual at least for the season; the usual is its presence in mixed waters. From the analysis of the various variables regarding the habitat of Jack mackerel and chub mackerel, it was concluded that there is no single pattern for a given season, at least for summer, which is the most important fishing season of the year. Significant differences have been found between the summer months of the years that have been analysed (2018-2020). It has been found that, at least for years 2019 and 2020, chlorophyll was not a significant parameter to explain the distribution of Jack mackerel. The use of the Jack mackerel potential habitat model showed that Jack mackerel habitat presented large changes in its latitudinal and longitudinal distribution during 2018, 2019 and 2020. The distribution of Jack mackerel and lantern fish (*Vinciguerria lucetia*) presented a similar spatial structure (variogram) during the summers of 2018-2019, and 2019-2020, which could be a key aspect in investigating the habitat of Jack mackerel. During the summer of 2018, a strong modal group of 28 cm was observed, and it was again detected in 2019 and 2020. Chub mackerel also registered a modal group of 28 cm which was observed until spring 2019. This group was not observed in the summer of 2020, and instead the entry of a new modal group of 30 cm was observed.

181. Peru presented paper SC8-HM06 "Habitat modelling of Jack mackerel (*Trachurus murphyi*) and chub mackerel (*Scomber japonicus*) in the Peruvian jurisdictional waters between 2019 and 2020". The work used GAM modelling to explain catches of Jack mackerel and chub mackerel in terms of covariates such as chlorophyll concentration (as a proxy of the presence of euphausiids), latitude, longitude, time of day, month, year, sea surface temperature (SST), anomaly of SST (ATSM), surface level anomaly (SLA), and altimetry of sea surface (ASM). Before the modelling exercise, an exploratory data analysis was performed to reveal possible aggregations or relationships between environmental variables, as well as spatial autocorrelation. The gradient of some covariates in the water column was also considered. The best performing model explained 23% of the variability of the Jack mackerel catches. Jack mackerel was found to be more aggregated in the water column closer to the surface during summer 2020 than in 2019. The model was strongly influenced by low values of chlorophyll, so the quality of the results depends on the availability of clear satellite images. The model for chub mackerel explained 40% of the variability of catches. Chlorophyll, altimetry anomaly, distance to coast, hold capacity of every vessel and spatial autocorrelation were significant variables in explaining the variability of chub mackerel catches.

182. The SC inquired whether it would be useful to plot centre of gravity plots for both anchoveta and Jack mackerel catches. Peru agreed that the suggestion to investigate whether similar environmental variables drive both species would be interesting and clarified that the same fleet fishes for both species, but during certain months so that the two seasons do not overlap. The meeting also discussed plotting the centre of gravity of the fleet, as an additional investigation.

183. Chile presented paper SC8-HM07 "Estimation and prediction of the spatial occurrence of Jack mackerel (*Trachurus murphyi*) using Bayesian Hierarchical spatial models". A methodological approach is presented for modelling the occurrence patterns of Jack mackerel (*Trachurus murphyi*) with the aim i) to describe the spatial

distribution of the species; ii) to determine the environmental variables that drive the spatial distribution; iii) to provide insights into the spatial structure of the resource for fisheries management purposes. Information from the commercial catches of Jack mackerel is used to implement the model. This information comes from different fleets that operate in the south-eastern Pacific: Ecuador and Peru, northern Chile, south central Chile and the international fleet from the high sea. The presence/absence of Jack mackerel is modelled with a hierarchical Bayesian spatial model using the geographical and environmental characteristics of each fishing location. Maps of predicted probabilities of presence are generated using Bayesian kriging. Bayesian inference on the parameters and prediction of presence/absence in new locations (Bayesian kriging) are made by considering the model as a latent Gaussian model. This allows the use of the Integrated Nested Laplace Approximation (INLA) which has been seen to be substantially faster than the well-known Markov chain Monte Carlo (MCMC) methods. In particular, the spatial effect has been implemented with the Stochastic Partial Differential Equation (SPDE) approach. The analysis shows that environmental and geographical factors can play an important role in directing local distribution and variability in the occurrence of Jack mackerel. Although this approach is used to recognise the habitat of adult Jack mackerel, it could also be used for other life stages in order to improve knowledge regarding the species population structure.

184. The SC commended Chile's work and asked a number of questions. Regarding the 2009 data from the Peruvian Jack mackerel fishery used in this paper, Peru clarified that 2009 was characterised by warmer than normal environmental conditions due to a mild El Niño event. During El Niño periods, Subtropical Surface Waters (SSA) enter coastal areas and the oxycline deepens, expanding what could be defined as suitable Jack mackerel habitat. Therefore, as fitted and with respect to the Peruvian waters, this model would at best represent the Jack mackerel behaviour in relation to environmental conditions corresponding to a mildly warmer El Niño event.

185. Chile responded that this paper aims to present a new approach to model the Jack mackerel distribution assessing the spatial correlation of fishing records and the response to environmental predictors. As has been highlighted in this paper, predictive analysis is applicable for 2009 and the response to different environmental scenarios should be evaluated in later versions of the model.

186. The SC noted that the results of this study suggest that sea surface temperature negatively affects the distribution of Jack mackerel while the concentration of chlorophyll-a and the turbulence induced by the wind have a positive effect. Furthermore, the results suggest the presence of Jack mackerel in areas where the minimum oxygen zone reaches depths of 50 metres. However, according to what was found and reported by Espino (2013)[4], the positive sea surface temperature anomalies favour the distribution of Jack mackerel in Peruvian waters. Likewise, during warm periods, the minimum oxygen levels (Bertrand et al. 2011)[5] and the 15°C isotherm (Flores et al. 2013)[6] are located deeper, which favours the vertical dispersal of Jack mackerel in Peruvian waters.

187. Chile responded that the results presented in this study refer to the entire spatial range evaluated and do not describe regional particularities. Spatial modelling suggests a more coastal distribution of Jack mackerel at its northern edge of distribution due to the presence of warmer and less productive waters in the oceanic region.

188. It was observed that on the more general fit of the model, the authors use a mixture of temporal scales, including a monthly scale for the Peruvian Jack mackerel fishery data and a daily scale for Chilean Jack mackerel

[4] Espino, M. (2013). El jurel *Trachurus murphyi* y las variables ambientales de macroescala. Revista peruana de biología, 20(1), 09-20. http://www.scielo.org.pe/pdf/rpb/v20n1/a03v20n1.pdf

[5] Bertrand, A., Chaigneau, A., Peraltilla, S., Ledesma, J., Graco, M., Monetti, F., & Chavez, F. P. (2011). Oxygen: a fundamental property regulating pelagic ecosystem structure in the coastal southeastern tropical Pacific. PloS one, 6(12), e29558. https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0029558&type=printable

[6] Flores, R., Espino, M., Luque, G., & Quispe, J. (2013). Patrones de variabilidad ambiental en el mar peruano. Revista peruana de biología, 20(1), 21-28. http://www.scielo.org.pe/pdf/rpb/v20n1/a04v20n1.pdf

fishery data. They asked how these different temporal scales are being handled within the model being run and whether both temporal scales are being mixed in the model.

189. Chile clarified that due to the differences in the time scales of the observations, the modelling scale was monthly.

190. Peru noted that the model was calibrated with only 35 observation from the Peruvian zone, 1,595 observations from the coastal Chilean zone and 624 for the high seas zone off Chile and observed that this unbalanced data could introduce bias in the model. They asked how to proceed in controlling or reducing this bias.

191. Chile responded that there is an evident imbalance in the data used in the modelling. However, even under this consideration the results are promising regarding the spatial correlation of the observations. A more complete database would undoubtedly improve the prediction and inference process with respect to environmental predictors.

192. Peru further noted another potential problem being the generation of pseudoabsence observations to complete presence/absence data to run the model. They asked why data from the commercial fleet full trajectories were not used in order to have "real" observations of absence.

193. Chile clarified that since this methodological approach used data from fishing sets, the trajectories of the commercial fleet were not considered, however it is a good recommendation for future versions of the model. Although the generation of pseudo-absence datasets is an active research topic and is subject to some debate, they preferred to use such a binomial distribution with a Bayesian spatial model instead of a less accurate model that allows the use of presence-only data.

194. Peru observed with regards to the environmental information being used, that different resources are used, such as satellite data but also Regional Ocean Modeling System (ROMS) models. The ROMS models are a good alternative for superficial or a general vertical resolution, but may not be as reliable as far as oxycline information is concerned. They asked whether an attempt had been made to validate this DO data with real CTDO profiles.

195. Chile responded that ocean circulation models offer a good alternative to analyse environmental variables from a three-dimensional perspective. As pointed out by Espinoza-Morriberon et al. (2019)[7], the ROMS-PISCES model (used in the Chilean study) has shown good performance in reproducing the seasonal and interannual changes in oxycline in the northern Humboldt system. Although it has not been shown in this paper, validation analyses of the model have been carried out using information provided by the World Ocean Atlas, confirming the good performance of ROMS-PISCES.

196. Peru noted that, although it is true that ROMS-PISCES models are a good alternative to describe general patterns such as the seasonal and interannual scale of the oxycline depth (Espinoza-Morriberon et al. 2019). In general, ROMS-PISCES are used to characterised regional and climatic patterns and not particular variability such as the daily variability because they are not very accurate on this small scale. Another point, normally the spatial grid to run ROMS-PISCES model is around 18 km or higher (as was used in Espinoza-Morriberon et al. 2019), but if catching operations by the fleet are closer than 1 km then it is a little difficult to associate ROMS-PISCES output to catches. Therefore, in a model with point presence/absence data, it would not represent well the conditions of the vertical column of water at meso and smaller scales. In addition, ROMS-PISCES has some bias associated with a more intense oxygen minimum zone at subsurface level than the observations. However, it is a very promising approach for habitat analysis, but it is important to validate and calibrate with gliders or acoustic observations in order to have a high temporal and spatial resolution.

[7] Espinoza-Morriberón, D., V. Echevin, F. Colas, J. Tam, D. Gutierrez, M. Graco (2019). Oxygen Variability During ENSO in the Tropical South Eastern Pacific Frontiers in Marine Science 5, 526

197. Peru also suggested that one of the conclusions of the paper, namely that there is a high connectivity within the stock, could be too much of an abstraction from the actual results (which strictly relate to the continuity of environmental conditions).

198. Chile also noted that Hierarchical Bayesian modelling based on INLA go further than a habitat suitability model since it incorporates the spatial correlation of the data and evaluates: i) the spatial effect, which indicates the intrinsic variability of the Jack mackerel distribution after excluding environmental variables; ii) the prediction of the occurrence of Jack mackerel incorporating the spatial effect and the environmental predictor variables.

199. The European Union underlined the challenge to model abundance of a species based on habitat suitability models in the next step, which was compared to the challenges faced in the Deepwater group. Chile clarified that other models (for example Generalised Additive Models) were even more limited than Bayesian methods.

200. China asked whether it could be concluded that Jack mackerel was absent from subtropical waters, given that little fishing effort was carried out in the area, and whether this analysis could be conducted at a higher time resolution (monthly) to track stock movements. Chile agreed that warmer regions might be unsuitable for Jack mackerel presence despite the lower detection effort, also because of other environmental features (e.g. lower productivity), and that it would be interesting to build longer (and possibly higher resolution) time-series.

7.2. Regarding inventories of environmental data, technologies, research programmes

201. Several presentations were made at the sixth Web Meeting (SC8-Doc06_rev1). A summary of these presentations and associated discussions are in Annex 10.

7.3. Nomination of a subgroup of specialists to evaluate advantages and biases of analysis methods and a subgroup to organise classification of fishing fleets

202. A proposal was brought forward to the meeting to formally request the delegations interested in this work to nominate experts that would participate in these two subgroups.

203. The SC:

> **recommended** that Members encourage participation of scientists interested in habitat modelling at large (e.g. from the Deepwater group) to be involved in these subgroups so as to increase cross collaboration on similar issues. A letter supporting this request was sent to the SC Heads of Delegations.

7.4. Symposium on the State of Art Habitat Monitoring

204. Aquiles Sepulveda (Chile) and Mariano Gutierrez (Peru) briefly presented the idea of the symposium, which would not be limited to Jack mackerel and oceanic conditions but rather have a broader scope encompassing multiple species and habitat types. Aquiles Sepulveda and Mariano Gutierrez were identified as project leads. SC Heads of Delegations were contacted to appoint Members to a steering committee for the symposium. As at the end of the SC, both Korea and New Zealand each nominated a person for the Steering Committee.

205. Chile offered to host the symposium, ideally in January 2022, and the meeting was asked to express their support. The meeting noted that financial support from the SC is in the workplan and the SC:

> **recommended** that the steering committee prepare a detailed plan for the Symposium to be presented to the Commission in its January 2021 meeting.

8. Exploratory fisheries

206. The SC discussed the Checklist for Exploratory Fisheries Proposals (as distributed on 21 August 2020) developed previously to determine if it is sufficient for the SC to assess exploratory fishery proposals against the requirements of CMM 13-2020 (Exploratory Fisheries).

207. Noting that the checklist was agreed to be a useful mechanism for the SC to review exploratory fishing proposals and also for proponents to check their own proposals against the requirements of CMM 13-2020 (Exploratory Fisheries), but that some Members had experienced difficulties filling in the checklist, the SC **agreed** that updating the checklist with additional detail to guide users would be beneficial.

208. The SC also **requested** that interested parties work intersessionally to update the checklist with additional detail in accordance with CMM 13-2020 (Exploratory Fisheries) and based on their experience of reviewing exploratory fishing proposals in recent years. Australia, Chile, Cook Islands, DSCC, Korea and New Zealand offered to assist with this task. Specific attention would be given to guidelines in the checklist as they related to exploratory fisheries in areas with very low prior knowledge.

209. DSCC noted that review of the exploratory fishing CMM was part of the Commission's upcoming workplan, and suggested that some feedback from the SC to the Commission might be helpful, including, for example, providing clarity around the provision that information that needs to be provided 'as far as available', and guidance as to how much data needs to be obtained (e.g., by doing the best stock assessment possible). DSCC noted that there is no provision in the measure so far for consultation with other interested parties, affected coastal States, or stakeholders.

210. The SC indicated that there did not appear to be issues with substantive aspects of the checklist, but it may need extra explanation and there needs to be a check against CMM 13-2020 (Exploratory Fisheries). Cook Islands suggested that when reviewing completed checklists, it would be useful to keep a note of those things that should be added on, are not useful or are confusing to make sure these points are captured in the intersessional review.

211. The Secretariat welcomed the suggestion to further develop the checklist for Fishery Operation Plans (FOP) and encouraged proponents to continue using the existing checklist.

212. The SC suggested that this discussion had highlighted a potential need to develop a template for Fisheries Operation Plans to assist proponents to meet the requirements of CMM 13-2020 (Exploratory Fisheries) and **requested** the Secretariat to work with Members intersessionally to develop such a template.

8.1. Cook Islands Exploratory Potting Fisheries Operation Plan

213. Cook Islands presented progress reports SC8-DW02, SC8-DW03 and SC8-DW04. Under the auspices of CMM 14b-2020 (Exploratory Potting CK) and its predecessors the Cook Islands has undertaken a three-year programme of exploratory trap fishing targeting lobsters and crabs on seamounts along the Foundation Seamount Chain. The analysis in SC8-DW03 used a series of experimental trap lines to estimate the effective fishing area of a trap, then selected fishing lines from a commercial exploratory operation on Kopernik Seamount that were set on "virgin ground" to estimate biomass from transect lines within a number of depth classes over the course of the fishery.

214. The experimental lines resulted in an estimated effective fishing area of a trap to have a 30 m radius. However, the high variability in the results suggests that a range of estimates should be used for biomass estimation. The plausible range total biomass was estimated to be 3,161 t – 790 t. The shallow areas of Kopernik Seamount (150-260 m depth) have the highest biomass and below 260 m biomass declined rapidly. Estimated biomass declines relatively rapidly from initial through Trips 1 to 3. Assessing the biomass weekly through the course of the fishery shows considerable variability in weekly mean biomass estimates but also a steep decline.

215. Management considerations for any future fishery ideally should be carried out across a number of seamounts each with a specific small TAC, along with other measures such as mesh size limits to protect the female population and closed seasons to avoid disrupting spawning and impacting females carrying eggs.

216. SC8-DW04 attempted to assess encounters with Vulnerable Marine Ecosystems (VMEs) situated on Kopernik Seamount. The information presented shows that potentially sensitive habitats are distributed across Kopernik Seamount, but also that they are distributed unevenly. More VME indicator taxa were encountered to the centre and to the central east of the seamount, and in particular in the valley between the two Kopernik hills. This analysis provides a first glance at the potential impact of this fishery on the benthic environment on the Foundation Seamount Chain. Additional work is still required to gain a more complete picture of the total impact.

217. The revised FOP (SC8-DW01_rev1) has presented a number of management options for the lobster and crab fisheries including the Global Total Allowable Catch (TAC), feature specific TAC, feature specific Total Allowable Effort (TAE), Species TAC size limits, pot mesh size rules and closed seasons.

218. The FOP draws on the findings of the formal sampling programme outlined in the previous FOP submitted to the 8th regular session of the Commission (COMM8), in particular refining current methods to conform to the Convention, CMM 13-2020 (Exploratory Fisheries) and other relevant CMMs, proposes long term viability of the target species as well as mitigation measures to ensure that the integrity of Vulnerable Marine Ecosystems (VMEs) is maintained within the fishing operation areas.

219. They propose to follow agreed limits from COMM8; the Total Allowable Effort (TAE) fishing day limit being 80 days per trip, setting and hauling no more than five lines of 100 traps per day and global Total Allowable Catch of 300 tonnes across exploratory areas outlined in Box 1 and Box 2. An extension to the fishing area is also proposed, with Box 2 east of Chile's Easter Island Region EEZ. It is proposed that global TAC and TAE limits will apply in the area with replacement of seamount number limits with feature specific limits.

220. DSCC noted that the limit of 20 t on the Kopernik Seamount does not appear to be included in the operational plan and wondered how that gets incorporated. They also noted outstanding issues related to cumulative impacts in the context of the Chilean proposal for an exploratory fishery in the same area.

221. Cook Islands responded that when they did their analysis, they looked at biomass and trends in catch and what level of fishing might reduce that rate of decline. So that they can make sure they were able to control the rate of decline. This was not included in the first version but is in the revision. They think this approach is better than the CPUE approach. In terms of cumulative impacts, it was unclear where the two proposals will overlap spatially.

222. The Cook Islands noted that the 20 t seamount limit is not explicitly included in the checklist, but is in the FOP, which is a document that the Commission shall consider in its deliberations and will be appended to the CMM.

223. The SC:

recommended:

- that the SPRFMO Commission allocate no more than an annual Total Allowable Catch (TAC) of 300 t a year for fishing years for the period October 2021- June 2023;
- within the global TAC, facilitate feature specific limits with the extension of the exploratory fishing area to include 'Box 2' area;
- that fishing operations shall take place over no more than 80 fishing days per trip (Trip Total Allowable Effort), setting and hauling no more than five lines of 100 traps a day for the period October 2021- June 2023;
- noting that during the course of fishing operations, additional seamounts may be discovered, if these fall shallower than 500 m and feature structure deemed suitable, opportunities shall be allowed for their exploration;
- five experimental days be added to the trip TAE for one trip between October 2021- June 2022. Note: all catches taken during experimental fishing are counted against the TAC;
- allowing the flagged vessel to test alternative trap designs.

224. The SC **agreed** that for the Cook Islands proposal, it is necessary to assess the progress of the Cook Islands fishery and work, and separately consider the new proposal for Chile.

225. The SC **accepted** the latest version of Cook Island's Fishery Operational Plan (SC8-DW01_rev1) and checklist (SC8-DW15).

226. DSCC noted their concern with the TAC of 300 tonnes in the Cook Islands FOP. They noted that the FOP states as a recommendation "That the SPRFMO Commission allocate no more than an annual total allowable catch (TAC) of 300 t a year for fishing years for the period October 2021-June 2023;" and that the FOP states that the Cook Islands will "Place a 20 t total allowable catch for *Jasus caveorum* on Kopernik Seamount per trip". DSCC noted that 3 trips are proposed for 2020 and that the FOP states that "With the 300 t, separated into three units i.e. 100 t combined catch per trip for lobster and crab in year two"; and that "this TAC would apply to the 15 selected seamounts for 2020/2021". In DSCC's view, this will open the door to potential serial depletion of other seamounts, which have not been assessed, and is not precautionary. They noted that this reinforces their concern over the cumulative impact of two Members fishing on the same or adjacent seamounts which are likely to be the same stock, in the absence of robust stock information.

227. The Cook Islands clarified that 300 t is a global TAC, with a 20 t limit specific to lobster on Kopernik Seamount, in addition to which there is a 40% CPUE limit reference point and they are moving to set TACs on each feature based on their size (interim value set at 302 kg/km^2 above 500 m depth) and estimated appropriate CPUE.

8.2. Chile Exploratory Potting Fisheries Operation Plan

228. Chile presented their proposal for an exploratory fishery for *Jasus* sp. and crabs on the Foundation Seamount Chain and Chile Rise in the south eastern Pacific. The proposal had been presented to a pre-SC web meeting and comments were incorporated into a revised version provided to the SC (rev1).

229. The SC discussed the proposals at length, noting a number of significant concerns, and given the limited time could not complete the review and make the needed revisions to the FOP.

230. The SC provided feedback and suggestions on areas of concern that should be considered in the further development of the proposal. These included:

- a need for more detail on the proposed move on rule for encounters with marine mammals and seabirds and other species of concern;
- More detail on the methods proposed for the planned depletion experiments and resulting analyses;
- More rationale for the calculation of the proposed catch limits;
- Clarity on how potential spatial overlap with other exploratory fisheries in the area will be managed; and
- Consideration and analysis of the cumulative impacts that may result from there being two exploratory fisheries in the same area.

231. Several Members offered to assist Chile intersessionally with revisions of the proposal.

232. The Cook Islands noted that there are two issues, one is that only a few seamounts in the Foundation Seamount Chain have been fished, because the SC was concerned about the proposition and put restrictions in place to limit the extent of exploration. The Cook Islands has put in a lot of time and effort to do this correctly and are now hoping to get those limits lifted to be able to explore more widely. Regarding working together, the Cook Islands still has some concerns as being near one another may impact the experiments. They also noted that the two Members have not discussed the distribution of catch (e.g., from the same region).

233. New Zealand expressed a view similar to the Cook Islands, thanking Chile for thinking about their feedback and offering to take some risk out of the depletion experiment, but New Zealand still don't understand the rationale for the TAC on the Foundation Seamount Chain. Given the experience of the Cook Islands to date, such a TAC should be reasonably well-substantiated. This is always difficult when a fishery is relatively new, but the Cook Islands did come forward with estimates of fishable area on a range of features. That type of information combined with proxy extraction rates would be useful. New Zealand would want to see maps of how the Members have agreed to fish in a separated way to ensure that they do not interfere with each other's research. New Zealand agrees with the Cook Islands that a cumulative assessment would be required. With regards to the Chile Rise area, New Zealand would like to see some substantiation for the fishable areas and the recommended TAC in that area as well.

234. Australia expressed appreciation for Chile's efforts in responding to the feedback provided. Australia generally agreed with the concerns raised by other Members. Australia felt that the catch limits for both areas would benefit from additional justification, and they suggested analysis of fishable area and depth for the target species would be helpful if bathymetric data were available. Australia noted that a joint proposal that outlines where each Member would fish, and possible cumulative impacts would be useful. Such joint proposals could consider the cumulative effort and catch limits, spatial overlap, stock structure hypotheses and interactions with non-target species, for example.

235. The SC noted a general concern about overlap and magnitude of catches and were also concerned about how a cumulative impact assessment could be done.

236. DSCC noted their concern with impacts on VMEs but were pleased with the inclusion of benthic cameras within the proposal to look at the issue. They also noted that a bigger question is about the cumulative impacts on an endemic species that seems to be limited to a small area with the Cook Islands fishery having indicated the distribution of the lobsters as being quite limited to Kopernik. The DSCC also asked in terms of the Chile Rise proposal, whether Chile were looking to fish *Jasus frontalis* or another species in the area. The DSCC provided written comments to Chile.

237. There was a brief discussion on a revised proposal (SC8-DW06_rev3) and associated checklist (SC8-DW18) provided by Chile.

238. The Cook Islands raised concerns with the Foundation Seamount Chain component of the SC8-DW06_rev3, proposal. It was noted that the outcomes from bilateral and working group sessions which confirmed that there would be no overlap between the Cook Islands exploratory area and Chile's proposal were not reflected

in this version. The successive proposals provided clarity that an overlap is being proposed, which the Cook Islands does not support, particularly as new methods are being trialled and it poses the risk of compromising the integrity of the results from scientific monitoring and assessment underway. The Cook Islands had expected that a more exploratory nature would be taken, using a gradual and precautionary approach before broadening the scope of the exploration. Additionally, any overlapping area would require a joint cumulative impact assessment analysis which has not been done. There is a need for further dialogue between Chile and the Cook Islands to address and avoid an overlap and ensure that sufficient information is available to evaluate the scientific integrity of the proposal. The Cook Islands expressed support for the Chile Rise area for the exploratory fishery in SC8-DW06_rev3.

239. New Zealand noted the improvements in the draft, but did not consider that their concerns were addressed, including the request for a rationale for the catch limit, but also the lack of specificity about how the fishery would be separated from the Cook Islands fishery with the scientific consequences of the lack of separation. There were improvements around the depletion experiments in reducing the risk, but there were not sufficient descriptions to reassure them. They noted that it would be possible to start an operation like this within Chile's EEZ and perhaps could consider restricting an exploratory fishery in the SPRFMO Area to the Chile Rise, but without the Foundation Seamount Chain included.

240. Chile reiterated that the three revisions were intended to reflect their willingness to harmonise the fishing activity regarding implementing a precautionary reference point and avoiding any explicit overlapping of fishing area, with the aim of gathering more data and information for future management actions. Likely due to difficulties related to the format of SC8, communication of Chile's detailed fishing areas was not tabled, although broad areas were proposed in Rev3. They intended to arrange exclusivity within areas. In the Rev3 document they indicated that a 300 tonne catch limit was proposed for their exploratory fishery. They also intended to carry out several Depletion CPUE experiments and recognised that any TAC should be set under scientific knowledge and a precautionary approach. Chile is concerned about the way that SC should address in the future situations of parallel proposals in the same area or region.

241. The SC:

> **recommended** that a small group continue to provide some additional advice on the Chilean proposal, noting that the work is likely to extend intersessionally and result in a revised proposal being provided to the 9th meeting of the Scientific Committee in 2021 unless the scope of the proposal is reduced to include only the Chile Rise and additional information provided.

8.3. European Union Exploratory Toothfish Fisheries Operation Plan

242. The European Union indicated that an earlier version of the FOP was presented at the seventh pre-SC web meeting. The initial comments were received and addressed in a rev1. The European Union received a specific request from the US to investigate interactions with whales and have now included a mitigation approach and what will happen in case of whale entanglement. They also received some additional comments from New Zealand on potential bycatch of deepwater sharks. They have looked at the available information and considered changing the approach but note that the science says catchability is low and availability of the species in the area is also low. The European Union indicated that if there is bycatch of these species, they will update the FOP to include a mitigation measure for future years as there is no intention to catch sharks. This was reflected in SC8-DW05_rev2.

243. The SC thanked the European Union for the response and research done to inform mitigation options. It was noted that if the risk of catching sharks is very low then the risk of having to change fishing operations because of a move on rule is also very low, but it provides a precautionary back stop in case the science is badly flawed.

244. Regarding the issue of deepwater sharks, some of which have low productivity and are highly vulnerable to fishing, Australia suggested that the provisions from the CMM for the European Union's exploratory toothfish

fishery on the South Tasman Rise may provide additional precaution in any future CMM relating to the current proposal. Australia also noted that it has a strong interest in the management of toothfish stocks, particularly with ensuring catch rates are precautionary and on improving understanding of stock structure and population connectivity. Australia noted that we need to exercise caution to avoid risk of localised depletion, which has been seen in toothfish fisheries elsewhere. Australia noted that they were particularly interested in any tagging studies that could be done to better understand population connectivity, particularly between fish encountered in the exploratory fishing area and CCAMLR areas including the Macquarie Island toothfish fishery and the Heard Island and Macdonald Islands toothfish fishery, recognising that these fisheries are within Australia's EEZ and are subject to strong management. Australia noted that they would appreciate an undertaking to report any tag recaptures to Australia and SPRFMO in a timely manner so that they can be used in relevant assessments.

245. The SC **expressed appreciation** for the structured risk assessment approach provided in the European Union's proposal.

246. The European Union commented that they hope concerns have been addressed, and that regarding the tagging, connectivity with other fisheries is also in the European Union interest. The European Union wish to know which stock it is, and as indicated in the FOP, fish will be tagged at rate of 5 fish per tonne, very much along the lines of the CCAMLR fisheries. They will continue to collect tag data and make them available to the SC.

247. The forms are consistent with the ones used at CCAMLR and in other toothfish fisheries in the SPRFMO region. The European Union noted familiarity with the CCAMLR forms and acknowledged they would use them.

248. Following circulation of SC8-DW05_rev2, the SC **accepted** the FOP and checklist (SC8-DW16) for the European Union proposal for an exploratory toothfish fishery.

8.4. Exploratory Toothfish Fishery updates (EU/NZ/Chile)

249. The update reports for the European Union (SC8-DW08) and New Zealand (SC8-DW09) exploratory toothfish fisheries were briefly presented at a pre-SC web meeting and there were no items raised for discussion at the SC.

250. The European Union and New Zealand reports were taken as read and accepted.

251. Chile provided an update on their exploratory fishery for toothfish noting that, due to the situation with COVID-19 pandemic, some technical difficulties arose in relation to the maintenance of the vessel and safety restrictions for crew and observers. They noted that it is not expected that this fishery will start in 2020 but is intended to begin as soon as conditions allow for safe operation.

9. Other Matters

9.1. Observer presentations

252. William Emerson (FAO) presented SC8-Obs04 with an update on the Areas Beyond National Jurisdiction Deep Sea Fisheries Project (ABNJ DSF). The second phase of the ABNJ Deep Sea Fisheries Project will support the implementation of an ecosystem approach to fisheries, with a focus on data-poor stocks, significant adverse impacts on VMEs, and deepwater sharks. SPRFMO's expertise in these matters will make a strong contribution to the DSF Project. Expertise from other regions will also be brought to SPRFMO, allowing for the global development of these areas of concern. The DSF Project will also contribute to an understanding of the application of international instruments by RFMOs and fishing nations, including the implications of the Biodiversity Beyond National Jurisdiction (BBNJ) negotiations, to position the fisheries sector as key players in ocean governance.

253. Australia expressed their appreciation for the progress made under Phase 1, including its bigger picture focus across the demersal RFMOs and the benefits of increasing participation and engagement. In relation to the deepwater sharks output, one of the key conclusions of the relevant SPRFMO and Southern Indian Ocean Fisheries Agreement (SIOFA) Environmental Risk Assessments was that data is very limited and needs to be improved and that there is a need for better identification guides for observers and crew. Australia noted overlap with the Deep Ocean Stewardship Initiative (DOSI) Fisheries Working Group's current focus areas, which include developing criteria to designate areas of VMEs from video surveys for conservation and management purposes, and producing a scientific review of pre-existing environmental impact assessments from different RFMOs prior to the next UNGA resolution review in autumn 2021.

254. FAO responded that they are aware of the lack of data on deepwater sharks and tasks include understanding what data is available/collected and what constraints there are on data collection (e.g., lack of ID guides, observer training etc). There is a further need to understand what would be required and then who/how that data can be collected, which the project can then follow up on.

255. DSCC thanked the FAO for their presentation and asked about eNGO involvement and how FAO will be approaching eNGO engagement. The FAO responded that they would continue to work with International Union for Conservation of Nature (IUCN) as they did in the first phase, but they are not limited to working with IUCN and will continue to look for other potential partners. Peru underlined that FAO has been very active in promoting an ecosystem approach to fisheries.

256. FAO noted that the first project did a survey of the deepsea RFMOs to assess their operations in relation to the requirements of ecosystem approach to fisheries. They found that they were generally in line with those requirements but that there were still some gaps, primarily in relation to the socioeconomic aspects and how to take these into account. This is specifically why the value chains consideration was added to this project.

257. The SC **requested** that the SPRFMO Secretariat assist and coordinate activities relevant to supporting the work of the SC during the planning phase of the DSF Project. This would include aspects relating to data-poor stocks, significant adverse impacts on VMEs, and deepwater sharks, and coordination with relevant experts from Members to ensure that the best guidance is provided to the DSF Project. This would be an in-kind contribution at this stage.

258. Marc Taconet (FAO) presented paper SC8-Obs05 on a proposed research collaboration between FAO-SPRFMO-GFW (Global Fishing Watch) on the use of Automatic Identification System (AIS) data technology to improve monitoring of high seas fisheries. AIS offers opportunities for near-to-real-time monitoring and higher time space resolution analyses and is already well established in the high seas. When combined with other data services, AIS can transform the way we observe, analyse, interpret, and eventually manage and monitor fisheries and the environment. There is an important role for International Organisations to facilitate access to outputs of innovative information technologies. FAO invited SPRFMO in a Research and Collaboration project on AIS, based on areas of reciprocal interest.

259. In 2018, SPRFMO signed the Fisheries and Resources Monitoring Systems (FIRMS) partnership agreement and the organisations have been working together to publish information about the status of stocks and fisheries managed by SPRFMO. FIRMS is also working on developing unique identifiers for inventoried fisheries. Last year, the FAO published a Global Atlas of AIS-based fishing activity which concluded that AIS can be considered for estimating fishing effort and can improve estimates of effort and CPUE and supplement VMS. Some possible research objectives, which could be at least partly supported by the on-going European Union funded BlueCloud in which FAO is partner, were provided for a collaboration project with SPRFMO on AIS including:

- To identify gaps in fishing activity monitoring
- Analyse fishing interactions among RFMO mandates
- Improve classification of fishing activity by gear
- Provide refined measurements of fishing effort; improve estimates of effort and CPUE

- Address feasibility of producing near-to-real-time indications of aggregated catch
- Contribute to ecosystem assessments
- Contribute to monitoring and predictions of the effects of climate change

260. The SC asked whether these data would be available for scientists to use. FAO responded that Global Fishing Watch developed the capacities, but there have been discussions that they will make available open data and meta data including aggregated data by fishing gear and area. For specific research projects there are two chapters in the atlas that are relevant, and data can be shared through data agreements.

261. Chile noted that this offers many possibilities for cooperation with SPRFMO, and they are particularly interested in strength of monitoring. They suggest that the CTC would also be interested in knowing about this project.

262. Peru noted that it would be good to see this data being made available to researchers and management agencies in developing countries in a user-friendly manner. FAO is well-known and appreciated for making data freely and easily available to all. FAO clarified that they would make the information available through the FAO catalogue, along with metadata. The FAO also has a specific online atlas for searching and visualising aggregated data. For specific identified projects, the FAO would develop a data sharing agreement in a secure environment where people could access high resolution data according to the agreed charter.

263. China asked how FAO or SPRFMO gets AIS data. The FAO responded that data are collected through the work of Global Fishing Watch which provides publicly accessible data, and that the data are processed by specific organisations and made available as processed data to different partners including FAO, according to certain agreements. The FAO also responded that it may require some more work between FAO and interested SPRFMO colleagues who wanted to help further define what they would like to do/achieve with this opportunity of working together. It was suggested that a small group could be formed to identify possible objectives and provide that information to FAO and formulate a project to be presented to the Commission.

264. China noted that the data can be used widely for monitoring fisheries and climate change and asked for clarification regarding the difference between VMS and AIS data. The FAO responded that VMS technology is designed for monitoring and surveillance via low frequency signals. AIS is designed for maritime security and safety but has been extended to fishing vessels and is collected at high frequencies. Due to the different frequencies you can do different types of analysis. One of the FAO case studies is looking at the utility of using AIS data in stock assessments, which brings together and compares AIS data, VMS data and logbook data. The conclusion was that AIS could be used for collecting information on fishing effort by longline vessels.

265. The SC asked if an MoU would be necessary or helpful to move this along. The Secretariat responded that SPRFMO is a member of FIRMS and the Secretariat is already working closely with this group within FAO, although this project would bring in other players to work with that could be covered under FIRMS or a separate agreement for this specific piece of work. It was noted that real time management of the squid fishery is in the long-term plan for SPRFMO and this could provide a possible mechanism. The FAO noted that they could support these types of agreements being developed, which may require the exchange of letters.

266. The SC **noted** that this seems a worthwhile initiative and important in relation to development of management measures that are ongoing in SPRFMO SC.

267. The presenter responded that if SPRFMO wish to define some research objectives, the FAO would be happy to connect further and develop a paper for a Commission meeting. The Secretariat offered its support and the SC **agreed** this would help to determine required resources and clearer development of the aims of the project.

268. Oceana provided a detailed proposal for Salas y Gomez and Nazca Ridges (SC8-Obs01).

269. HSFG noted that fishing in this area occurred in the late 1990s when a New Zealand trawler collected some information, which HSFG will provide to Oceana.

270. DSCC thanked Oceana for the presentation and supported the proposal, noting that it enjoys widespread support from the Environmental Non-Governmental Organisation (eNGO) community, is consistent with ABNJ, and could send a strong signal to the Convention on Biological Diversity that biodiversity protection in the high seas is of great importance to SPRFMO, which would show SPRFMO as a proponent of maritime protection.

271. The delegation of Peru made a statement acknowledging the effort of Oceana in drafting a proposal for the Salas y Gomez and Nazca ridges. Peru emphasised that it is committed to the conservation of the marine environment and acts accordingly within its national jurisdiction, with the current elaboration of the Nazca Ridge National Reserve ("Dorsal de Nazca") by their national competent authorities, and in the international fora and bodies. However, Peru cannot support such a proposal in this forum due to the fact that there are elements that need to be studied and discussed in greater depth by national authorities competent in such matters.

272. Oceana responded that this was its first presentation of this proposal but it will start working with relevant governments going forward, but they wanted to present it in this forum first because they thought that comments from the SC would provide good information to inform their presentation to countries.

273. DSCC gave a presentation focused on VMEs (based on SC8-Obs02), highlighting three matters: On the "threshold" issue, DSCC said the excursion into the Canadian (DFO) and the MSC thresholds is a distraction. For the DFO report, taking a single scientific paper (not even accepted policy), relating to national waters (Newfoundland and Labrador), the continental shelf and slope is not helpful. The report recommends 100% protection as precautionary and the alternative, non-precautionary 70% is described as interim. On the Marine Stewardship Council (MSC), DSCC noted that the full quote reads "In the case of VMEs the team shall interpret "serious or irreversible harm" as reductions in habitat structure and function below 80% of the unimpacted level". Serious or irreversible harm" is far higher than "significant" adverse impacts, and "reductions in habitat structure and function" are very different from protection of VME, and the test as a whole is totally different from "significant adverse impacts" on VMEs, as required by UNGA resolutions and FAO Guidelines.

274. DSCC said that it was clear that there was considerable scientific uncertainty around the habitat suitability model and there was no linear relationship between habitat suitability and observed occurrence. DSCC suggested that the SC should advise that CMM 03-2020 (Bottom Fishing) is not appropriate as it does not properly address benthic impacts, and should be revised to prevent SAIs on VMEs: that areas where VMEs are known or likely to occur should be closed; that an encounter protocol should be designed to trigger when a VME has been encountered, that there was inadequate data underpinning the habitat suitability (HSI) model and that it was not fit for the purpose used; that SPRFMO should have the mandate to close areas that the HSI model predicts are likely to or known to contain VMEs; and the encounter test should be changed from "unexpected" to "avoid significant adverse impacts on VMEs".

9.2. Reappointment of Officers

275. Dr James Ianelli (USA) was re-confirmed as the SC Chairperson. Mr Niels Hintzen (EU) was re-confirmed as vice-Chairperson.

276. There were no offers for the position of Chairperson for the Deepwater working group and all other Working Group Chairpersons were re-confirmed.

9.3. Level and use of the Commission's scientific support budget item

277. The current status of the Commission's scientific support budget is described in SC8-Doc09. The Secretariat explained that table 2b of the paper shows the projected work plan items paired with funds that have been made available by the SPRFMO Commission. The paper also shows the voluntary contributions made by Australia, China and the European Union and the related SC activities that these contributions are intended to support.

278. The SC recognised that due to the COVID-19 pandemic, three items had been delayed from the 2020-21 financial year, including a squid workshop, a Jack mackerel workshop, and the Habitat Monitoring symposium. The Secretariat pointed out that Financial Regulation 2.4 limits carry-over of unspent SC appropriations to $50,000. As such, $34,715 would not be carried over to the 2021-2022 Financial Year. This leads to a projected deficit of $23,060 in the 2021-2022 Financial Year.

279. The SC **agreed** that a data workshop for Jack mackerel would be planned for late in the 2020-2021 financial year, and that $34,715 be set aside for supporting independent experts and associated costs for this workshop. If (due to the COVID-19 pandemic or for other reasons) it is not possible to run the workshop in the 2020-21 financial year then the SC will request that the Commission make an exceptional decision allowing for $34,715 to be carried over to the 2021-22 financial year.

280. The SC:

> **recommended** that the Australian contribution be firstly used to cover the projected deficit ($23,060) and to use the remainder on high priority workplan items including aligning the Deepwater and Habitat Monitoring work.

281. The SC furthermore:

> **recommended** that notwithstanding regulation 2(4) that the Commission exceptionally agree to carry funds forward to next financial year if the COVID-19 pandemic continues to limit activities that can be undertaken during the 2020-21 financial year.

282. The SC also **requested** that the Secretariat coordinate a small intersessional working group to develop the work plan prior to COMM9.

9.4. Planned intersessional activities

Deepwater

- Development of a manual/identification guide for VME species.
- Work to reduce uncertainties in risk assessments for benthic habitats and VMEs.
- Development of a process to review all recent and historical benthic bycatch data to determine the ongoing effectiveness of the spatial management measures, and an annual update of that analysis using the most recent bycatch data.
- Work involving the alignment of Deepwater and Habitat Monitoring workstreams.

Jack Mackerel

- Develop prioritised terms of reference for the data and assessment benchmarks.
- A Jack mackerel data workshop, to address issues such as consideration of a new ageing method and methods for assessing CPUE.
- A Jack mackerel stock assessment benchmark workshop to cover topics such as a review of the single and two-stock hypothesis implementations of the JJM assessment model.
- Development of a programme for an exchange of otolith samples and a meeting to allow analysts to compare and test methods in order to achieve international cross validation of Jack mackerel ageing methods.
- Leading meetings to prepare for a meaningful Management Strategy Evaluation workshop with managers (which is planned for between CTC-8 and COMM-9).

Squid

- Squid Workshop including potential assessment techniques and appropriate measures of fishing effort (prior to SC9).
- Reaching an updated agreement on consistent approaches to genetic analyses for Jumbo flying squid.

Habitat Monitoring

- Habitat Monitoring Symposium planned for late 2021 or early 2022.
- Nominations to symposium steering committee (2 persons have been nominated during SC8).
- Formation of sub-groups to study vessel characterisations (related to acoustic data) and methods of analysis (e.g., spatial analysis).

Exploratory Fisheries

- Update of the exploratory fisheries checklist with specific attention given to guidelines for exploratory fisheries in areas with very low prior knowledge.
- Develop a Fisheries Operational Plan template consistent with CMM13-2020.

9.5. Next meeting venue and timing

- Future meeting plans are discussed in SC8-Doc10. Panama had offered to host in 2021 and considering current conditions the Secretariat was **requested** to re-confirm Panama's offer.
- Korea confirmed their offer to host in 2022. There were no expressions of interest to host the 2023 and 2024 SC meetings.

10. Report adoption and Meeting Closure

283. The report was adopted at 23:28 (NZDT) on 8 October 2020. The meeting was closed at 23:28 on 8 October 2020.

Annex 1: Collated Scientific Committee Recommendations and Requests

Commission guidance and intersessional activities

The SC **requested:**

- that the Secretariat coordinates a small intersessional working group to develop the workplan prior to COMM9;
- volunteers to self-appoint to provide expert input into a project funded by a European Union grant to increase the spatial data capability of the Secretariat (SC8-Doc07 Annex 1).

Deepwater

In terms of Orange roughy data review and evaluation, the SC **recommended**:

- that the median yield estimate of 396 tonnes be set as the annual catch limit for 2021 and 2022 and 2023 for the NW Challenger stock;
- that 0.75 of the median yield estimate of 348 tonnes, being 261 tonnes, be set as the annual catch limit for 2021 and 2022 (unless an updated assessment is done in this time) for the Lord Howe Rise stock;
- that 0.5 of the median yield estimate of 108 tonnes, being 54 tonnes, be set as the annual catch limit for 2021 and 2022 for the West Norfolk Ridge stock;
- that these Orange roughy catch limits apply for no more than 2 years (and 3 in the case of NWC), noting that a more precautionary approach should be taken if insufficient advancement is made in data collection to support stock assessments including acoustic surveys for the relevant stocks in that time.

Concerning VME encounters and spatial management, the SC:

- **agreed** that an assessment of how ID guides could be developed should be added to the work plan and if funds are needed, they could come from the SC budget and **requested** that the Secretariat investigate if this type of work could be coordinated through the ABNJ project.

After considering the paper developing a multi-taxonomic level list of VME indicator taxa (SC8-DW11) , the SC:

- **requested** Members and CNCPs to begin compiling information they hold on VME groups that can contribute to updates to the list.

The SC additionally **agrees**:

- that the cumulative BFIA provided by New Zealand and Australia represents: the best science available to the SC at the current time; provides a sound basis for formulating management advice to the Commission; meets international standards (such as the FAO Deep-Seas Guidelines) and complies with the SPRFMO BFIA Standard and, consequently, **accepts** the BFIA (SC8-DW07_rev1).
- that the impacts of bottom fisheries on target and non-target fish stocks are appropriately assessed under the SPRFMO assessment framework noting:
    - for Orange roughy, stock assessments have been undertaken that indicate all stocks are likely above limit biomass reference points and several are above target biomass reference points used elsewhere for the management of this species

- for other target species caught in SPRFMO demersal fisheries, workplans are being developed for stock structure delineation studies, which may inform future assessment and management
- for non-target and bycatch (discarded) species, ecological risk assessments have been undertaken to categorise these species into the SPRFMO stock assessment framework and prioritisation of species estimated to be at high and extreme relative risk from fishing has been undertaken.

- that captures of marine mammals, seabirds, reptiles and other species of concern are rare in midwater trawl for bentho-pelagic species and bottom trawl fisheries and appears to be rare in bottom line fisheries but **requests** bottom fishing Members to collaborate to develop a framework for providing precautionary advice on such captures.
- that, with respect to impacts on benthic fauna and VMEs, that:
  - The habitat suitability models have high statistical skill in classifying suitable VME taxa habitat. However, there is great uncertainty in translating model outputs to estimates of abundance of VME taxa on the seafloor, as well as issues of potential model over-prediction leading to over-optimistic estimates of protection for some taxa.
  - the estimated footprints of midwater trawls for benthopelagic species and demersal line gears are orders of magnitude lower than those for demersal trawl gears and are thought to represent a low risk to VME status and habitat protection.
  - the equilibrium status of most VME indicator taxa in most areas is qualitatively favourable across a range of sensitivity analyses, although there is a high level of uncertainty.
  - The proportion of suitable VME indicator taxa habitat protected is uncertain but qualitatively favourable at most scales assessed. However, there are a number of areas at smaller scales (Fishery Management Areas) where the level of suitable habitat protected for some VME taxa is less favourable including Northwest Challenger, Central Louisville and Southern Louisville.
  - Suitable habitat for VME indicator taxa deeper than 1400 m is unlikely to be impacted by fishing (which essentially ceases at 1250 m). If a depth cut-off of 1400 m is applied, the proportion of suitable habitat for a subset of VME indicator taxa including stony corals unlikely to be impacted increases on the Central and Southern Louisville Ridge and becomes qualitatively favourable, but the core depth distribution of many other VME indicator taxa likely overlaps with fishable depths in these areas.
- that, although the appropriate scale to assess and manage impacts on VMEs has not been defined in SPRFMO, the smaller scale of the Fishery Management Areas is likely to be a more biologically appropriate scale at which to assess and manage these impacts than larger scales.

The SC also **recommended**:

- that in its review of CMM 03-2020 (Bottom Fishing), the Commission may wish to consider additional precautionary management measures for areas and taxa at higher risk from bottom trawl fisheries to address uncertainty and provide additional confidence that the CMM will meet its objective;
- that the Commission provides guidance to the Scientific Committee on the level of protection, structure, or function of VMEs it requires to assure that Significant Adverse Impacts on VMEs are prevented, or requests advice on this in the multi-annual workplan.

Jack Mackerel

The SC **recommended**:

- that intersessional work on comparison of protocols and exchange of otoliths between Members take place, including a possible intersessional workshop;
- a 15% increase in 2021 catches throughout the range of Jack mackerel- at or below 782 kt;
- that a Jack mackerel data workshop (3-4 days) be held in 2021 to address *inter alia* some of the following topics (a final terms of reference will be developed prior to COMM 9):
  - Collating an overview of the number of samples per quarter and fleet related to total catch taken in the length and age sampling data;
  - Fully consider the new ageing method developed by Chile and the implications for associated parameters (growth, maturity, natural mortality) and the assessment. Carry out a comparison of age length keys of different members, including looking at sample sizes. It would be good to have all the Chilean age data from all years available for the benchmark. If this is not available, lengths may need to be used for some of the earlier years;
  - Look carefully at diagnostics and model structure of the new Chilean set-based CPUE index;
  - Consider whether the self-sampled length distributions should be used for the European Union catch data in future assessments;
- that a Jack mackerel benchmark workshop (minimum of 4 days) be held in 2021, conditional on a successful data workshop being held, to address *inter alia* some of the following topics (a final terms of reference will be developed prior to COMM9):
  - Evaluate how the age data affect other model assumptions, namely natural mortality and weight-at-age variability over time;
  - Explore the impact of the first age in the assessment. Currently the assessment starts at age 1, but recently there have been some age zero fish turning up in the catch, and the benchmark should consider how these should be treated;
  - Review the single stock and two-stock hypothesis implementations of the JJM assessment model, projections, environmental regimes and reference points;
  - Review the methods used to carry out projections and, if needed, explore alternatives. Ensure documentation and options are up to date;
  - Improve model diagnostics and upgrade the graphical display of model results, potentially more fully incorporating FLR tools (since that's been used for the MSE and has largely been adapted).

Squid

The SC **requested**:

- that the Secretariat update the Japan and Ecuador catch figures prior to 2014 using the information contained in the FAO database so that SPRFMO has a more complete historical record for Jumbo flying squid captures;
- that the number of vessels (and gross tonnage) for vessels that fished in the squid fishery in the SPRFMO area by flag State and Year continue to be documented and presented to the SC.

The SC **recommended:**

- that Members check the catch data contained in tables 1 and 2 of SC8-SQ01_rev1 and liaise with the Secretariat in cases where significant discrepancies exist;
- that the maturity schedule be finalised via email and **requested** that the Secretariat make the form for classification schemes for jumbo flying squid available for Member use.

The SC also:

- **noted** that colour photographs of the gonadal stages be developed to help with assigning stages to squid and **requested** that Members and CNCPs provide guidance and also provide the guides in the respective languages;
- **agreed** that the Squid Monthly Catch and Effort data template in SC8-SQ01_rev1 was appropriate at this time and **recommended** that it should be used to collect this type of data from the squid fishery;
- **accepted** the Squid Jigging Observer Data Template with the understanding that the Secretariat would make the updates referred to in Paragraph 162 and also remove the transhipment tab pending a possible future CTC discussion on the merits of its inclusion into this specific template.

With regards to the Squid Biological Sampling Data Template the SC:

- **requested** that the Secretariat investigate the possibility of using the original observer template, in part to avoid the need for extra funds and due to the minor suggested differences.

Regarding effort limits for the Squid fishery:

- there was broad support for establishing effort limits based on the precautionary approach, but several Members expressed concerns that the recommendation of a specific limit needs to be based on more comprehensive scientific research and more complete discussion among Members, including *inter alia*, a discussion on the relative merits of active versus listed vessels.

Habitat Monitoring

Regarding the nomination of a subgroup of specialists to evaluate advantages and biases of analysis methods and a subgroup to organise classification of fishing fleet, the SC:

- **recommended** that Members encourage participation of scientists interested in habitat modelling at large (e.g. from the Deepwater group) to be involved in these subgroups so as to increase cross collaboration on similar issues.

Regarding the Symposium on the State of Art Habitat Monitoring, the SC:

- **recommended** that the steering committee prepare a detailed plan for the Symposium to be presented to the Commission in its January 2021 meeting

Exploratory Fisheries

The SC:

- **requested** that interested parties work intersessionally to update the checklist with additional detail in accordance with CMM 13-2020 (Exploratory Fisheries) and based on their experience of reviewing exploratory fishing proposals in recent years.

On a potential need to develop a template for Fisheries Operation Plans to assist proponents to meet the requirements of CMM 13-2020 (Exploratory Fisheries), the SC:

- **requested** the Secretariat to work with Members intersessionally to develop such a template.

On the Cook Islands' exploratory fisheries plan, the SC **accepted** the latest version of Cook Island's Fishery Operational Plan (SC8-DW01_rev1) and **recommended**:

- that the SPRFMO Commission allocate no more than an annual total allowable catch (TAC) of 300 t a year for fishing years for the period October 2021- June 2023;
- within the global TAC, facilitate feature specific limits with the extension of the exploratory fishing area to include 'Box 2' area;
- that fishing operations shall take place over no more than 80 fishing days per trip (Trip Total Allowable Effort), setting and hauling no more than five lines of 100 traps a day the period October 2021- June 2023;
- noting that during the course of fishing operations, additional seamounts may be discovered, if these fall shallower than 500 m and feature structure deem suitable, opportunities shall be allowed for their exploration;
- that five experimental days be added to the trip TAE for one trip between October 2021- June 2022. Note: all catches taken during experimental fishing are counted against the TAC;
- allowing the flagged vessel to test alternative trap designs.

On Chile's exploratory fisheries plan, the SC

- **recommended** that a small group continue to provide some additional advice on the Chilean proposal, noting that the work is likely to extend intersessionally and result in a revised proposal being provided to the 9th meeting of the Scientific Committee in 2021 unless the scope of the proposal is reduced to include only the Chile Rise and additional information provided.

On the European Union's exploratory fisheries plan, the SC:

- **accepted** the Fishery Operational Plan and checklist (SC8-DW16) for the European Union proposal for an exploratory toothfish fishery.

Other Matters

Concerning the FAO ABNJ Deep Sea Fisheries Project (ABNJ DSF), the SC:

- **requested** that the SPRFMO Secretariat assist and coordinate activities relevant to supporting the work of the SC during the planning phase of the DSF Project.

On the level and use of the Commission's scientific support budget item, the SC:

- **recommended** that the Australian contribution be firstly used to cover the projected deficit ($23,060) and to use the remainder on high priority workplan items including aligning the Deepwater and Habitat Monitoring work;
- **recommended** that notwithstanding regulation 2(4) that the Commission exceptionally agree to carry funds forward to next financial year if the COVID-19 pandemic continues to limit activities that can be undertaken during the 2020-21 financial year;
- **requested** that the Secretariat coordinate a small intersessional working group to develop the working plan prior to COMM9.

In terms of the next meeting and venue, the SC:

- re-confirmed Dr James Ianelli (USA) as the SC Chairperson with Mr Niels Hintzen as vice- Chairperson;
- re-confirmed all current Working Group Chairpersons;
- **requested** the Secretariat to re-confirm Panama's offer to host the SC9 in 2021.

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Annex 3: SC8 Meeting Agenda

1) OPENING OF THE MEETING a) Adoption of Agenda b) Meeting Documents c) Nomination of Rapporteurs d) Meeting programme and timetable	DOCUMENTS SC8-Doc01_rev1, Doc02 SC8-Doc03_rev3 SC8-Doc04_rev3
2) ANNUAL REPORTS DISCUSSION	SC8-Doc12-29
3) COMMISSION GUIDANCE AND INTER-SESSIONAL ACTIVITIES a) "Expanded" SC multi-annual workplan b) Review of intersessional work to highlight "reduced" workplan c) Secretariat SC related activities	 SC8-Doc05 SC8-Doc06_rev1, Doc08 SC8-Doc07, Doc11_rev2
4) DEEPWATER a) Review of inter-sessional activities b) SPRFMO Orange roughy assessment data review and evaluation (NW Challenger and Lord Howe Rise) c) VME encounters and Spatial management d) Bottom Fishery Impact Assessment (BFIA) e) CMM 03 request regarding ongoing appropriateness f) Advice to the Commission on Deepwater	 SC8-DW10 SC8-DW11, DW12, DW13, SC8-DW07_rev1, DW17, DW14
5) JACK MACKEREL a) Inter-sessional activities including fishery conditions, connectivity, stock structure and growth b) Management Strategy Evaluation c) Assessment data review and evaluation d) SPRFMO Jack mackerel assessment e) Advice to the Commission on Jack mackerel	 SC8-JM03, JM04, JM06, JM07, JM08, JM09 SC8-JM05 SC8-JM01, JM02
6) SQUID a) Review of inter-sessional activities b) Genetics and maturity overview c) Squid assessment data and template development d) Advice to the Commission on Squid	 SC8-SQ02 SC8-SQ01_rev1
7) HABITAT MONITORING a) Report to the SC on inter-sessional activities b) Inventories of environmental data, technologies, research programmes	 SC8-HM03, HM05, HM06, HM07 SC8-HM01, HM02, HM04, HM08
8) EXPLORATORY FISHERIES a) Cook Islands Exploratory Potting Fisheries Operation Plan b) Chile Exploratory Potting Fisheries Operation Plan c) EU Exploratory Toothfish Fisheries Operation Plan d) Exploratory Toothfish Fishery updates (Chile, EU, NZ)	 SC8-DW01_rev1, DW15 DW06_rev3, DW18 DW05_rev2, DW16 SC8-DW02, DW03, DW04, DW08, DW09
9) OTHER MATTERS a) Reappointment of Officers b) Level and use of the Commissions Scientific Support budget c) Planned Inter-sessional activities d) Next meeting venue and timing	 SC8-Doc09 SC8-Doc10
10) REPORT ADOPTION AND MEETING CLOSURE	

Annex 4: Annual Reports

Australia

Paper SC8-Doc13 provides an update on fishing activity by Australian-flagged vessels in the SPRFMO Convention Area. Two Australian-flagged vessels fished in the SPRFMO area in 2019 using demersal line gears and one Australian-flagged vessel fished using trawl gears. In 2019, the total retained catch reported in logbooks was 123 t for demersal line gears and 62 t for trawl gears. *Lethrinus rubrioperculatus* (spotcheek emperor) accounted for 31% (39 t) of the 2019 longline catch; the remainder comprised *Dentex spariformis* (yellowback bream; 13%; 16 t), *Etelis coruscans* (flame snapper; 10%; 13 t), *Lethrinus miniatus* (redthroat emperor; 8%; 9 t); Nemadactylus spp. (morwongs; 7%; 9 t) and other species (30%; 37 t). Trawl catch in 2019 was 62 t, comprised predominantly of *Hoplostethus atlanticus* (Orange roughy; 70%; 44 t) and *Beryx splendens* (alfonsino; 22%; 13 t). During 2019, observer coverage levels met or exceeded the levels specified in CMM 03-2018 and CMM 03-2019, which superseded CMM 03-2018 in April 2019. One interaction with a basking shark (*Centorhinus maximus*; dead) was reported in the trawl fishery in 2019. Full observer data describing any interactions with benthic taxa during 2019 were not available at the time of writing the report. In the non-trawl fishery in 2018, observers reported 19 kg of non-living 'benthos' (likely to have been rocks/mud) in four separate fishing operations.

Chile

Document SC8-Doc26 provides Chile Annual Report 2020 Jack mackerel. The industrial purse seine fleet operating on the Jack mackerel fishery in the SPFRMO area and Chilean EEZ between January and July 2020 consisted of 70 fishing vessels. As of 2016, Jack mackerel operations have been concentrated within the Chilean EEZ (99%). In particular, during this fishing season (2020), the fleet has been operated 100% in the Chilean EEZ, with fishing areas close to the coast. During the first half of 2020, 523,139 metric tonnes of Jack mackerel were caught in the Chilean EEZ. This value exceeds the national catch limit and is explained by transfers from other fishing nations. These catches begin in December of the previous year (2019) until June of this year (2020), with a monthly average of around 60,000 tonnes; monthly average that exceeds 80,000 tonnes in the period between January to May 2020. This situation is consistent with what was reported by the two hydroacoustic surveys that were carried out during 2020; also reporting high levels of biomass. Indeed, the survey in the northern central zone (March-April) reported 1,728,532 tonnes (+ 16.3% compared to 2019); while the survey in the south central zone (July) reported 1,548,640 tonnes (+ 258% compared to 2017). In addition, during the first half of 2020, the sizes from catches ranged between 25 and 65 cm in FL. The main mode was 27 cm in FL and the secondary mode was 35 cm in FL. Finally, it is important to inform that, as of January 2020 it an Electronic Monitoring System has been implemented to survey compliance with Bycatch Reduction Plans and Fishery regulation in general. Furthermore, during 2020 the mandatory use of Electronic Logbooks has been implemented in the entire industrial fleet to report on a set by set basis, total catches, bycatch and discards, locations of sets and other fishery information according to legal requirements.

Document SC8-Doc27 provides Chile annual report Jumbo Squid. The jumbo squid fishery has participation of artisanal and industrial vessels. The allocation of the national quota for the industrial sector corresponds to 20% and the remaining 80% is assigned to the artisanal sector. In 2019 the artisanal fleet landed 17,376 tonnes of jumbo squid, equivalent to 29.86% of the national total. This activity had the participation of 1,066 vessels of dimensions equal to or less than 18 metres in length. The largest fishing operation was carried out by vessels 12 metres or less in length, with a participation of 94.75%, equivalent to 1,010 vessels. This group of vessels landed a total of 14,478.46 tonnes, which corresponds to 83.32% of the total landings made by the artisanal fleet. The industrial landings of jumbo squid involved 35 vessels, of which 15 landed more than 3 tonnes per fishing trip. Of the latter, 10 were the vessels that used mid-water trawling as a capture method for the target fishing of this resource, landing 39,688,967 tonnes, equivalent to 97.60% of the total landed by this fleet during 2019. The industrial operation also used for the capture of jumbo squid the purse seine and bottom

trawling gears, which represented 1.75% and 0.65%, respectively, of the total landings made during 2019 by this fleet. 2019 stands out as the year in which the artisanal fleet landed the least number of tonnes in the 2012-2019 period. On the other hand, most of the catches have been made in the Exclusive Economic Zone (EEZ) of the Chilean maritime territory.

China

SC8-Doc19 provides China annual report on the Jack mackerel fishery. Two Chinese trawlers operated in the SPRMFO Convention Area for Jack mackerel in 2019. The Jack mackerel catch was 22,706 tonnes with 135 tonnes of chub mackerel. The fishing season was from February to September. Similar to the previous years, the fishery firstly took place in the high seas off South-central Chile and then moved to northern Chile, where the young Jack mackerel were distributed, at the end of the fishing season. The nominal CPUE was very stable and maintained at a high level, which indicated the stock has been recovered. There was no fishing activity of the Chinese pelagic trawlers in the SPRFMO area in 2020.

SC8-Doc20_rev1 provides an update on fishing activity of the Chinese squid jigging fleet in the high seas of the South-east Pacific in 2019. A total of 503 vessels were recorded to operate in the SPRFMO Convention area and caught 306 thousand tonnes of Jumbo flying squid. The actual number of the active fishing vessels varied from 193 (January) to 459 (December). The number of fishing vessels and fishing days increased, compared with 2018, but the annual catch and nominal CPUE decreased. Research activities focused on genetic diversity and feeding ecology of the Jumbo flying squid.

Document SC8-Doc21 presents on the implementation of China's 2019 Observer Programme. One observer was sent to a Chinese trawler and worked on board from 26 February to 31 July. A total of 90 fishing days and 137 tows were observed, accounting for 41.5% (calculated by fishing days) or 38.5% (calculated by tows) of the total effort and met the 10% observer coverage requirement. For the squid jigging fishery, three observers were placed on board five vessels, and three jigging vessels were designated to serve as studying vessels. A total of 726 fishing days were observed and 29,574 squid were measured in the 2019 observer mission.

Cook Islands

The Cook Islands annual report (SC8-Doc25) provides a summary of exploratory fishing activities in the SPRFMO Convention Area in 2019 and one trip in 2020 by a single Cook Islands flagged vessel. The exploratory fishing operations were restricted to the Foundation Seamount Chain fishing area, southeast of French Polynesia. The first year of trap fishing operations commenced in 2019 targeting *J. caveorum* and *Chaceon spp*. A total of 169.76 t was landed from the four trips, with *Jasus caveorum* recorded as the target species for trips 1-3 that occurred in 2019 but changed to *Chaceon sp*. for trip 4 which occurred in 2020. Catch composition consisted of 168.28 t of the target species (99.13%), including 146.62 t (86.37%) of *J. caveorum* and 21.65 t (12.75%) of *Chaceon sp*. In addition, a small amount of bycatch of 1.48 t, less than 1% of the total catch) was landed.

The Cook Islands sampled 10% of traps as advised by in CMM 14b-2019, superseded by CMM 14b-2020 (Exploratory Potting CK) for *J. caveorum* and *Chaceon sp*. The Cook Islands also undertook research activities and analysis during its fishing operations which have been submitted to SPRFMO SC8 (SC8-DW02, SC8-DW03, SC8-DW04) including a summary of activities across the four fishing trips, the biomass estimation of *J. caveorum* on Kopernick Seamount and an attempt to assess the Cook Islands interactions with VME indicator taxa.

Information on abandoned, lost, or discarded fishing gear is provided in the annual report. There were no interactions with seabirds, marine mammals, or other species of special interest (SSI). Additionally, a summary of VME interaction is provided in the annual report.

Ecuador

The Jack Mackerel Ecuador annual report (SC8-Doc28) presents historical biological and fishing information collected for the small pelagic fish monitoring programme of the Public Institute for Aquaculture and Fisheries Research (formerly National Institute of Fisheries) by the Ecuadorian purse seine fleet, when this resource is available in Ecuadorians waters. The principal fishing zones when Jack mackerel (JM) is available in Ecuadorian waters are recorded in the Gulf of Guayaquil and around Peninsula de Santa Elena. The historical size structure ranges from 14 to 66 cm Total Length, denoting the presence of three groups of size classes, as well as two strong modal groups. In the case of giant squid, SC8-Doc29 analyses the available biological and fishing data collected from the artisanal fleet (targeted fishing and bycatch) in the Gulf of Guayaquil during 2019 and historical data, in order to contribute to the knowledge of the population dynamics of the species and the sustainability of the resource in the region; The female organisms registered 49.6% in stage I (immature), 48.9% stage II (maturing) and 1.5% stage III (mature); It should be noted that stages I and II in females were the most frequent and more numerous than males throughout the 2019. In the analysis per month, the females registered between January and April 19.6% stage I, 76.4% stage II, 4.0% stage III; from May to October 67.7% stage I, 31.9% stage II, 0.4% stage III, and November to December 32.3% stage I, 67.7% stage II.

European Union

A report (SC8-Doc12) was presented on the European Union fishing activity in 2019 in the South Pacific Regional Fisheries Management Organisation (SPRFMO) Convention area and the observer programme implementation in 2019. The data on catches of Jack mackerel (*Trachurus murphyi*) by one European Union trawler in 2019 covers the period from March to August. Total catch in 2019 was just over 12,000 tonnes. There was no fishing activity of the European Union fishing fleet targeting *Trachurus murphyi* in the SPRFMO Convention area in 2020.

A short section on the PFA self-sampling programme has been included in the report, demonstrating the main results of the self-sampling activities that cover all trips by European Union vessels in the area.

A comparison of the European Union observer data on Jack mackerel with the PFA self-sampling data has been submitted to the SPRFMO SC (SC8-JM03). This comparison demonstrated that there is close correspondence (in catch compositions and length compositions) between scientific observers and self-sampling for trips that were covered by both programmes. However, there are clear differences in overall length compositions from using only the observer trips or using all the self-sampling trips. This is because the self-sampling trips cover all areas and seasons of the fishery while the observer trips may miss some areas or seasons. In the future, the self-sampling trips could be used to generate the length compositions to be used in the assessment of Jack mackerel.

Korea

Korea's Annual Report (SC8-Doc18) described the fishing activity, the research activities, and the observer programme implementation in the SPRFMO Convention Area in 2019. The total catch of Jack mackerel (*Trachurus murphyi*) in 2019 by two Korean trawlers was 7,444 tonnes, and there was no trawl fishing activity in 2020. A total of 15 jigging vessels operating in the Convention Area caught 5,577 tonnes of Jumbo flying squid (*Dosidicus gigas*) in 2019. Korea has worked on three research projects on Jumbo flying squid: 1) diet composition, 2) genetic structure analysis, and 3) mercury concentration. The squid samples were collected by scientific observers dispatched on board Korean jigging vessels in 2018. To determine the trophic ecology of Jumbo flying squid 92 stomachs of *D. gigas* were analysed. Molluscs were the most common prey items, comprising 90.6% based on the ranking index. Its diet also included small quantities of fishes, crustaceans, seaweeds, and vinyl. The consumption of molluscs taxon increased when the size of the squid increased. Among the three molluscs taxon, cephalopods were the dominant taxon. Also, a total of 59 individuals of D. gigas prey gene structure analysis was carried out. 29 representative haplotypes were obtained after

bioinformatics analysis of raw reads generated by MiSeq sequencer. The haplotypes were composed of 3 phyla, 3 classes, 6 orders, 8 families, 13 genera. D. gigas occupied most of the reads, indicating its cannibalism. Other cephalopods such as Ommastrephes bartramii and Argonauta sp. were identified. The genetic structure analysis of D. gigas was conducted for preliminary test of the SC WorkPlan. A total of 46 samples were analysed using mtDNA cytochrome c oxidase subunit I (COI), and the analysis followed the process set out in SC6-SQ11. A total of 15 haplotypes were identified from a 576 bp fragment of mtDNA analysed. The study of mercury concentrations in different organs of the D. gigas found that the highest mercury concentration was found in the liver (0.094 ± 0.035 mg/kg). However, mercury levels of all tissues are below the limit specified by international guidelines (e.g. EC No. 1881/2006, 0.5 mg/kg). Korean scientific observer programme for distant-water fisheries has been in place since 2002. Four observers dispatched in two trawlers and two jigging vessels collected the biological information of the target species and bycatch species in 2019. Korea is planning to send one observer on squid jigging vessels in October 2020 for collecting scientific data (genetic samples, statolith and more) in the Convention Area to continue working on the scientific research.

New Zealand

SC8-Doc14 provides an update on New Zealand's fishing activities in the SPRFMO Convention Area in 2019. Ten New Zealand vessels fished in the SPRFMO Convention Area, four using trawl methods and six using bottom line methods. Overall catch and effort was the lowest it has been in recent years, with 253 trawl tows completed taking 472 tonnes of fish. The majority of the trawl catch was Orange roughy (460 t), with a small amount of alfonsino (12 t). There were 183,000 hooks set using bottom line methods with a total catch of 133 t, the majority of which was bluenose and wreckfish (57 and 50 t respectively).

New Zealand met all requirements for observer coverage, with 100% coverage in trawl fisheries, and 24% of hooks observed in bottom line fisheries. Over 4,000 fish were measured, including 2,800 Orange roughy and over 400 each of alfonsino and bluenose. Unscaled length frequency information on a number of species is provided in the report.

The majority of research activities by New Zealand in 2019 were continuations of previous projects and additional work to support the ongoing review and testing of the new bottom fishing CMM. New Zealand provides information on a range of ecosystem considerations, including interactions with seabirds, marine mammals, reptiles, other species of concern, non-target fish and elasmobranch catch, and catch of benthic organisms. Information on abandoned, lost, or discarded fishing gear is also provided. There were no interactions with seabirds, marine mammals, or other species of concern on New Zealand vessels in 2019, and no encounters with potential VMEs pursuant to CMM 03-2019 (Bottom Fishing).

Peru

As of June 2020, there are 99 Peruvian vessels authorised and registered in the Commission Record of Vessels authorised to fish within the SPRFMO Convention area (SC8-Doc23, SC8-Doc24). In 2014, up to 5 Peruvian purse seine/trawlers caught 2,556.9 t of *Trachurus murphyi* and 1190.0 t of *Dosidicus gigas* in the SPRFMO Convention area. This fleet of Peruvian larger multipurpose purse seine/trawl vessels has now been reduced to only 2 vessels. No Peruvian vessel has fished for *T. murphyi* in the SPRFMO Convention area since 2015. A total of 1,122.3 t of *Scomber japonicus* were caught by 5 Peruvian purse seiners in 2016. No Peruvian vessel has fished for *S. japonicus* in the SPRFMO Convention area since 2017. Two Peruvian scientific research vessels caught a total of 1.6 t of *D. gigas* in 2015 and one of them caught 1.0 t in 2018, while a variable number of small artisanal jigger vessels were reported to have occasionally fished for *D. gigas* in the SPRFMO Convention between 2014 and 2018. According to IMARPE estimates, these small artisanal jigger vessels may have caught an estimated maximum of 5,066 t of *D. gigas* in 2017. Details of all these catches have been reported in previous annual reports to the SPRFMO Scientific Committee. No fishing activities or sea going research activities by Peruvian flagged vessels directed to non-highly migratory species in the SPRFMO Convention area have been reported for 2019 and the first semester of 2020.

In recent years, the Peruvian marine environmental conditions have been characterised by a sequence of warmer and cooler than normal events intercalated with relatively short periods of neutral or 'normal' conditions. Since 2014 there has been a weak El Niño in mid-2014, a strong El Niño during 2015 and the first half of 2016, a moderate-coastal El Niño from late 2016 to early in 2017, a weak-to-moderate La Niña from late 2017 to early 2018, and a weak El Niño from very late in 2018 to early 2019. This has been followed by a period of close to neutral thermal conditions, with slightly colder but close to neutral conditions between April and the end of 2019 and warmer but still close to neutral conditions during the first semester of 2020. These environmental conditions have impacted the Peruvian fishery for Jack mackerel (*Trachurus murphyi*) in Peruvian national waters by causing a more dispersed distribution, reduced availability, lower abundance indexes and consequently lower catches of Jack mackerel in Peru between 2014 and the first part of 2018; conversely, the slightly warmer than neutral conditions associated with the weak 2018-2019 El Niño followed by more neutral conditions during the remainder of 2019 and first half of 2020 have favoured the expanded distribution farther offshore of denser concentrations, increased availability to the industrial purse seine fleet, much higher abundance indexes and consequently higher catches of Jack mackerel during the second half of 2018, throughout 2019 and the first half of 2020. Jack mackerel abundance indexes from scientific surveys and from the fishery have increased noticeably during the second half of 2018 and throughout 2019 and the first half of 2020. CPUE (catch per unit of effort) from commercial fishing and acoustic abundance indices from research surveys in late 2018 and throughout 2019 and early 2020 were similar or well above the maximums observed between 2010 and 2014, and were consistently much higher than those observed during 2015-2017. In late December 2019 IMARPE (Instituto del Mar del Peru) updated the available 2019 Jack mackerel assessment made for the Peruvian (far-north) stock during the 7th meeting of the Scientific Committee (SC7), based on which a range of options for setting the 2020 TAC was included in its advice to the Government, recommending that a TAC for 2020 be established that considers a multiplier of F2019 not exceeding 2.0, which corresponded to a maximum estimated F = 0.0652 and a maximum projected TAC = 140,000 t, accepting a risk of 30.9% that the estimated biomass by January 1st 2021 be lower than that estimated for January 1st 2020. A conservative initial TAC for 2020 of 100,000 t was set by the Government in January 2020, and based on an updated assessment of the situation with the newer information and data collected during January, February and March, the initial TAC was reviewed upward by the end of March 2020, bringing the TAC for the whole year to 140,000 t, which was the maximum within the range advised by IMARPE. The main results of an updated 2020 assessment with the same JJM model used during the SC07 but with information and data updated to June 2020 and total catch projected to the end of the year is also presented. These results show an increasing trend in the biomass estimates since 2016 and an overall healthy situation of the Peruvian Jack mackerel stock within the natural low abundance regime as it appears to have been during the last two decades.

Russian Federation

Russia presented its annual report (SC8-Doc16). In 2019 only one Russian trawler "Aleksandr Kosarev" worked in the high seas of the Southeast Pacific. The total catch was 9,423 t for Jack mackerel and 44 t for chub mackerel in 102 fishing days. The average catch from March to July 2019 was 8.6 t per hour. The highest CPUE was recorded in August – 95.4 t per fishing day. A Russian scientific observer was onboard the trawler "Aleksandr Kosarev" during the whole period of activities in 2019. In 2019, 25,127 specimens of Jack mackerel were measured, 4,346 specimens were analysed, and 2,002 specimens were taken for age sampling by the scientific observer. The bycatch of chub mackerel was very low and therefore, the amount of collected material was limited – 1,594 specimens were measured, 252 specimens were analysed, and 37 specimens were taken for age sampling.

Due to the COVID-19 pandemic, the Russian fisheries in the SPRFMO area in 2020 only started on August 12th. In 2020 only one Russian trawler "Admiral Shabalin" worked in the high seas of the Southeast Pacific. The total catch was 2,485 t for Jack mackerel as of September 15, 2020.

Chinese Taipei

Jumbo flying squid widely distributes in the eastern Pacific and has been targeted by Chinese Taipei's squid-jigging fleet since 2002 (SC8-Doc22). The number of operating fishing vessels varied from 5 to 29 between 2002 and 2019. There were 10 vessels involved in the fishery in 2019 which produced 2,085 tonnes of Jumbo flying squid. The nominal CPUE was 3.41 t/vessel/day in 2019 which was greater than the previous year. The major fishing grounds for the fishing vessels were located around 15°–20°S, 75°–83°W, while some vessels operated in the equatorial waters (around 0°–6°S, 100°–110°W) in 2019.

Data of logbook, transhipment and landing of Chinese Taipei's squid-jigging fleet have been collected entirely and submitted to the Secretariat of SPRFMO. Research on the stock status and spatial dynamics of Jumbo flying squid has been conducted. The monthly length composition of Jumbo flying squid was calculated from catches by weight category. A biological sampling programme has been designed following the protocol of the SPRFMO in 2019. Three squid samples were collected in the 2019 fishing season, which were belonged to large-sized group and in mature stage. No bycatch was recorded for the squid-jigging fleet in 2019 fishing season. The observer programme for squid fishery has been developed in 2018 and one observer will be onboard one squid-jigging vessel in 2021 fishing season.

United States of America

The United States (SC8-Doc15) currently has no vessels participating in the fisheries managed by SPRFMO. As such, the United States has no data or information to provide regarding United States fisheries operating under SPRFMO jurisdiction in 2019 or 2020. Similarly, the United States has no information to provide regarding 1) catches, effort, and CPUE summaries; 2) fisheries data collection and research activities; 3) biological sampling and length/age composition of catches; 4) ecosystem approach considerations; and 5) observer implementation reports for fishing activities under SPRFMO jurisdiction.

The United States has a continuing interest in the fisheries managed by SPRFMO and may have vessels that enter these fisheries in the future. If United States-flagged vessels enter SPRFMO-managed fisheries, the United States would provide the Commission with all relevant data and information.

Vanuatu

Vanuatu submitted a nil report (SC8-Doc17) and maintains its interest in SPRFMO fisheries and may have fishing activities in the SPRFMO area in the future.

Annex 5: Report of the Deepwater Workshop

Available via the SC8 meeting webpage.

Annex 6: Differences between the single stock hypothesis (H1) and two stock hypothesis (H2) model configurations

	H1	H2
Number of "stocks"	1	2
Number of recruitment regimes	1	1 (South) 2 (North)
Stock-recruit relationship years	2000-2017	2000-2017 (South) 1970-1996 (North; Regime 1) 2001-2016 (North; Regime 2)
Growth	L_∞=74.4, k=0.16	L_∞=74.4, k=0.16 (South) L_∞=80.4, k=0.16 (North)
Natural mortality	0.23	0.23 (South) 0.33 (North)
Catchability	For ages 2-10	For ages 2-10 (South) For ages 1-6 (North)
Selectivity in Peruvian fishery	Changes similar to other fisheries	Changes only once (2002)
Population body mass at age 4 (vectors differ)	195 g	195 g (South) 555 g (North)
Maturity	95% at age ~4.5	95% at age ~4.5 (South) 95% at age ~2.9 (North)

Annex 7: Jack Mackerel Advice Sheet

Stock status summary for Jack mackerel, October 2020

Stock: Jack Mackerel (*Trachurus murphyi*)

Region: Southeast Pacific

In conformity with the approach by the SC since 2012, a comparison was made between the 1-stock (H1) and 2-stock (H2) model configurations for Jack mackerel. Both models showed similar trends with an increasing overall biomass, high recruitments in recent years, and low fishing mortality.

Advice for 2021

Following the guidelines set out by the accepted rebuilding plan and given stock assessment results, 2021 catches should be at or below 782 000t.

Stock status

		2019	2020
Fishing mortality in relation to:	F_{MSY}	Below	Below
Spawning stock biomass in relation to:	B_{MSY}	Above 100%	Above 100%

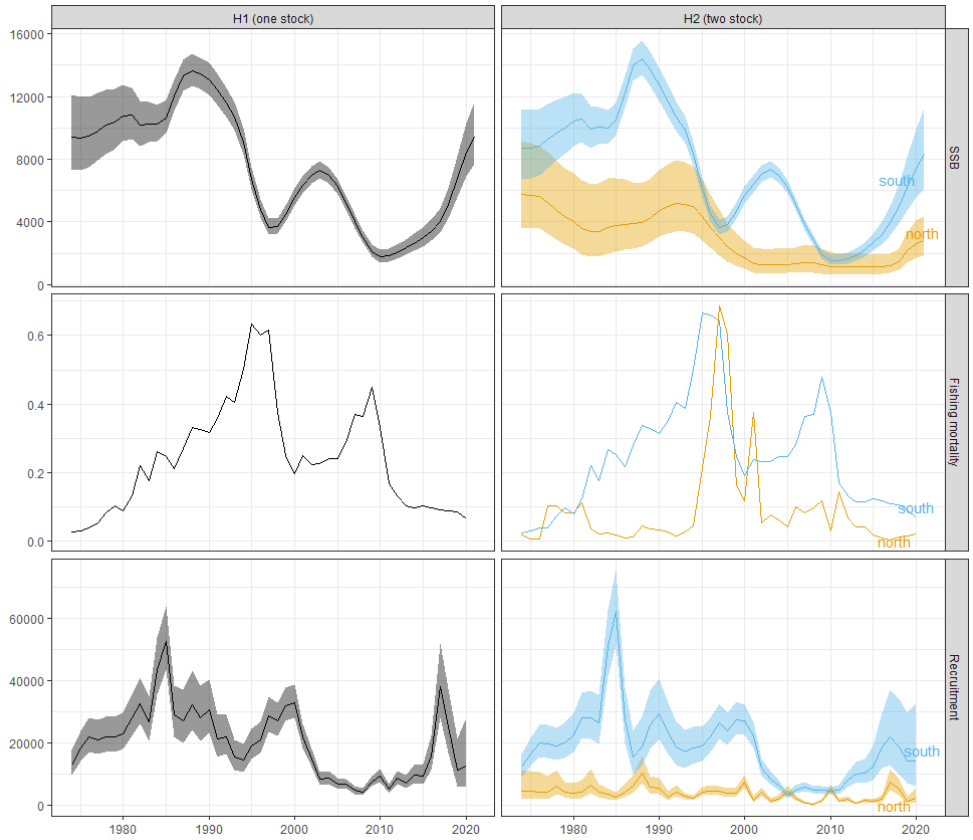

Figure 1: Jack mackerel in the southeast Pacific. Summary of stock assessment estimates over time showing spawning biomass (in thousands of tonnes; top), total fishing mortality (as an instantaneous rate per year; middle), and recruitment at age 1 (millions; bottom). Columns show results for the one-stock hypothesis (H1, left) and two-stock hypothesis (H2, right, "north" stock in yellow and "south" stock in blue). Shaded areas refer to the estimated uncertainties

Table 1: Advised catch, Catch Limits and reported catch of Jack Mackerel in the southeast Pacific

Year	Advice	Recommended Maximum Catch	Catch Limit CMM area	Catch Limit throughout range	Catch throughout range
2013	Projection results under the assumption of recent average recruitment at the levels estimated for the recent period (2000–2012) indicate that fishing mortality should be maintained at or below 2012 levels to improve the likelihood of spawning biomass increasing. This results in catches for 2013 on the order of 441kt or lower.	441,000	360,000	438,000	353,120
2014	In sum, the advice to the Commission is to aim to maintain 2014 catches for the entire jack mackerel range in the southeast Pacific at or below 440 kt.	440,000	390,000	440,000	410,703
2015	The Commission should aim to maintain 2015 and 2016 catches for the entire jack mackerel range in the southeast Pacific at or below 460 kt.	460,000	410,000	460,000	394,332
2016	The SC agreed that the recommendation from 2014 for catches in 2016 is still appropriately precautionary. Namely, that the Commission should set 2016 catches limits for the entire jack mackerel range in the southeast Pacific at or below 460 kt, based on a status quo fishing mortality of 2014.	460,000	410,000	460,000	389,067
2017	On the application of the adjusted rebuilding plan adopted by the 2nd Meeting of the Commission as proposed from SC02, the Commission should aim to maintain 2017 catches for the entire jack mackerel range in the southeast Pacific at or below 493 kt.	493,000	443,000	493,000	404,845
2018	Given current stock status, the second tier of the Jack mackerel rebuilding plan could be applied, thereby substantially increasing the potential catch. Considering the uncertainties in the assessment however, the Scientific Committee adopts a precautionary approach and advises to maintain 2018 catches for the entire Jack mackerel range in the southeast Pacific at or below 576 kt.	576,000	517,582	576,000	526,323
2019	The SC recommended status quo fishing effort which gives 2019 catches throughout the range of the Jack mackerel stock(s) at or below 591 kt. Although the stock is estimated to be in the "second tier" of the harvest control rule (>80% of B_{MSY}), the retrospective analysis shows a tendency of overestimating the stock size. In addition, there is information that suggests that the growth of jack mackerel has been underestimated. These two factors warrant additional precaution and further investigation.	591,000	531,061	591,000	631,545
2020	In line with the accepted rebuilding plan ("Adjusted Annex K") and because the Jack mackerel biomass is estimated to be above B_{MSY}, the SC recommended a 15% increase in 2020 catches throughout the range of Jack mackerel resulting in a total catch limit at or below 680 thousand tonnes.	680,000	618,001	680,000	*649,915**
2021	In line with the accepted rebuilding plan ("Adjusted Annex K") and because the Jack mackerel biomass is estimated to be above B_{MSY}, the SC recommended a 15% increase in 2020 catches throughout the range of Jack mackerel resulting in a total catch limit at or below 782 thousand tonnes.	782,000			

2013 advice was given by the Science Working Group.

* Preliminary value estimated at SC08

Annex 8: Jack Mackerel Technical Annex

Available via the SC8 meeting webpage.

Annex 9: Squid issues and statements

Record of debate on Squid status and development of advice to the Commission

Several SC8 participants drafted a recommendation in relation to an effort limit for the squid fishery based on information provided by the Secretariat on effort in terms of vessel numbers and gross tonnage.

The initial drafting was "recommends that the Commission limits the total gross tonnage of the active fleet that fishes for jumbo flying squid in the SPRFMO Convention Area in 2021 to 2023 to a maximum of 450,000 total gross tonnage"

There was a question of whether this included just active fishing vessels or registered vessels. It was clarified that a cap on vessels would be active vessels as those are the ones relevant to the sustainability of the fishery. The implementation of the limit is a Commission issue, and that the limit is argued on a biological sustainable point of view in this instance, but how that cap would be implemented across Members and CNCPs is not an issue for the SC.

It was commented that both the stock status of squid and fishing effort should be taken into account. Under conditions of poor stock status, a TAC should be set and then fishing effort should be considered to be limited. With the stock status of squid not being clear, the SC should set a timetable to clarify stock status and then SC would recommend a catch limit to control effort.

The decreasing trend in CPUE in the Convention Area is concerning as noted in Peru's Annual Reports. Chinese data show a decreasing trend in their CPUE and also the Korean CPUE data. Particularly worrisome is the data submitted by Korea in SC8-Doc18 that shows a noticeable decreasing CPUE trend in Korean data from 2012 to 2019 (figure 4). That paper was not specifically shown or mentioned, but decreasing trend is more dramatic if CPUE is defined from data from 1990 to 2019. Catch by vessel between 2008 and 2019 is particularly worrisome. This is more dramatic than what was shown in the European Union analysis. This is also in line with discussions in Vanuatu. Peru also agree that something has to be done to limit fishing effort in the Convention Area but also concerned about the not closing possibilities of coastal States that have established fisheries in domestic waters to expand into the Convention Area. If a recommendation to the Commission is going to be agreed on this issue, Peru would like to extend the paragraph to note the need to allow for increases above that tonnage to allow for coastal States with domestic squid fisheries to expand activities into the adjacent convention area.

It was noted that additional text would require scientific justification as to why it would be sustainable to add more fishing effort on top of the limit proposed. Some Members suggested recommendations to the Commission to consider measures to control fishing effort should include vessel numbers and years. Also, coastal waters should be included. The metric/measure used to manage fishing effort would be for the Commission to decide since that is a policy decision.

Chinese Taipei queried that if the stock status of squid is unclear, why should a limitation be placed on the fishing effort first. They expressed the view that the stock status should be known first and then a catch limit considered.

The Chair clarified that stock status is a very difficult problem and requires lots of resources. In lieu of not having that information, managing a fast growing and highly variable species is challenging. The Proponent has identified a concern with overall catch rates, which has been used to justify the need for a limit on effort.

Peru agreed that the decreasing trend in CPUE suggests decline in stock size.

CALAMASUR noted that in regards to Peru's suggested addition to the recommendations, what is being requested will not necessarily lead to an increase in effort if vessels were being redistributed from one fishing area (national waters) to another (the high seas).

Chinese Taipei indicated that in principle they agree with the precautionary approach, but remember at SC7 there were discussions on how to limit fishing effort and that a number of approaches that could be taken were identified, although the SC did not reach consensus on the issue. SPRMFO is going to hold a workshop to discuss fishing effort and how it might be limited. Propose this be deferred to after a workshop next year where hopefully consensus could be reached.

Peru stated that if the agreed approach was setting a catch limit, Peru would look for an allocation as a coastal State, but the same criteria should be applied to a limit on fishing effort. On the proposal to defer management to after a discussion at a workshop, Peru suggested that separate text be added to provide Commission an opportunity to delay until after a workshop next year.

Korea stated that a limitation of gross tonnage is a reasonable approach, but the value of the limitation is more of an issue that requires further discussion. Another issue is that Peru has identified a decrease in CPUE in Korea's annual report. Korea clarified that yes, there has been a decrease in CPUE, but mantle length has also decreased, and it is unclear if this means the biomass has decreased. The upcoming Commission meeting can discuss limitation of fishing effort.

China also noted that the response of CPUE could be caused by other reasons, including the movement of the fleet to the northern area and catching smaller squid, and it could also relate to the increase in fishing effort. China also noted that CMMs should be considering actions in high seas and EEZ.

Reflecting on the discussion, the European Union felt that many of the conversations are considerations for the Commission rather than the SC, and that the point made by Peru is better suited to the Commission as it is unclear what the science aspect of it is. The European Union felt that it is important that advice is provided according to the precautionary approach.

China noted that the proposal at SC7 to have a workshop to quantify the fishing effort came from Chile and was supported by all Members, but it was delayed because of the COVID-19 pandemic. They proposed to hold the workshop ahead of next years' SC meeting to discuss the issues, as was suggested by Chinese Taipei.

Chile agreed that in general, the proposal by the Secretariat to reference the appropriate sections in the Convention in the recommendation seems sensible.

Some Members supported the suggestion that:

> "the Commission limits the total gross tonnage of the active fleet that fishes for Jumbo flying squid in the SPRFMO Convention Area in 2021 to 2023 to a maximum of 450,000 total gross tonnage of fishing vessels, and consider provisions for allowing further increases above this total gross tonnage limited to those which could be requested by coastal Member states with established Jumbo flying squid fisheries in national jurisdictional waters in accordance with the criteria listed in Article 21 (paragraph 1) of the Convention concerning Participation in Fishing for Fishery Resources."

Other Members wished to pursue effort limits in a future workshop because:

> "According to paragraph 2 (a) and (b) of Article 20 of the Convention, the specific CMMs adopted by the Commission shall, as appropriate, include the determination of reference points (or precautionary reference points as described in Annex II of the 1995 Agreement) and the actions to be taken if those reference points are approached or exceeded. To ensure the sustainability of the squid resource, they agree that a precautionary interim measure for the Jumbo flying squid fishery is needed. They also believe that such action shall be taken under the circumstances that a determinate reference point is adopted. However, unfortunately, there were no scientific analyses submitted to the SC to support the rationale of the abovementioned suggestion so far. In addition, with reference to paragraph 3 of Article 20, in determining a total allowable catch or total allowable fishing effort for any fishery resource under paragraph 2 (c), the Commission shall take into account factors, such as the status and stage of development of the fishery resource, fishing patterns of the fishery resource, relevant environmental factors and so on. As a result, they are wondering if the abovementioned suggestion has taken these factors

into consideration. They urged the SC to follow the regulations specified in Article 20 of the Convention, carry out relevant analysis and initiate discussions on the possible management, such as setting the TAC and the limitation of fishing effort. Except setting TAC and capping fishing effort, imposing a closed area or a closed season or banning fishing operations in the spawning area could be one of the management measures of fishery resources as well. They suggested the SC to start discussion on these relevant topics."

In response, all Members agreed that precautionary measures are most effective if reference points would be established. However, some Members noted that the necessary data are currently unavailable to define such reference points and it is unlikely that the SC will be able to provide clear, quantitative advice in relation to reference points for a number of years. One interpretation was that Article 3 (para 2) of the Convention guides us what to do in such instances and specifies that:

"...the Contracting Parties, the Commission and subsidiary bodies shall: (i) be more cautious when information is uncertain, unreliable, or inadequate; (ii) not use the absence of adequate scientific information as a reason for postponing or failing to take conservation and management measures;".

Ecuador recommended that the Commission, before limiting the total Gross Tonnage ensure 100% monitoring onboard for industrial vessels, in order to have more reliable information, which will allow the strengthening of the scientific evaluation of the population of Jumbo flying squid; as well as, the prohibition of transhipments in the Convention Area; in order to reduce fishing pressure on the stock of this species.

CALAMASUR Position Statement

Presented by Alfonso Miranda – President of CALAMASUR

"I am honored to take part in this meeting one more time on behalf of the Committee for the Sustainable Management of the South Pacific Jumbo Flying Squid (CALAMASUR) together with a delegation comprising artisanal vessel owners, industrial processors-exporters and technical professionals.

Through this document, CALAMASUR, aims to put on record three aspects of our concern. The first one is the urgent need to define a formula to limit the existing fishing effort in the Jumbo flying squid fishery that has continually increased over recent years. The second aspect is that, despite the improvements brought about by CMM 18-2020 (Squid) for the regulation of the Jumbo flying squid fishery adopted in Vanuatu, we consider that a higher standard needs to be set for the coverage of on-board observers. Finally, we consider that the relevance of authorising transhipments on the high seas should be widely discussed during the next meeting of the Commission.

The following briefly describes the three aspects:

1. Limiting the fishing effort

Although the CMM 18-2020 (Squid) for Jumbo flying squid in international waters of the South Pacific has been approved in Vanuatu, it did not include the most urgent issue on the management of Jumbo flying squid: limiting the on-going increase in fishing effort. This fact encourages us to be very responsible during the current meeting of the SC to achieve an adequate formula that can be proposed to the Commission.

According to the data provided during the first session on Jumbo flying squid in this meeting, we have witnessed that over the recent years, while there is very limited biological information of the stock which is essential to define the sustainability status of the resource, no action has been taken to limit the increase of fishing effort. Thus, the figures rose from 185,000 gross tonnage in 2014 to 449,000 in 2019. In other words, the fishing power has increased by 142% while the main challenges to ensure a sustainable harvest have not been addressed.

For this reason, there is an urgent need to agree during this meeting on a formula to limit the fishing effort to recommend to the Commission. Such a formula should allow, under the application of the precautionary

principle, to correct this behaviour that is incompatible with the rational management of fishing resources. In consequence, CALAMASUR proposes closing registration to new industrial vessels in the official registry.

2. Observer coverage

In recent years, governments, industrial and artisanal fishery stakeholders, academia, and non-governmental organisations have repeatedly reported systematic behaviour by vessels authorised to catch Jumbo flying squid in the South Pacific RFMO Convention Area. This behaviour is related to turning off the AIS devices for more than 24 consecutive hours in order to enter coastal state jurisdictional waters or exclusive economic zones to illegally catch the resource, infringing third country sovereignty. These acts, apart from showing a behaviour suspected of Illegal, Unreported and Unregulated fishing (IUU), poses a risk to the life of the crew of these and other vessels by limiting their safety rights. Other acts technically documented are the duplication of the Maritime Mobile Service Identity (MMSI) and the manipulation of vessel position by modifying the AIS information.

We acknowledge the progress made by the CMM 18-2020 (Squid) approving a coverage for observers equivalent to 5% of the fishing days. Nevertheless, we consider that this coverage is insufficient. Furthermore, although the on-board observers' duties are mainly related to scientific data collection according to the CMM 16-2019, observers have the right to perform their roles in freedom, without being assaulted, blocked, delayed, intimidated, or disrupted. At the same time, observers have the obligation to permanently maintain their independence and impartiality while they are on duty. In that sense, given the issues of illegal fishing and considering the goals of the observer's program, but also their rights and obligations, we believe that an increase of their coverage will have a deterrent effect on high risk behaviour of IUU fishing. This will benefit all of us, the delegates present in this meeting and interested in discouraging IUU fishing.

In light of the above, we consider that it is necessary to re-assess the appropriate level of observer coverage for the Jumbo flying squid fishery before the year 2023, which is the deadline set forth in article 10 of the CMM 18-2020. CALAMASUR proposes that the coverage should be 100% of the vessels, applied by other RFMOs in other regions of the world.

3. Transhipments on the high seas

Although the South Pacific RFMO focuses on its goal of ensuring conservation in the long-term and the sustainable use of fishing resources, we should not forget that, as set forth in article 3 of the Convention, the first principle of this RFMO is the conservation and management of fishing resources in a transparent, responsible and inclusive way, taking into account the best international practices. In that context, we would like to express that, at CALAMASUR, we do not consider that distant water fleets implement the best international fishing practices because they are known for conducting actions precisely in the opposite direction.

In that context, transhipments on the high seas reduce the number of movements of long-distance fleets, but they also keep fleets isolated for long periods of time. This exposes long-distance fleets' crews to potential infringement of labour rights or even to risks of slavery and human right violations.

For those reasons, we consider that the relevance of high seas transhipments should be an issue of special concern and discussion during the next meeting of the Commission. With that regard, CALAMASUR proposes that all high seas transhipments should be banned.

Finally, we would like to point out that there are coastal state artisanal fleets that have been fishing Jumbo flying squid in international waters since before the creation of the South Pacific RFMO and that continue their operations in that area. We therefore urge Member States and Cooperating Non-Contracting Parties to act in alignment with this reality and to take necessary actions to allow these fleets access to the vessels list. We consider that urgent action is needed to avoid compliance issues with the recent Jumbo flying squid CMM 18-2020 (Squid). We emphasise that those artisanal fleets sustain the livelihoods of many of coastal communities,

including thousands of families whose interests are considered in Principle 8 of this RFMO and duly detailed in Article 3 of the Convention.

We kindly urge Members to act now given that there are few weeks left before the Jumbo flying squid CMM 18-2020 (Squid) enters into force. Despite the particular social and cultural reality of artisanal fleets, they have the capacity to fully comply with all the requirements that this Commission decides to promote. Nevertheless, this will not be possible if the measures discussed and proposed here are not turned into actions that include those stakeholders who are paradoxically responsible for the largest worldwide catches for this species.

To conclude, we thank all of you for taking the time to listen to our remarks and for your relevant contributions to the regulation of the fishery that is the focus of today's meeting."

Annex 10: Habitat Monitoring Web Meeting

The sixth pre-SC Web Meeting (SC8-Doc06_rev1) focussed on Habitat Monitoring Topics. The following paragraphs contain a summary of the various presentations and resulting discussion held during that web meeting.

Peru gave a presentation based on Meeting Document SC8-HM04, which was an inventory of the different monitoring programmes that exist in Peru, including a number of programmes involving crew members being trained as observers to collect data on top predators and in correct techniques for handling and liberating different marine species. Peru quoted a figure of 22% of fishermen having been trained in liberation techniques of top predators.

At the sixth pre-SC Web Meeting Peru gave a presentation based on Meeting Document SC8-HM01, which was an inventory of environmental data that exists for habitat studies. Korea asked about the use of industrial fishing fleet vessels to collect acoustics data, and whether the data could be calibrated. Peru explained that most of the vessels could collect calibrated acoustics data, but this varied with the manufacturer of echosounder (for example Simrad or Furuno). If the reflectivity of the sea bottom in a specific location is well known, then it can be used as a reference for calibration purposes.

At the sixth pre-SC Web Meeting Chile presented paper SC8-HM08 "Habitat Monitoring of Chilean Jack Mackerel based on acoustics from fishing vessels 2020". Mean density estimates and spatial distribution obtained from acoustic data recorded by 4 vessels of the Chilean Jack Mackerel (CJM) fishing fleet in their usual fishing operations during the year 2020 are presented and compared with previous years. The abundance calculation was made only for the year 2020 based on a completely random sampling design through the geostatistical method. Acoustic data was collected with eco-integration systems that allow digital recording of the information during the entire trip of the vessels from the harbour to the fishing grounds and back to the harbour. Unlike 2018 and 2019, when the Jack mackerel remained close to the coast between January and March, and then expanded its distribution to the west with respect to the port of discharge (Talcahuano), in 2020 the Jack mackerel stayed near the coast between January and May, only expanding their distribution in the latitudinal direction in April and May, reaching -32°00'S in the north and -40°00'S in the south. Mean acoustic densities in m^2/nm^2 corresponding to the years 2018, 2019 and 2020 were calculated and the highest acoustic densities were registered in 2019. During 2020, a small increase was observed in the mean density of the schools of Jack mackerel compared to 2019 in the month of March, however, in the months of January, February and April the mean density of the schools detected the year 2020 was lower than 2019. The total abundance of Jack mackerel was estimated as 2,476 million individuals that in biomass represents a total of 1,424,990 tonnes of Jack mackerel in the central-south zone of Chile, with a coefficient of variation of 4.17%. The abundance estimate obtained in 2019 was higher than that calculated for 2020, however, the biomass obtained in 2020 is greater than that of 2019, due to the greater effective area of distribution of CJM and the presence of larger fish compared to 2019. Results obtained were used to update the series of historical estimates of relative abundance that are registered for this fleet since 2004.

There was great interest in the use of this data for this purpose, and a number of the challenges of using acoustics data collected by the fishing fleet were identified and discussed in detail.

There is also a potential issue that while some of the acoustics systems on the vessels are calibrated, not all could be calibrated.

It was clarified that the vessels were collecting acoustics data all the time they are at sea (port to port) and that some data exists where vessels were transiting, but generally the data is only in the area where vessels are actually fishing, and in the year studied there is therefore no information from outside of the Chilean EEZ. It was noted that the area covered by the data is small, and focussed on the area where the industry believe fish could be found, whereas the government series of acoustics indices is much more systematic and covers

a larger area. However it was noted that this series would be complementary to the government series, and sometimes the most productive months are before the scientific survey which occurs in June, so this series has the advantage of a wider sampling period within the year. It was noted that in some years, when the Jack mackerel concentrate in the same areas as the fleet, the estimates are very similar.

The potential of using this data to develop a habitat index to assess not only area but also quality of habitat was considered. Or to map how much of the potential habitat is actually being used by Jack mackerel. The data suggested that the Jack mackerel area appeared to have changed by a factor of 3 between 2019 and 2020. Peru explained that in their research they distinguish between areas of high concentration, and other areas where Jack mackerel are dispersed over a wider area.

The European Union suggested that it would be interesting to demonstrate the method of generating mean density from fishing vessels in more detail and suggested a **small subgroup to discuss the advantages and biases of analysis methods**.

Peru gave a presentation based on Meeting Document SC8-HM02, regarding a potential protocol for the use of the technology of acoustic data collection aboard fishing vessels operating in the SPRFMO area. It was queried why in table 2 of SC8-HM02 measurement of noise is not required for Fishing Vessels of Levels 1 and 2 (while it is for Levels 3 and 4). It was explained that because of the definition of Level 1 and 2 vessels, noise from these vessels should be low. Korea noted that the use of acoustics data by industrial vessels is very important, and that Simrad systems are very accurate and that this data is already used by other RFMOs. Peru noted that CCAMLR have been using this kind of data for more than 20 years, and that SPRFMO should be able to learn from the protocols that they have developed. Peru suggested that **a subgroup of specialists should be assembled** to develop all six of the required protocols. It was suggested that a template could be developed and also that a list of the vessels and their acoustics equipment could be compiled by each Member in order to **organise the classification of the fishing fleet**. A frequency table with the number of different vessels at each of the different levels, along with ways to identify the differences between the Level 1, 2 etc classifications was recommended. Chile has already started to compile this kind of information. It was observed that the sampling requirements will be different for different kinds of fishing, and that New Zealand and Australia would use different frequencies etc for their bottom fisheries.