SPRFMO

Scientific Committee

The Hague, Kingdom of the Netherlands
10-14 October 2016

REPORT OF THE 4th SCIENTIFIC COMMITTEE MEETING

1. Welcome & Introductions

The participants were welcomed to the meeting by Mr. Frans Vroegop, from the Department of Fisheries at the Ministry of Economic Affairs in Kingdom of the Netherlands. Dr James Ianelli, Chair of the Scientific Committee (SC), opened proceedings, and participants introduced themselves.

2. Administrative Arrangements

2.1 Adoption of Agenda

The Chair sought proposed changes to the Draft Agenda. Several presentations were added to the agenda with consent of the SC. The agenda is attached as Annex 1.

2.2 Meeting documents

Access to meeting documents (all electronic) was explained. The proposed meeting schedule (SC04-02) was accepted as well as updated versions for the document list (SC04-03_rev3) and Agenda items and related papers (SC04-04_rev4). The list of participants is attached as Annex 2. Late papers relevant to agenda items 3 – 6 were added to the list of meeting documents.

2.3 Nomination of rapporteurs

Rapporteurs were assigned and included: the Chairperson (agenda item 1 and 2), the Secretariat (agenda item 3 and others not specified), New Zealand and vice-chair (agenda item 4), Chile (agenda item 5), New Zealand (agenda item 6), Australia (agenda item 7 and 8), EU (agenda item 9) and the invited experts (agenda item 10).

3. Discussion of Annual Reports

Annual Reports were provided for this meeting by Australia, Chile, China (2), Colombia, European Union, Korea, New Zealand, Peru (2), Russian Federation, Chinese Taipei, United States of America, and Vanuatu (papers SC04-07 to 17 and 29 to 31). Participants made brief presentations of their reports and provided answers and explanations in response to questions. In addition, Observer Implementation reports were either contained within those annual reports (Peru, China, Australia, Chile, Korea) or as separate papers (the EU [SC04-32] and New Zealand [SC04-18])

The presentations of the annual reports were followed by discussions among representatives as summarised in Annex 4 below.

4. Commission Guidance and other intersessional activities

4.1. Commission SC Workplan

The workplan (COMM-04 Annex D) provides guidance to the SC. The items were reviewed and it was noted that most of the workplan will be addressed based on intersessional activities and work to be

done during the week. The Chair shared the presentation shown to the 2016 Commission in order to provide an overview of how results from the SC are communicated to the Commission.

In addition, the SC noted that two intersessional web meetings had been conducted in July (SC04-05) and in September (SC04-28), and the SC expressed its support for those coordination meetings.

4.2. Secretariat SC related activities

Paper SC04-25_rev1 informed the SC about relevant meetings that the Secretariat had attended over the past year, in particular: a meeting of the Sustainable Ocean Initiative discussing biodiversity beyond national jurisdiction, a meeting by the CBD, a UN workshop addressing the impact of bottom fishing on VMEs and long-term sustainability of deep-sea fish stocks, last year's CCAMLR meeting, Our Oceans 2015 conference, and a data workshop with regional data managers. The Executive Secretary specifically noted a need to communicate important progress made by RFMOs to coastal states and regional seas programmes that operate in conjunction with UN and other programmes. The paper also summarized the various data releases that the Executive Secretary has authorised during the past year. It was noted that one of these data releases related to a dataset that was released to support a risk assessment of Southern hemisphere porbeagle sharks conducted as part of the FAO-implemented GEF Project in ABNJ.

The potential development and/or strengthening of collaboration among RFMOs was discussed. The SC Chair indicated that such collaborations were typically restricted by funding sources. Chile indicated support for collaborations development, however keeping in mind that we are a cost-effective organisation. The Secretariat reminded the SC that the Commission had directed the Secretariat to prepare advice and guidance on potential collaborations and asked for views from the SC. Reference was made to existing MoU's with ACAP and CCAMLR. François Gerlotto mentioned that there was ongoing collaboration between ICES and the SPRFMO acoustics working group.

4.3. Assessment Workshop

Jim Ianelli chaired a workshop of a sub-group of Member scientists that preceded the SC04 meeting. The purpose of the workshop was to provide more focus on the assessment model used for Jack Mackerel within SPRFMO. Recommendations from this group were implemented, including sensitivity runs, and continued in the regular SC meeting, also used to develop the basis for advice. Specific activities included evaluating the sample size of the data sources used in the assessment based on the SC-03 data workshop outcomes, evaluating new fisheries selectivity settings to reduce the number of parameters to be estimated in the assessment models, and evaluating whether rescaling natural mortality to reflect higher mortality at younger ages would result in better model fits. As with practice at previous SCs, the incremental addition of updated 2015 and new 2016 data was evaluated.

4.4. Fishery dependent acoustic Task Group

The proposal concerning "Fishing vessels as scientific platforms" was presented in 2015 as an initiative taken by IREA. A special issue was published by Fisheries Research (Volume 178, SPECIAL ISSUE: THE USE OF FISHING VESSELS AS SCIENTIFIC PLATFORMS, June 2016). It gathers 15 contributions and a biographical list can be found in SC04-INF01.

Francois Gerlotto presented a report of the activities of the Fishery dependent acoustic Task Group (SC04-27). The document submitted in Port Vila on calibration of fishing vessel echo sounders was presented to the ICES WGFAST during its meeting in Vigo, Spain, April 2016. The document was positively analyzed and is now considered as a final version. The project on JM Target Strength (TS) studies was discussed in Vigo by scientists from the SPRFMO area (Australia, NZ, Chile, Peru, EU). They concluded that it was too soon to consider performing experiments at sea and recommended the preliminary step of studying the existing data. A workshop will be organized by IREA, IMARPE and SNP (Lima, 7-10 November, 2016), to produce a synthesis on the existing TS equations. The question of the huge flow of acoustic data from FVs was discussed in Vigo. There is a need for acoustic monitoring

methods including choice of indicators, data collection, processing, management and storage. This question will be explored during the workshop in November and a proposal submitted to SPRFMO. Dr John Horne (Univ. Washington, Seattle) offered to provide his expertise in this field.

A report of Peruvian acoustic activities aboard FVs (SC04-26) was presented and covered calibration methods developed in Peru for single frequency digital echo sounders. These methods were applied and validated, and the acoustic data collected aboard fishing vessels analysed. Besides offering information for the assessment of several species of fish and squids, the acoustic data is useful to: get relative abundance indexes of macro zooplankton; detect the upper limit of minimum oxygen zone; detect internal waves and other physical structures; detect the vertical migration of fish and plankton; and calculate the volume of the pelagic habitat. The task group suggests that the SC recommend the design of joint synoptic surveys using data collected along the normal tracks of fishing vessels that are properly equipped and calibrated. The goal is to advance toward an Ecosystem-Based Approach to Fisheries Management.

4.5. Jack mackerel Age/Growth Task Team

SC04-JM04 was presented and covered the analysis of jack mackerel otolith microstructure. The age-size estimation showed a high growth rate in the first 200 days. This growth rate is higher than the one estimated for jack mackerel from Peru by Goicochea et al. (2013), who observed a mean size at 150 days of approximately 9.3 cm total length, compared to the 15 cm in FL, at the same age, estimated in the current study. Certain doubts arose regarding the interpretation of daily-rings which suggests the need to conduct a validation study for the periodicity of primary micro-increments in otoliths of juvenile and adult fish.

SC04-JM05 was presented on developing a protocol for age-determination of jack mackerel. An inter-calibration exercise and a scientific workshop was undertaken. The inter-calibration exercise included participants from the Netherlands, Ecuador, Russia and Chile, while just two countries attended the workshop (Ecuador and Chile). The workshop showed large differences between readers. The protocol contains procedures for reading including identifying checks indicating hatch date, annuli, and how to interpret otolith margins.

SC04-JM03 was presented in two parts. The first part examines the application of the two known criteria used for the analysis of the growth of microstructures in otoliths: the Individual Mark Reading (IMR) and the Group Band Reading (GBR). The first criterion (IMR) shows a great coincidence in the readings of microstructures in otoliths from northern Chile and central-southern Peru for the first year (365 rings, corresponding to a total length of 19.5 to 20.8 cm). The second criterion (GBR) was only applied in the analysis of otoliths from central-southern Peru and these readings indicate that at one year of age (365 rings read) jack mackerel would have reached a total length of 28.4 cm. These results, and especially those with the GBR criterion, suggest that at one year of age jack mackerel reaches a much larger total length than the 15.3 cm corresponding to the growth parameters currently in use. The second part of this study analyses the frequency in the formation of the growth rings after the first formed ring in otoliths from southern Peru. Two types of ring formation patterns were identified: one with the formation of quarterly rings (Pattern I) and the other with semi-annual rings (Pattern II). The occurrence of these quarterly type-I and biannual type-II growth rings in the otoliths of jack mackerel underlines the need to clearly distinguish and properly identify these two types of rings in the age determination process in order to avoid the overestimation or underestimation of the ages of jack mackerel. From these results it seems clear that the problems and uncertainties regarding the age determination of jack mackerel within the context of the SPRFMO are still not resolved and more in-depth analyses of the otolith microstructure and of the formation process of daily, seasonal and annual rings are needed.

The SC discussed the possibility of deriving an ageing error matrix based on precision evaluation information (inter-reader comparisons) presented in the Chilean paper. Chile indicated they will follow up on whether data can be made available.

The SC **agreed on the need to maintain age reading research as a high priority and to account for ageing error** in the jack mackerel assessment.

The SC recommended that activities such as jack mackerel age-determination workshops and age validation work continue to be pursued.

The SC noted the need to refine ageing protocols to be more descriptive/detailed (e.g., include specifics on sections preparation and other procedures to ensure standardisation) and to develop QAQC procedures such as ongoing training for age readers.

The SC noted that analysis and validation of juvenile growth is a key information gap. It was suggested that a tagging experiment may be more useful than experimental (laboratory) growth studies.

The SC noted potentially confounded differences in age reading versus differences in population structure between Peru and Chile (i.e., separate but related issues of age determination/growth estimation and stock discrimination) and there was a pressing need to resolve these.

5. Jack Mackerel Working Group

5.1. Report on Inter-Sessional assessment/research by Participants

Paper SC04-JM06 evaluated parsimony in the stock assessment model for Jack mackerel. The paper showed that the use of temporal blocks in selectivity reduces significantly both the number of parameters (parsimony) without a large loss in the fit goodness of the model and also the parameter correlation produced in large-scale models. It was concluded that the use of variable selectivity by year in the current assessment model was not justified. The age-compositions fitted substantially less well under this scenario and objectively evaluating selectivity blocks was difficult. The SC agreed to continue using time-varying selectivity in the assessment model for the fishing fleet age composition.

Cristian Canales also presented paper SC04-JM07 on weighting factors for likelihood components in the statistical assessment model. The results of reviewing the data weighting factors in the jack mackerel assessment model showed that, in general, the value of these sample sizes should be down-weighted. The SC appreciated results from this analysis and included these characteristics in models 1.4 and 1.8.

A late information paper was presented by Dr Sepúlveda on Biophysical modelling to assess population connectivity and inter-annual variability in the recruitment patterns of jack mackerel in the southeastern Pacific. An individual-based model (IBM) was coupled to a validated hydrodynamic model to simulate annual patterns in the early life history of jack mackerel for the period 1994-2014. The IBM configuration included realistic initial conditions related to the location and synchrony of spawning in three spawning grounds: coastal area off Peru, coastal area off northern Chile and oceanic area off central Chile. The proposed modelling scheme reasonably simulates the early life history of jack mackerel and can also be considered when evaluating the current stock structure hypotheses. The high dispersion range and spatial overlap of modelled recruitments support the hypothesis of a single panmictic population, which is consistent with the genetic evidence of jack mackerel in the southeastern Pacific.

5.2. Inter-Sessional Progress with the Stock Structure Research Programme

Francois Gerlotto presented a paper (SC04-JM02) which has been submitted to Fish and Fisheries discussing the stock structure of Jack mackerel under a new proposed metapopulation theory, which distinguishes territory bounded and environmental bounded habitats for sub-populations. In light of this theory he shows how stock structure over time for Jack mackerel might be explained.

5.3. Jack mackerel Stock assessments

The Commission advised the SC to execute a "benchmark' assessment in 2016 for which a two-day workshop was held prior to SC04. The data and assessment results for the models leading to advice are provided in Annex 7.

5.3.1. Updating of data sets for additional stock assessment runs

The Secretariat provided an updated historical catch data series to 2015 as well as an initial estimate of 2016 catches for use in the assessment (SC04-JM01 Annex 1). Changes to previous versions for this data series are explained in the paper and generally limited to the 2015 final figures as advised by Members and CNCPs. Paper SC04-JM01 also shows that generally previous estimates for total current catches have been within 10% of the final figures with Fleets 1 and 4 showing the highest variance.

2016 initial estimates were created by applying the mean observed difference, by fleet, between the provisional 2010-15 figures and the final 2010-15 figures, to the available 2016 monthly catches. Most initial estimates were accepted, but adjustments based on participant's knowledge were applied for China, the EU, Vanuatu and Korea. China adjusted its initial estimate downwards based upon this year's poor fishing conditions. The EU and Vanuatu fleets have finished fishing for the year and they were able to provide final estimates. Korea adjusted its initial estimate upwards based upon the entry of a second vessel into the fishery during September and one vessel is expected to continue fishing until the end of the year. In addition, Chile clarified that it has already caught 5,100 tonnes from international waters.

For the first time, standardized data templates were used to receive catch, age and length data from the fisheries and from the data used to derive indices. The templates proved useful as it allowed easy comparison of e.g. length-frequency data. Suggestions were made to improve the templates for next year's data compilation exercise.

Catch data were updated for all fleets including their age or length compositions. The Chinese CPUE index, Peruvian CPUE index, offshore / EU combined index, Russian CPUE index, Chilean CPUE index, and echo-abundance index from Peru were all updated.

All datasets were added in an incremental way to the dataset used for the assessment to allow testing the impact on stock perception following from each data addition. A complete list of the model configurations and access to the data tables can be found online (https://goo.gl/Gdc2c7) or in Annex 7 of this report.

5.3.2. Re-run of 2015 model configuration

Prior to simulation testing alternative model configurations, the final accepted model of 2015 (SC03) was used as a starting point for comparison. All alternatives tested were evaluated incrementally starting from the 2015 model configuration (but including updated data as described under 5.3.1).

5.3.3. Alternative model configurations

In the past several years the assessment model code has been enhanced to better evaluate model configurations. This includes approaches to evaluate how consistently the model performs when data years are successively excluded from the most recent period (so-called retrospective evaluation). Another capability added this year was the facility to profile over a model scale parameter in order to see which data components and model assumptions are most affecting estimates. Such plots are useful for evaluating among model structural assumptions.

Over 18 alternative model configurations were tested in the benchmark workshop and extending into the SC meeting. The complete list of the model configurations is published following the link as given under 5.3.1. A description of the configurations tested is provided below. Model 1.18 was used as the basis for the one-stock hypothesis. Models 1.18 (for the south) and 1.6 (for the north) were used for the two-stock hypothesis.

Model number	Model description
1.0	2015 base configurations with all data updated to 2016
1.1	As 1.0 but downweighting nominal CPUEs (EU and Russia)
1.2	As 1.0 but downweighting discontinued surveys (acoustic Peru, DEPM, acoustic Chile Central South)
1.3	As 1.0 but applying dataset uncertainty (through sample size of the multinomials and the CVs) set according to the estimated uncertainty of these datasets following from the 2015 data workshop
1.4	As 1.0 but applying dataset uncertainty (CVs) set according to numbers provided in SC04-JM07
1.5	As 1.0 but selectivity changes in the fisheries as set according to SC04-JM06
1.6	As 1.0 but selectivity changes in the fisheries as set according to SC01 settings
1.7	As 1.0 but downweighting catch-at-age
1.8	As 1.0 but rescaling sampling size using the Francis T1.8 method
1.9	As 1.0 but varying natural mortality between 0.05 and 0.5 in steps of 0.05
1.10	As 1.0 but implementing age-varying natural mortality following Lorenzen 1998, scaled to the maximum ages to be 0.23
1.11	As 1.0 but including a selectivity change in the Northern Chilean acoustic survey in 2015 and 2016 to reflect changes in availability due to El Nino
1.12	Combining 1.11 and 1.5
1.13	Combining 1.12 and 1.7
1.14	Combining 1.11 and 1.3
1.15	As 1.11 but including a change in the Northern Chilean acoustic in 2014, 2015 and 2016
1.16	As 1.11 but including the natural M following Lorenzen 1998 scaled to the mean of 0.23 (*unsuccessful*)
1.17	As 1.11 but including ageing-error
1.18	As 1.11, including time-varying selectivity in the fleets up to 2016
1.19	As 1.18 but including provisional age-error matrix
2.0	As 1.18, assuming steepness of 0.8 and recruitment regime from 1970-2013
2.1	As 1.18, assuming steepness of 0.8 and recruitment regime from 2000-2013
2.2	As 1.18, assuming steepness of 0.65 and recruitment regime from 1970-2013
2.3	As 1.18, assuming steepness of 0.65 and recruitment regime from 2000-2013

The Jack mackerel working group scrutinized model fits under each of these model configuration and discussed the implications of the changes in configuration. Using likelihood profiles, likelihood tables and diagnostic plots, the SC agreed on a final model for the combined stock. The proposed model configuration for the two-stock model as suggested by Peru was accepted as well.

Models 1.1, 1.2, 1.3, 1.4, 1.7, 1.8 (which downweighted certain datasets) were considered useful to test the sensitivity to data. Models 1.5 and 1.6 were informative to evaluate the trade-off between the number of parameters to estimate and the goodness of fit, and discussions led to the conclusion that fit was appreciated over reducing the number of parameters to be estimated, except for the Northern area in the 2-stock model, where setting selectivity time-blocks was deemed necessary to stabilize the assessment (model 1.6). To estimate what value of natural mortality would best fit to the observations, models 1.9, 1.10 and 1.16 were evaluated, but they didn't indicate any new candidate for the natural mortality assumption. Subtle changes in selectivity pattern estimation in the fisheries and surveys were deemed necessary (models 1.11 and 1.18) to get a best fit to the input data. This exercise lead to the selection of three models (1.11, 1.14 and 1.18) as candidates for the basis of advice. Under model 1.14 the individual datasets were weighted based on results obtained from the data workshop. Given the subjective nature of the data workshop exercise, it was agreed that more work needs to be allocated to retrieve robust uncertainty estimates of each of the datasets used in the assessment. The difference between model 1.11 and 1.18 is subtle and only assumes different selectivity patterns in the last 2 years of the fisheries.

5.3.4. Projections

The SC evaluated the ability of the assessment model to estimate stock productivity (via the stock-recruitment "steepness" parameter). The approach developed at the meeting was to "profile" over alternative fixed values and examine the likelihood components. This evaluation showed that information available to estimate the steepness parameter was limited, especially for alternative model configurations. Models 2.0 – 2.3 were used to project the jack mackerel stock into the future. Results are given in Fig. 2 and are used to provide advice to the commission.

5.4. Advice to the Commission on jack mackerel stock status

The SC is tasked to give advice on the status of jack mackerel. Similar to last year, the group agreed to present a range of plausible model configurations in order to reflect real concerns over recruitment uncertainty and productivity. 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 assessment approach has matured and advice has been relatively stable over the past four years.

Conditions for the jack mackerel stock in its entire distribution range in the southeast Pacific shows a continued recovery since the time-series low in 2010. Under the two-stock model the Northern unit shows stable and relatively low biomass over the past decade. Fishing mortality is estimated to be well below candidate F_{MSY} levels. Recruitment in the most recent years shows signs of stronger incoming year-classes although the information is highly uncertain and may be influenced by the recent strong El Niño.

The results are in line with previous assessments. Historical fishing mortality rates and patterns relative to the provisional biomass target is shown in Figure 1 (so-called Kobe plot). Projection results under the assumption of recent average recruitment at the levels estimated for the recent period (2000–2013) continue to indicate that if fishing mortality is maintained at or below 2016 levels the likelihood of spawning biomass increases are improved. This results in catches for 2017 on the order of 493 kt or lower. Longer term projections (fishing at or below intended 2016 levels; i.e., mortality that corresponds to 460 kt in 2016) indicate there is a high probability of increased spawning biomass. Near term spawning biomass is expected to increase from the 2016 estimate of 4.1 million t to 5.2 million t in 2017 (with approximate 90% confidence bounds of 4.0 – 6.6 million t).

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.**

A two-page summary of the advice on Jack mackerel is provided in Annex 3. The Commission notes the following in their work-plan to the SC:

> *Conduct the stock assessment of Jack mackerel. Advice from these results should be based on application of the adjusted rebuilding plan adopted by the 2nd Meeting of the Commission as proposed from SC02.*

The results addressing these requested projections are given in Table 1 for short-term and longer-term projections. Models 2.0 and 2.2 assume long-term average recruitment conditions (assuming that the environment is conducive to a more normal recruitment productivity regime) while models 2.1 and 2.3 assume recent average recruitment conditions (assuming a lower productivity regime). Example population trajectories under the different fishing mortality rate multipliers and productivity scenarios are shown in Figure 2.

Table 1. Summary results for the short term catch and medium, long term predictions for models 2.0-2.3 for the single stock hypothesis and for summed values under the two stock hypothesis (bottom panel). Note that "B" in all cases represents thousands of t of spawning stock biomass and B_{MSY} is provisionally taken to be 5.5 million t of spawning biomass in all cases and the bottom panel is the result of north and south models combined. Reference F_{2016} refers to the fishing mortality assuming the full TAC will be taken in 2016 (TAC uptake estimated to be 92% in 2016).

Model 2.0, steepness=0.8, recruitment from 1970-2013

Reference F_{2016}	B_{2018}	$P(B_{2018} > B_{MSY})$	B_{2022}	$P(B_{2022} > B_{MSY})$	B_{2026}	$P(B_{2026} > B_{MSY})$	Catch 2017 (kt)	Catch 2018 (kt)
0.00	7047	94%	11940	100%	15945	100%	0	0
0.50	6713	89%	10312	100%	12546	100%	232	298
0.75	6555	86%	9619	99%	11247	100%	345	435
1.00	6351	81%	8792	98%	9807	99%	493	609
1.25	6255	79%	8430	97%	9215	98%	563	689

Model 2.1, steepness=0.8, recruitment from 2000-2013

Reference F_{2016}	B_{2018}	$P(B_{2018} > B_{MSY})$	B_{2022}	$P(B_{2022} > B_{MSY})$	B_{2026}	$P(B_{2026} > B_{MSY})$	Catch 2017 (kt)	Catch 2018 (kt)
0.00	6706	90%	9547	100%	10857	100%	0	0
0.50	6372	82%	8017	97%	8049	96%	232	299
0.75	6214	78%	7372	93%	7010	88%	345	437
1.00	6010	71%	6608	82%	5886	63%	493	612
1.25	5915	67%	6276	74%	5435	48%	564	692

Model 2.2, steepness=0.65, recruitment from 1970-2013

Reference F_{2016}	B_{2018}	$P(B_{2018} > B_{MSY})$	B_{2022}	$P(B_{2022} > B_{MSY})$	B_{2026}	$P(B_{2026} > B_{MSY})$	Catch 2017 (kt)	Catch 2018 (kt)
0.00	6845	92%	11387	100%	15421	100%	0	0
0.50	6512	86%	9763	99%	12014	100%	231	297
0.75	6355	82%	9071	98%	10704	99%	344	434
1.00	6151	76%	8244	96%	9244	97%	492	607
1.25	6057	72%	7882	94%	8641	96%	562	687

Model 2.3, steepness=0.65, recruitment from 2000-2013

Reference F_{2016}	B_{2018}	$P(B_{2018} > B_{MSY})$	B_{2022}	$P(B_{2022} > B_{MSY})$	B_{2026}	$P(B_{2026} > B_{MSY})$	Catch 2017 (kt)	Catch 2018 (kt)
0.00	6603	88%	9383	100%	10756	100%	0	0
0.50	6269	80%	7857	96%	7956	95%	232	299
0.75	6112	75%	7213	91%	6913	86%	344	436
1.00	5909	67%	6449	78%	5780	59%	493	611
1.25	5814	64%	6118	70%	5324	44%	563	691

Model 1.6 North (recruitment: 1970-1996 and 2001-2013) + 1.18 South (recruitment: 1970-2013), steepness=0.8

Reference F_{2016}*	B_{2018}	B_{2022}	B_{2026}	Catch 2017 (kt)	Catch 2018 (kt)
0.00	7302	12099	15921	0	0
0.50	6882	10084	12202	281	337
0.75	6686	9241	10767	415	489
1.00	6500	8490	9551	547	630
1.25	6322	7820	8516	675	761

*Average $F_{2014\text{-}2016}$ was used for the Northern stock

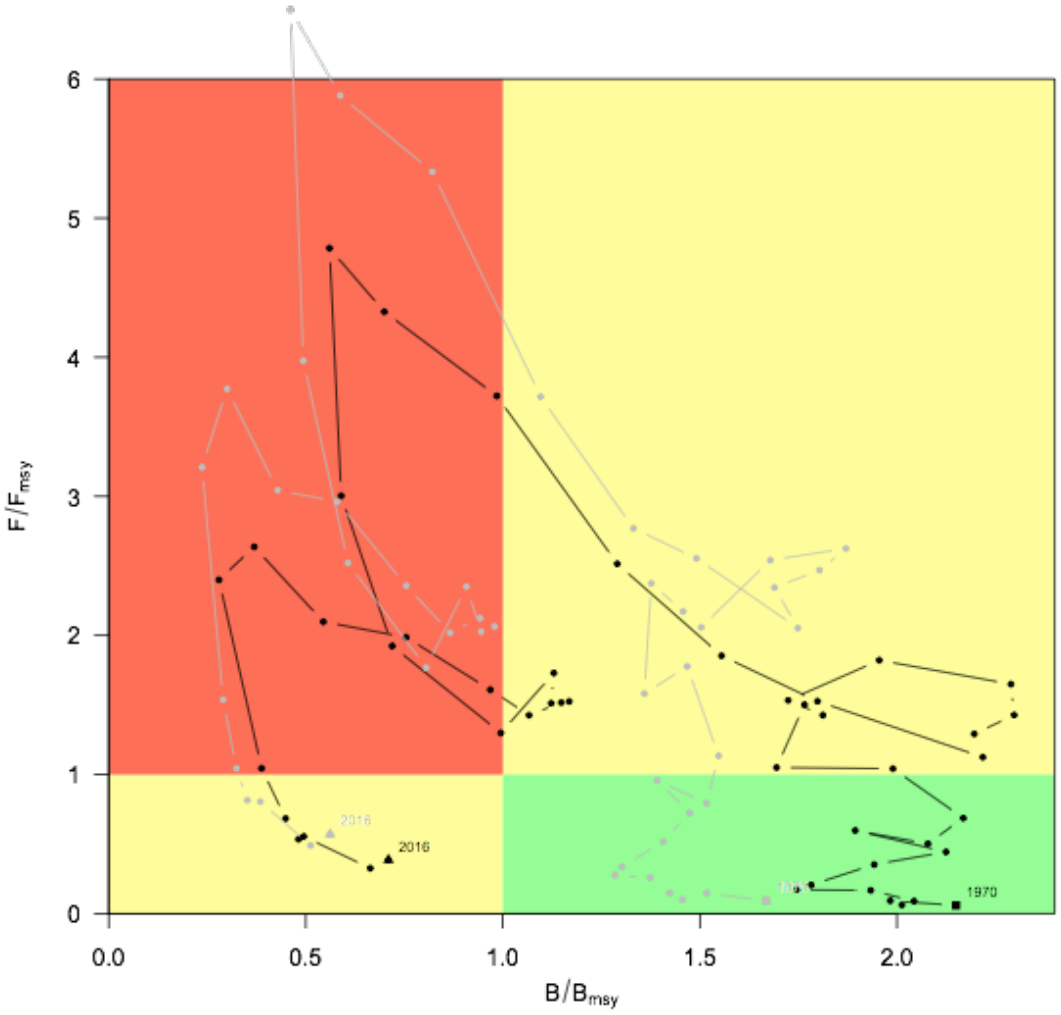

Figure 1. Phase plane (or "Kobe") plot of the estimated trajectory for jack mackerel under Model 2.2 (steepness = 0.65; grey line) compared with Model 2.0 (steepness = 0.8; higher productivity, black line) with reference points set to F_{MSY} and B_{MSY} estimated for the time series 1970-2013.

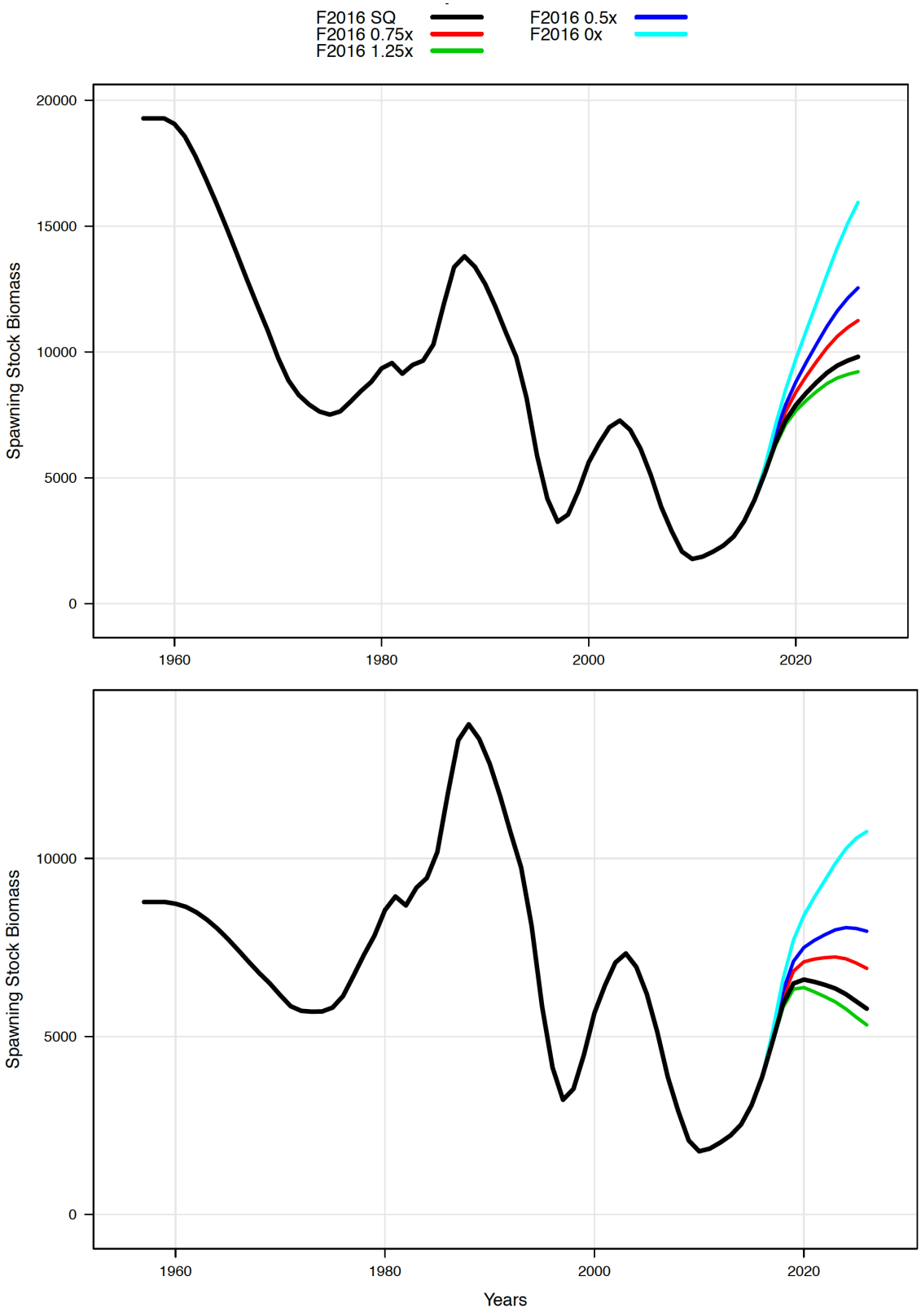

Figure 2. Projections of jack mackerel population trajectories for different multipliers of the reference 2016 fishing mortality rate under models 2.2 (recruitment from 1970-2013; top) and 2.3 (recruitment from 2000-2013; bottom). The provisional B_{MSY} is 5.5 million t.

5.5. Other jack mackerel topics

In 2015, a self-sampling protocol was initiated for the EU freezer-trawlers fishing in the SPRFMO area. SC04-INF04 provides a description of the fishing carried out by vessels belonging to members of the Pelagic Freezer-trawler Association (PFA) within the SPRFMO area during 2015 and 2016. The PFA self-sampling programme has been carried out during all trips from April to September. The self-sampling programme delivers information on spatial and temporal evolution of the fishery, species and length compositions, CPUE and ambient fishing conditions (temperature and depth). Ambient water temperature (at fishing depth) appears to have been higher in 2016 compared to 2015. A comparison between self-sampling data and observer data shows that there is generally a close correspondence between the two sources.

6. Deepwater Working Group

6.1. Applications to fish outside the footprint or above reference period catch levels

In paper SC04-DW02, New Zealand updated the Scientific Committee on the exploratory fishing for toothfish pursuant to CMM 4.14. Seven sets of integrated weight line were made in August 2016 in depths of 1000 to 2300 m. A total of 35 994 hooks were set, of which 30 424 were recovered (the rest were lost on broken lines). Substantial information was collected, but this has not yet been fully analysed. A total of 29 tonnes of toothfish was caught, all *Dissostichus mawsoni* (Antarctic toothfish), and mostly males with late-stage or spent gonads. A total of 104 toothfish were tagged using standard CCAMLR tags. There was little fish bycatch, mainly of rattails. An average of 0.48 kg of VME material was recovered from each set. Relatively few birds attended the vessel (there were 88 sightings, mostly of Cape, snow, or Antarctic petrels. Standard CCAMLR mitigation was used throughout (meeting or exceeding SPRFMO requirements) and no seabirds were killed or injured. No marine mammals, reptiles, or other species of concern were observed. It is anticipated that the second exploratory fishing trip will occur in 2017 and a more comprehensive analysis of the two trips will be considered by New Zealand's domestic working groups and, depending on timing, submitted to SC-05. Data and information will be shared with CCAMLR, consistent with the MoU between the two organizations, and should contribute to the understanding of the distribution, dynamics and status of stocks of Antarctic toothfish in both SPRFMO and CCAMLR areas. The SC:

- **noted** the completion of the first trip of the 2-year exploratory fishing programme approved under CMM 4.14;
- **noted** that substantial information was collected;
- **noted** that the catch of 29 tonnes greenweight was under the 30 tonne annual limit;
- **noted** the tag and release of 104 Antarctic toothfish (*Dissostichus mawsoni*);
- **noted** that this paper has been provided to the CCAMLR working groups to facilitate cooperation between the two organisations consistent with the MoU;
- **affirmed** its suggestion made at SC3 that the full data and analyses from the trip should be shared with CCAMLR;
- **agreed** that closer collaboration with CCAMLR, especially with respect to tagging of toothfish (as per CCAMLR's request - paper SC04-DW01) would be mutually beneficial;

The Secretariat resented paper SC04-DW01. The SPRFMO Scientific Committee supported increasing collaboration between CCAMLR and SPRFMO especially considering the likelihood of shared toothfish stocks.

The SC agreed that a tagging programme for toothfish was a priority for that fishery and that it should be implemented and managed in close cooperation with CCAMLR to ensure best practice implementation of the tagging activities and to avoid unnecessary duplication of resources within the Secretariats.

The SC expressed an interest in working closely with CCAMLR on stock assessment of toothfish stocks exploited by fisheries in both Convention Areas. This could involve the sharing of data and reports and, potentially, the participation of SPRFMO toothfish experts in the relevant CCAMLR meetings. The SC asked the Secretariat to explore those possibilities intersessionaly.

6.2. Inter-Sessional deepwater assessments

Deepwater assessment for orange roughy were prepared by New Zealand and presented under report section 6.3.

6.3. SPRFMO deepwater stock assessments

In paper SC04-DW03, New Zealand reported progress on the development and testing of a data-limited approach for stock assessment of orange roughy in the western SPRFMO Area. Results of preliminary assessments combining the estimation of a spatially-disaggregated CPUE index of abundance and the fitting of a state-space biomass dynamics model (BDM) were presented. Preliminary analyses were conducted on six management areas/potential biological stocks using catch and effort information from New Zealand fishing vessels only. Spatially-disaggregated CPUE analyses provided more reliable indices of relative abundance in all stocks, which were informative for biomass dynamics modelling in four management areas. The need to compile complete catch series to improve the effectiveness and accuracy of BDM modelling and assessment outputs was stressed. Catch and effort information from Australian vessels will also assist with improving spatial CPUE indices and extend the assessment to the South Tasman Rise orange roughy stock. Results of BDM validation and case study application to a domestic stock of orange roughy within the New Zealand EEZ were presented. The BDM approach can serve to reliably estimate biomass trajectories and stock status in data-limited circumstances for a long-lived species such as orange roughy. A similar case study application and validation of the spatially-disaggregated CPUE method is ongoing. The results will of this validation be available to the scientific committee in 2017. Critical next steps include: 1) the estimation of a complete catch history for each stock; 2) fine-tuning of the spatially-disaggregated CPUE indices; and 3) BDM re-runs including process error sensitivities and initial depletion scenarios. The SC:

- **noted** New Zealand's continued work on provisional stock assessments for orange roughy in the western part of the SPRFMO Area;
- **agreed** that the assessment approach presented by New Zealand is appropriate to estimate reliable biomass trajectories and stock status of orange roughy in the SPRFMO area, based on currently limited available information.
- **noted** that simulation testing of the spatially disaggregated CPUE approach is underway and the results will be available in time for SC5;
- **noted** that the BDM modelling approach has already been simulation tested;
- **noted** that full catch histories for the assessed areas will be required to finalise these stock assessments;
- **urged** other bottom fishing nations to consider providing full catch histories with sufficient precision to be used in the CPUE and BDM analyses;
- **noted** that finalised estimates of initial biomass, productivity, and stock status for some orange roughy stocks should be available in time for SC5 in 2017
- **agreed** that this work should contribute to the development of a revised CMM for bottom fisheries in the SPRFMO Area once the stock assessments are finalised
- **noted** that opportunistic collection of fisheries independent acoustic data from commercial fishing vessels should be encouraged as this will benefit orange roughy assessments.

No progress has been made on stock assessments for other target species in the deepwater fisheries. In regard to bycatch, it was recognized that efforts should be undertaken to assess the impacts on

bycatch species, in particular on low productivity species as called for in paragraph 47 of the UN FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas. To advance this work the SC will consider a risk based approach to prioritize species and areas in regard to further research and advice on conservation measures to the Commission. Until this work can be completed, the SC:

- **recommended** that the Commission discuss and consider amending the list of "other species of concern" in Annex 14 of CMM 4.02 to include deep-sea sharks in the SPRFMO Convention Area categorized as critically endangered, endangered, vulnerable or near threatened on the IUCN Red List. Annex 5 contains the current IUCN red-listed deepwater shark species and CITES appendix II relevant species.

6.4. VME distribution and spatial management approaches

In its national report, New Zealand updated SC-04 about progress on the spatial modelling of VMEs within the SPRFMO Area and on the use of the Zonation software tool to prioritise areas for protection and design candidate spatial management areas to protect VMEs from significant adverse impacts while providing for fisheries. No separate paper was provided but New Zealand anticipated using this information to develop proposals for a revised bottom fishing measure. Discussions suggested that the process of defining the most valuable areas for conservation or fishing, and appropriate levels or thresholds for protection, were not entirely scientific issues. It was noted that the percent of fishable depths and the percent of the distribution of VME taxa impacted by bottom trawling would also need to be considered in the design of spatial management areas. As foreshadowed in S-04-DW-04, therefore, New Zealand and Australia intend to convene stakeholder and other working parties to consider candidate spatial management proposals using predictive models of VME density, the distribution of fishing, and decision support software. The SC:

- **noted** steady progress made by New Zealand in the predictive modelling of the likelihood and density of VME indicator taxa and in relation to bottom fisheries;
- **urged** New Zealand to continue this work and include it in the development of proposals for a new bottom fishing measure for the consideration of SC-05.

6.5. Other Deepwater topics

The ABNJ Deep Seas Project Report (SC04-INF02) was presented by the Executive Secretary. Members discussed the recent FAO workshop of global experts on orange roughy held in June 2016. They covered historical aspects of the regional development of the fisheries, biology, stock assessment and key management issues. Recent developments in science and approaches to management were specifically highlighted with respect to the future for the sustainable management of the fisheries. Two participants of that workshop reported that, although the report was unavailable, one of the main recommendations was that CPUE indices should be avoided where possible when assessing deepwater stocks. They reported that the preferred methods involved fishery independent data, usually acoustic technology. New Zealand agreed with those preferences, but noted that the only currently available information for assessment of SPRFMO stocks was CPUE data. The SC:

- **agreed** that there would be value in collecting fisheries independent data for orange roughy assessments, and discussed ways to encourage fishery independent surveys and identify priorities areas for such surveys within the SPRFMO Area;
- **noted** that funding for the collection of fishery independent surveys using research vessels was unlikely to be available in the near future;
- **agreed** to support fishery independent data collection for orange roughy using either research voyages or commercial fishing vessels from those nations having both interests and capacities

- **agreed** to support convening a workshop on survey design, best practice, and validation techniques to develop a SPRFMO standard to collect these types of data, based on existing AUS/NZ standards;
- **noted** that this type of data collection may apply to other deepwater species such as alfonsino, as well as pelagic species such as jack mackerel.

In paper SC04-DW04, New Zealand described progress toward a revised, comprehensive measure for bottom fisheries. As foreshadowed at SC-02, this approach will require: the identification of an appropriate fishing footprint; the setting or revision of sustainable catch levels for key target species; the mapping of the distribution of vulnerable marine ecosystems (VME) within the footprint; and the design of management measures to prevent significant adverse impacts on VMEs, in particular, areas that will be open or closed to fishing within the footprint. New Zealand suggested two potential approaches to drawing this work together into a new bottom fishing measure, but acknowledged that intermediate approaches are also possible:

- A prescriptive SPRFMO bottom fishing measure with a single (bottom trawl[1]) footprint for all bottom fishing members, a consistent approach to move-on rules that applies to all bottom fishing members, and move-on triggers that apply to all bottom fishing members; or
- A high-level SPRFMO bottom fishing measure that defines just the performance objectives, standards and evaluation criteria for management; each bottom fishing member could choose how to give effect to the CMM's requirements (as in CMM 2.03 and the current CMM 4.03).

DSCC underlined the difference between existing Australian and New Zealand move-on rules, identifying strengths and short-comings in both. The discussion covered a number of topics including differing approaches amongst Contracting Parties to open and closed areas and the move-on rule. The pros and cons of the different approaches to the move-on rule were discussed at some length. DSCC considered that the move-on rule should be applied consistently to all vessels and that area from which vessels had been required to move-on should not be re-opened until the SC has determined that re-opening did not pose a threat to VMEs. Considering that the footprint might still expand within blocks, DSCC recommends applying move on rule throughout all areas opened to fishing.

SC discussed the alternative approaches suggested by New Zealand (for advantages and disadvantages refer to Appendix 1 of SC04-DW04) and:

- **agreed** that a more prescriptive bottom fishing CMM for all members may be easier to implement and control, more consistent, and more likely to work effectively, compared with a high-level CMM under which members can choose how to give effect to the CMM's requirements;
- **noted** that a single, prescriptive measure may not be possible across both western and eastern parts of the SPRFMO Area given that Chile has a historical footprint as well as Australia, New Zealand and Korea.
- **noted** that it may not be possible to develop a prescriptive bottom fishing measure for the western part of the SPRFMO Area in time for proposals to SC-05 and the 2018 Commission meeting;
- **noted** that Australia and New Zealand will continue to work together to make progress on proposals for a revised bottom fishing measure for the consideration of SC-05.

[1] Midwater trawling for bentho-pelagic species has been determined to be included within the SPRFMO definition of bottom fishing but is considered unlikely to cause significant adverse impacts on VMEs

7. Squid assessment research

7.1. Summary of papers presented

China presented a paper on biology for the jumbo flying squid, characterizing the growth pattern, longevity, hatching time and potential spawning ground off the Peru waters. Two cohorts (winter-spring and summer-autumn cohort) and two size groups (medium-size and a large-size) was defined.

SC04-33 from China was a study which applied the generalized linear models (GLMs) to standardize CPUE of the Chinese jigging fishery from 2004 to 2014 which is used as relative abundance index. SC04-34 was a Bayesian state-space surplus production model based on this derived standardized CPUE data and FAO total catch of the jumbo squid in the southeast Pacific Ocean. This model was used to assess the dynamics and status of jumbo squid stock in the Convention Area. The posterior distribution of K (carry capacity) was found sensitive to the upper boundary of its prior distribution, and subsequently six scenarios with different upper boundary values were considered and evaluated. The stock assessment suggests that the fishery was not subject to overfishing and the stock was not overfished, and this conclusion is robust regarding the scenarios considered in this study. The sensitivity analysis suggests that the stock assessment can well capture the dynamics for relative stock biomass of jumbo flying squid, but not for absolute stock biomass, suggesting that this stock assessment may not be used to provide information for advising the development of TAC-based management regulations.

- The **SC agreed and encouraged further development of this and alternative models for assessing jumbo flying squid in the region.**

SC04-20 summarized squid in the Peruvian waters. Although catches of jumbo flying squid are fairly high and increasing, the few partial assessments available suggest that the stock or stocks are in a healthy situation at present. However, this may change on short notice given the high variability in abundance typical of squids and, therefore, the SPRFMO should not wait for the stock or stocks to be in critical condition or have their sustainable use being hampered to implement adequate databases and develop and start applying appropriate stock assessment and fishery monitoring tools and procedures that would facilitate the provision of timely advice and the eventual adoption of management measures that may be needed. The medium and long term research priorities identified in the SC Research Programme 2013 adopted by the SC-01 served as a basis for defining the type and level of detail of the data to be provided to the SPRFMO Secretariat on a regular basis for regular reporting, monitoring and stock assessment purposes and this level of detail is further defined in the existing templates for reporting on the catch per tow for trawlers and per drift set for jiggers, which includes full details of the vessel and gears used and of the individual fishing operations. It is therefore recommended that the templates already available be used for recording as well as for reporting on the fishing activities of trawlers and jiggers participating in the jumbo flying squid fishery in the Convention area; that provisions be made to, to the extent possible, recover the same type of information for past fishing activities, if available; and that plans be made for the sooner implementation in the jumbo squid fishery of an Observer Programme similar to the one already existing for vessels participating in the fishery.

7.2. Discussion on squid assessment data needs

The papers summarizing the status and limitations of squid data held by the Secretariat and the paper detailing research and data needs for D gigas were presented to the SC (SC04-21 and SC04-20*)*. The SC noted that the resolution of data varies markedly and that there are data gaps. These gaps may influence the perception of recent increases in squid catches.

The SC initially addressed the question on whether the intended goal for SPRFMO was to apply a TAC and/or effort-based management to the squid fisheries The SC noted that the intention of the preliminary squid assessment modelling was not for this work to be used in setting TACs. Rather, the

preliminary work allows the SC to explore possible assessment methods and the status of populations. Importantly, the kobe plots presented in the preliminary assessment use a relative scale (not absolute). Noting this caveat it does provide some information on the ratio of B/BMSY and F/FMSY.

It was discussed that the lack of the ability to estimate carrying capacity (K) was a significant limitation. However, it was also suggested that despite the general consensus that squid stocks are in good shape and are not overfished or subject to overfishing, and acknowledging that squid populations are highly variable and exhibit large changes based on prevailing environmental conditions, the lack of reliability around a K estimate should not necessarily preclude a precautionary TAC from being considered in the future should the Commission request such advice.

Adding to the uncertainty, it was discussed that there is limited information on stock structure and the biology of the species, with some discussion of spatio-temporal differences in biology, in particular length at maturity. Differences between length at maturity in squid populations have been observed between and within seasons and in different areas. It also appears that these differences are correlated with El Nino cycles. Stock structure delineation will influence how the stocks are managed. It is possible that currently, environmental conditions appear to have a larger influence on squid populations than fishing pressure.

There was some discussion around the CPUE standardization used in the assessment, noting that catch rates and the number of active vessels fluctuates throughout the year. The SC noted that for the Chinese Fleet the vessels are owned by a relatively small number of companies. However, there were likely to be some small variations in fishing power and squid catchability between boats.

There was some discussion around whether there was a correlation between recruitment and carrying capacity, with the SC noting that for this study, R and K did not appear to be strongly correlated. It appears that K was more strongly correlated with Q (catchability). Nonetheless, it appears that fishing is not currently impacting heavily on the population. The SC also discussed that the data used (last 10 years) was all of the available data and that this partly explains why the estimate of K is difficult. There are some gaps in the data used and the Secretariat proposed that the squid catch series could be improved with relatively little work.

An amendment to the distribution map presented was suggested so that the map indicates that the fishing ground extends to 41 degrees south.

The SC discussed the level of environmental data required to inform squid assessments and stock assessment more broadly and it was noted that environmental data for stock assessment can be collected through various sources external to observers. It was also noted that care is required not to overload observers. Satellite and modeling data can be useful sources for this information.

There was some discussion on the need for observer coverage in the jigging fishery, given it is such a clean fishery in terms of bycatch. It was noted that observers are important from the perspective of validating logbook data, so it is not just collection of biological and bycatch data that are important. It was raised that some squid fisheries (e.g. China) comprise many small boats, so any observer program for the squid fishery, will need to consider the feasibility of deploying at sea observers on these smaller vessels.

The SC discussed the issue of future-proofing data collection and the importance of being prepared for novel methods. The example of genetic methods was used, and it was noted that these methods are advancing quickly and are becoming less expensive to use. However, the application of some of these techniques may be impractical for squid. In designing and implementing observer programs this should be considered to ensure that data is being collected that can take advantage of these evolving methods.

The SC also discussed whether the fishery and associated stock assessments will require fishery dependent and fishery independent data in the future and noted that Peru undertakes some fishery

independent surveys using acoustic methods. It was noted that sole reliance on fishery dependent data is riskier.

The SC discussed that SC04-19 represented good progress towards better understanding species biology, in particular spawning locations and reproductive biology, for squid. There was some discussion around the relationship between hatching date and the location of mature spawning females, with the hypothesis that the lag in the hatching date and the highest proportion of spawning females might be due to multiple stocks. It was thought that this lag between spawning and hatching was probably unrealistic given the life history of the species.

The SC agreed that the information specified in Annexes 1 to 6 of CMM4.02 is the minimum necessary for it to undertake effective monitoring and assessments for stocks in the Convention area. The SC requires that this information is provided in a timely manner to the Secretariat of SPRFMO so that assessments can be prepared, reviewed and used for providing scientific advice for the SPRFMO Commission.

The SC discussed that the wording of CMM4.02 para 1 (e) might not make it explicit enough that this information is important for effective monitoring and stock assessments. This has created some confusion for Members and CNCPs when preparing their data for submission to the SPRFMO secretariat. The SC advises the SPRFMO Commission that this confusion may be an important reason for delays in the provision of scientific advice on the stock(s) of jumbo flying squid in the Convention area. **The SC recommends that the SPRFMO Commission amend CMM4.02 to avoid confusion for Members and CNCPs regarding the use of the same templates for data recording and reporting.**

The SC also noted that the requirement of CMM4.02 for Members and CNCPs to provide by the 30th June, their previous (January to December) year's data on fishing activities and the impacts of fishing described in sections 1b) – 1d) of CMM4.02 is currently not possible for some fleets participating in the jumbo flying squid fishery in the Convention Area. This is due to vessels being at sea for periods longer than 12 months before returning to port and there being no current option for submission of vessel logbook data prior to this return. In this circumstance a member or CNCP may not be compliant with CMM4.02. **The SC also recommends that the SPRFMO Commission amend CMM4.02 to allow for an extension in the timing of data submissions in those cases where the Members and CNCPs do not yet hold this information for all vessels in their fleets and that an anticipated submission date is provided**.

The SC noted that CMM4.02 includes data confidentiality requirements for the SPRFMO secretariat. Specifically, it requires the Secretariat to operate comprehensive and robust processes to maintain the confidentiality of the non-public domain data that Members and CNCPs provide to it. **The SC requests the SPRFMO Commission to remind all Members and CNCPs that issues of data confidentiality are provided for in CMM4.02 and this may not be used as a reason for failure to submit data to the Secretariat**.

The preparation of stock assessments for stock(s) of jumbo flying squid fishery in the Convention area is constrained by the availability of historical fishing data. **The SC requests that the SPRFMO Commission commence a data recovery initiative to minimize the impact of this constraint. The data recovery should provide data that is consistent with the specifications of Annex4 of CMM4.02 to the extent possible**.

The SC discussed the implementation of observer programmes for jumbo flying squid fisheries in the Convention Area. It noted that CMM4.02 requires Members and CNCPs to develop, implement and improve observer programmes (see section below on observer programme).

The SC was advised that for some vessels operating in the jumbo flying squid fisheries in the Convention Area the placement of at sea observers may be logistically difficult due to the small size of these vessels. The SC was also advised that there is negligible bycatch in jigging fisheries. The SC noted that without the implementation of observer programs the SC may not have access to

information to verify vessel logbook and bycatch data and to the capacity to design and implement necessary biological sampling activities. Electronic monitoring, Study fishing fleet with trained captains and crews[2], and Vessel Self-Sampling may provide opportunities to overcome this constraint. CMM4.02 currently does not provide guidance on whether these developing methods could be used to meet the SC's requirements of the data collected by at sea observers. **The SC asks the Commission to acknowledge the ongoing work to provide verification of fisheries vessel data.**

7.3. Suggested amendment to CMM4.0.2

Paragraph 1e) compile data on fishing activities and the impacts of fishing and provide these in a timely manner to the Secretariat of the South Pacific Regional Fisheries Management Organization (SPRFMO) using the SPRFMO data recording and reporting templates. ~~Such~~ [These] data are to be provided ~~in sufficient detail to facilitate~~ [for] effective [monitoring] and ~~stock~~ assessment [of stocks]. Members and CNCPs will provide by the 30th June, their previous (January to December) year's data on fishing activities and the impacts of fishing described in sections 1b) – 1d) above. [In exceptional cases where Members and CNCPs do not yet hold this information for all vessels in their fleets an extension in the timing of data submissions (for this missing data) is possible provided that an anticipated submission date is specified to the SPRFMO Secretariat.

7.3. Other topics

There was a discussion about the level of environmental data required to inform squid assessments and stock assessment more broadly and it was noted that environmental data for stock assessment can be collected through various sources external to observers. It was also noted that care is required not to overload observers. Satellite and modelling data can be useful sources for this information.

There was some discussion on the need for observer coverage in the jigging fishery, given it is such a clean fishery in terms of bycatch. It was noted that observers are important from the perspective of validating logbook data, so it is not just collection of biological and bycatch data that are important. It was raised that some squid fisheries (e.g. China) comprise many small boats, so any observer program for the squid fishery, will need to consider the feasibility of deploying at sea observers on these smaller vessels.

The SC discussed the issue of future-proofing data collection and the importance of being prepared for novel methods. The example of genetic methods was used, and it was noted that these methods are advancing quickly and are becoming less expensive to use. However, the application of some of these techniques may be impractical for squid. In designing and implementing observer programs this should be considered to ensure that data is being collected that can take advantage of these evolving methods.

The SC discussed whether the fishery and associated stock assessments will require fishery dependent and fishery independent data in the future and noted that Peru undertakes some fishery independent surveys using acoustic methods. It was noted that sole reliance on fishery dependent data may be riskier.

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[2] "**A Study Fleet** is a subset of fishing vessels from which high quality, self-reported data on fishing effort, area fished, catch, and biological observations are collected. Participating vessels fish in commercial mode, and are selected to be representative of general commercial fishing vessels. The data collected from these vessels can be used to supplement the stock assessment process."

females might be due to multiple stocks. It was thought that this lag between spawning and hatching was probably unrealistic given the life history of the species.

8. Ecosystem Approach to Fisheries Management

The Secretariat presented paper SC04-23, which summarises the number of interaction records for certain protected species, and noted that paragraph 9 in the seabirds CMM asks for information on number and type of seabird interactions to be provided in annual reports. The Secretariat noted that some of the data collection templates are very new to SPRFMO and so data on some aspects was lacking at this time.

New Zealand thanked the Secretariat for paper SC04-23 and pointed out that the seabird captured by a NZ longliner and provisionally identified (and reported to the Secretariat) as a black petrel had since been identified by two separate seabird experts as a great-winged petrel (formerly called grey-faced petrel).

The SC discussed that there was some information on protected species interactions that is included in annual reports that was not reported in the summary document, and whether this may indicate that the mechanism for updating the interactions report needs to be strengthened. However, it was agreed that inclusion of any omissions could be resolved easily during the SC meeting. The Secretariat has formally taken submissions dating back to 2007, but any information on interactions with protected species for earlier years was not included in this paper. The SC also discussed whether there was, or should be, a separate process for collecting bycatch information for fish species. Currently, most of the information collected is for protected species. The SC discussed whether other species of concern, such as elasmobranchs and deepsea sharks, should be included in this summary report. It was agreed that porbeagle sharks should be added to the list. Additional species were tabled for annex 14 of CMM 4.0.2 that could be added to the list (see Annex 5). One future consideration is whether the SC could utilise the Bycatch Data Exchange Protocol that is being used across a range of RFMOs and national bodies. The SC provided the Secretariat with the latest WCPFC paper on the Bycatch Data Exchange protocol.

It was discussed that an assessment of the likelihood of various interactions is some work that could be done intersessionally, which may help prioritise the additional species to be included in the reporting summary and Annex 14 of CMM4.02. Given the level of new information becoming available, this idea was supported by the SC.

The EU presented paper SC04-22 on seabirds and pelagic trawlers. The SC discussed that it may be difficult to agree with some of the conclusions given the limited number of trips the data was collected from. The SC could not agree to the conclusion that pelagic trawlers did not seem to inflict a substantial mortality on seabirds. The conclusion that bird bafflers cause a greater risk to seabirds was also questioned because of the design of this study; at the same time, it was acknowledged that bafflers are likely to be less effective than bird scaring lines. The seabirds CMM states that they bird scaring lines should be used unless prevented by operational requirements. The SC discussed that presentations like this are important to build a more comprehensive picture of on-water fishing operations, and that this should be encouraged in the future.

It was discussed that some efforts have been made to develop protocols to exchange bird interactions data and it was hoped SPRFMO would help facilitate such a protocol. The Secretariat noted that it was possible to relate vessel specifics and gear configurations to the observations of interactions. Forms exist for recording seabird mitigation configurations and are completed by observers. Currently, there is no protocol for recording other observations, such as estimates of the numbers of birds attending vessels and other bird behaviour. It was suggested that the Secretariat could engage with Birdlife on ABNJ workshops on collection and analysis of data associated with observer programs for determining the effectiveness of various mitigation measures.

Regarding the ACAP best practice guidelines, there were no major adjustments made in the recent

review except that the offal/discharge management was made more prominent in the guidelines.

Bauke de Vries from the EU Pelagic Advisory Council gave an informative presentation to the SC on the ecosystem focus group and its activities on ecosystem mapping focusing on pelagic stocks and their interactions in the North Sea and North Pacific Ocean. The presentation was appreciated by the SC.

9. Observer programme

9.1. OPWG

The SC was requested to comment on the draft observer programme CMM and whether the annex 7 of CMM4.02 remains adequate for observer data collection in the Convention Area. The draft observer CMM requires Members and CNCPs to develop, implement and improve observer programmes to attain the following objectives:

(i) To collect vessel information, effort and catch data for all fisheries and fished species in the Convention Area, including target, by-catch and associated and dependent species.
(ii) To collect biological or other data and information relevant to the management of fishery resources in the Convention Area, as specified in these standards, or as identified from time to time by the Scientific Committee or through processes identified by the Commission.
(iii) To collect relevant scientific information related to the implementation of the provisions of the Conservation and Management Measures (CMMs) adopted by the Commission.
(iv) To collect representative data, including length-frequency and biological samples, across the Convention Area, distribution of fishing effort, seasons, fishing fleets and fleet types.

The SC noted that the objectives of the draft CMM contain a mixture of objectives, mostly aimed at improving data on fisheries and ecosystems, but also aimed at compliance monitoring. The SC emphasizes that a potential conflict exists between scientific observation objectives and compliance objectives which could result in lower quality scientific data when the scientific monitoring is combined with compliance monitoring.

The SC noted that the focus of the draft observer CMM appears to be on the application of observers (as persons) in the collection of data. Electronic monitoring (see SC04-24), study fishing fleet with trained captains and crews[3], and Vessel Self-Sampling[4] may provide opportunities to overcome this constraint. The SC committed to conduct a study to evaluate adequate coverage of the proposed observer programme, perhaps through simulation studies or in adopting work done from other areas. This work is expected to be completed by 2019. Also, the SC discussed the sampling effort and aspects related to best practices for measuring observer coverage (refer to Annex 6 for specific comments on the Draft CMM).

9.2. E-monitoring, self-sampling and study fleet

The SPRFMO SC4 discussed progress on the data collected by electronic monitoring systems used on commercial fishing vessels and how this data may comply with CMM4.02 (Standards for the Collection, Reporting, Verification and Exchange of Data). Globally, automated and electronic collection of data is increasingly being applied to assists with monitoring fishing activities in the high seas and within national fisheries.

[3] "***A Study Fleet*** *is a subset of fishing vessels from which high quality, self-reported data on fishing effort, area fished, catch, and biological observations are collected. Participating vessels fish in commercial mode, and are selected to be representative of general commercial fishing vessels. The data collected from these vessels can be used to supplement the stock assessment process.*" Cited from http://www.nefsc.noaa.gov/read/popdy/studyfleet/

[4] **Vessel self-sampling** is the process whereby the crew of vessels collect data for commercial and/or scientific purposes which is being shared to inform the stock assessment process.

Paper SC04-24 described the progress on the implementation of electronic monitoring in Australia fisheries in the recent period. Australia has implemented electronic monitoring in pelagic longline, demersal longline and gillnet fisheries. The Australian application is focused on the verification of vessel logbook data. Vessels in the trial are continuously monitored by camera in combination with sensors on hydraulics and drums and VMS/GPS. A random subset of the video footage collected is then analysed on return of the vessel to verify the logbook reporting for the same period. The introduction of electronic monitoring has enabled the introduction of vessel specific responses for protected species interactions and is being used to improve reporting practices. However, electronic monitoring must be supplemented by on-board observers and/or port sampling to maintain sufficient levels of biological data collection for stock assessments.

Other electronic monitoring research in the Pacific region include: (1) the GEF ABNJ Tuna Project which has set up two pilot trials of EOS systems using video cameras, and GPS to create an integrated profile of a vessel's fishing activity at sea. Purse seine vessels operators fishing out of Ghana and tuna longline vessels operators fishing out of Fiji are participating in this project; (2) WCPFC has an Electronic Reporting and Electronic Monitoring Intersessional Working Group and is implementing trials on longline vessels through its Scientific Services Provider (SPC) and ISSF; (3) New Zealand has also conducted several trails in different fisheries for different monitoring purposes and is now developing a programme for implementing electronic monitoring for all its domestic fisheries over the next few years (integrated electronic monitoring and reporting system, IEMRS). Its implementation in Australia and other trials should provide the SC with relevant information on how electronic monitoring and on-board observers can be used together to ensure that scientific data needs are met in a cost effective way for SPRFMO fisheries.

To facilitate the use of electronic monitoring in SPRFMO fisheries the SPRFMO-SC4 requests:

1. the SPRFMO Secretariat explore opportunities to collaborate with neighbouring RFMOs (WCPFC and CCAMLR) on implementing electronic monitoring;
2. that members continue to provide information from their national activities on the implementation of electronic monitoring to the SC.
3. Intersessional work is undertaken to generate a table of the CMM4.02 data fields with a corresponding indication (and evidence) on whether this data could, possibly or is unlikely to be provided by electronic monitoring. This table would be presented to SC5 for the purpose of discussing how electronic monitoring is incorporated into CMM4.02.

Both CMM4.02 and the draft observer CMM currently lacks guidance on whether these developing methods could be used to meet the SC's requirements of the data collected by at sea observers. **The SC therefore seeks a mandate from the Commission to explore where electronic monitoring, study fleets and self-sampling or a combination thereof can provide for collection and verification of fisheries vessel data as part of a wider observer programme.**

10. Collated Advice to the Commission

10.1. Jack Mackerel

Short term TAC advice on Jack Mackerel has been taken up under section 6.3. To reiterate, The Commission should aim to maintain 2017 and 2018 catches for the entire jack mackerel range in the southeast Pacific at or below 493 kt. However, should indicators of recruitment continue to be positive (as will be evaluated at SC-05), increasing the TAC in 2018 may be appropriate.

10.2. Deepwater

Recent average landings of orange roughy from SPRFMO Areas have remained below those in the reference years 2002-2006 and the average number of participating vessel has declined from 24 to 6. New Zealand has taken an average of 1,050 t over the past 5 years compared with 1,852 t in the

reference years (57%) and Australian has taken an average 46 t over the past 5 years compared with 257 t in the reference years (18%). No other members have bottom fisheries in the SPRFMO Area.

The SC notes that further progress has been made on the development of stock assessment models for the eight stocks of orange roughy in the SPRFMO Area. The historic catches of all nations are required before these models can be considered reliable for management advice. There was sufficient data to test a stock assessment modelling approach for four stocks using New Zealand data alone. Initial indications of current biomass from these models were 22%, 22%, 23%, and 44% of the unfished biomass, all with broad confidence limits. If the inclusion of catch data from all nations confirms these estimates of depletion, then the Commission may wish to consider measures to increase stock biomass. Recent average New Zealand landings from these four stocks have totalled 537 tonnes compared with preliminary productivity estimates of about 470 tonnes. The short-term risk of further depletion of these stocks is considered to be low if catches continue at this level. The SC anticipates more comprehensive advice will be available in the coming year as part of the development of a new bottom fishing measure.

Some of the catches of orange roughy in the SPRFMO Area come from the straddling stock with New Zealand (ORH7A). This stock was assessed in 2014 and the stock was estimated to be at 42% of the unfished biomass.

The SC is encouraged by the progress on the difficult task of predicting and mapping the distribution of VMEs and VME indicator taxa in the SPRFMO Area. New Zealand will continue to conduct scientific studies on VMEs and spatial management and every effort will be made to use all available information. The SC supports moving towards spatial management, and recognizes that Australia and New Zealand are working closely together and with their industries and other stakeholders.

10.3. Squid

The SC agreed that the information specified in Annexes 1 to 6 of CMM4.02 is the minimum necessary for it to undertake effective monitoring and assessments for stocks in the Convention area. The SC requires that this information is provided in a timely manner to the Secretariat of SPRFMO so that assessments can be prepared, reviewed and used for providing scientific advice for the SPRFMO Commission.

The SC recommends that the SPRFMO Commission amend CMM4.02 to avoid confusion for Members and CNCPs regarding the use of the same templates for data recording and reporting.

Recognizing certain exceptional circumstances noted above for some fisheries (see section 7.2), the SC also recommends that the SPRFMO Commission amend CMM4.02 to allow for an extension in the timing of data submissions in those cases where the Members and CNCPs do not yet hold this information for all vessels in their fleets and that an anticipated submission date is provided.

The SC requests the SPRFMO Commission to remind all Members and CNCPs that issues of data confidentiality are provided for in CMM4.02 and this may not be used as a reason for failure to submit data to the Secretariat.

The SC requests that the SPRFMO Commission commence a data recovery initiative to minimize the impact of this constraint. The data recovery should provide data that is consistent with the specifications of Annex 4 of CMM4.02 to the extent possible.

The SC noted that without the implementation of observer programs the SC may not have access to information to verify vessel logbook and bycatch data and to the capacity to design and implement necessary biological sampling activities. Electronic monitoring, Study fishing fleet with trained captains and crews, and Vessel Self-Sampling may provide opportunities to overcome this constraint. CMM4.02 currently does not provide guidance on whether these developing methods could be used to meet the SC's requirements of the data collected by at sea observers. The SC asks the Commission to acknowledge the ongoing work to provide verification of fisheries vessel data.

11. SC Research Programme

In addition to the existing research programme, a non-comprehensive list of research requirements was noted:

1) Organize a stock structure workshop to define a united framework to provide management advice for management under variable stock structure assumptions
2) Evaluate the effectivity of using voluntary submissions of data collected by fisheries for assessment and management advice purposes
3) Re-estimate the ageing error conversion matrix currently used in the assessment model so that it more accurately reflects the Jack mackerel situation.
4) Specific to the jack mackerel assessment:
    a) Intersessional work is needed to ensure that the software is working well prior to the workshop (or meeting)
    b) Broader involvement in developing documentation of the model equations and assumptions (some output features in the software could use better explanations)
    c) Investment in software development (e.g., shiny app) to facilitate data entry and model specifications would be worthwhile. The goal here is to minimise potential errors.
    d) The data and configuration files need better cross checking prior to the meeting with links to where they come from (e.g., offshore age compositions).
    e) Regarding activities at SC05, the **SC recommends that SPRFMO continues providing technical support and that members continue to commit resources toward assessment activities and capacity building.**
    f) Furthermore, the SC encourages development of alternative software platforms and consider an ensemble approach. It was noted that proceeding along these lines should be limited in order to avoid requiring more time and effort (and confusion) to compile the assessment and provide advice to the commission.
5) Providing some funding to the ADMB/TMB foundation by SPRFMO to secure the support of the main assessment software used.

12. Election of Chairpersons

Chairs and vice-chairs for the SC and the Deepwater subgroup were elected by the SC. Jim Ianelli and Niels Hintzen were re-elected as Chair and vice-Chair of the Science Committee. Mauricio Galvez was elected as the Chair of the Deepwater subgroup. A new Squid subgroup was created and Gang Li was elected as its first Chair.

13. Other Matters

The Secretariat noted the update of the website and seeks feedback. The Guidelines for the annual reports were discussed and the SC requested that the Secretariat update the guidelines and circulate a draft prior to SC05.

14. Next meeting

The next meeting will be held from September the 20th to the 28th 2017 (to allow for a potential workshop) in Shanghai, China.

15. Adoption of Report

The SC unanimously adopted the report.

16. Meeting Closure

The meeting was closed at 2337 hours on the 14th of October 2016.

4th Meeting of the Scientific Committee

The Hague, Kingdom of the Netherlands
10 - 14 October 2016
SC-04-01
Agenda

1. Welcome and Introduction
2. Administrative Arrangements
   2.1. Adoption of Agenda
   2.2. Meeting documents
   2.3. Nomination of Rapporteurs
3. Discussion of Annual Reports
4. Commission guidance and other Inter-Sessional activities
   4.1. Commission SC Workplan
   4.2. Secretariat SC related activities
   4.3. Assessment workshop report
   4.4. Fishery dependent acoustic Task Group
   4.5. Jack mackerel Age/Growth Task Team
5. Mackerel Working Group
   5.1. Report on Inter-Sessional assessment/research by Participants
   5.2. Inter-Sessional Progress with the Jack Mackerel Stock Structure Research Programme
   5.3. Jack Mackerel Stock Assessments – Technical Session
   5.4. Other Jack Mackerel topics
6. Deepwater Working Group
   6.1. Applications to fish outside the footprint or above reference period catch levels
   6.2. Inter-Sessional assessments of Deepwater species
   6.3. SPRFMO Deepwater stock assessments
   6.4. VME distribution and spatial management approaches in the Convention Area
   6.5. Other Deepwater topics
7. Squid Assessment
8. Ecosystem Approach to Fisheries Management
9. Observer Programmes
   9.1. Observer Programme Working Group
   9.2. E-monitoring
10. Advice to the Commission
    10.1. Jack Mackerel
    10.2. Deepwater
    10.3. Other
11. SC Research Program
12. Election of Chairperson and Vice-Chairperson

13. Other Matters
14. Next Meeting
15. Adoption of Report
16. Meeting Closure

4th Meeting of the Scientific Committee

The Hague, Netherlands
10-15 October 2014

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South Pacific Regional Fisheries Management Organisation

Stock status summary for jack mackerel, October 2016

Stock: Jack Mackerel (*Trachurus murphyi*)
Region: Southeast Pacific

Advice for 2017

The SPRFMO Science Committee advises to maintain 2017 catches at or below 493,000t.

Stock status

		2014	2015	2016
Fishing mortality in relation to	F_{MSY}	Below	Below	Below
Spawning stock biomass in relation to	B_{MSY}	Below	Below	Below

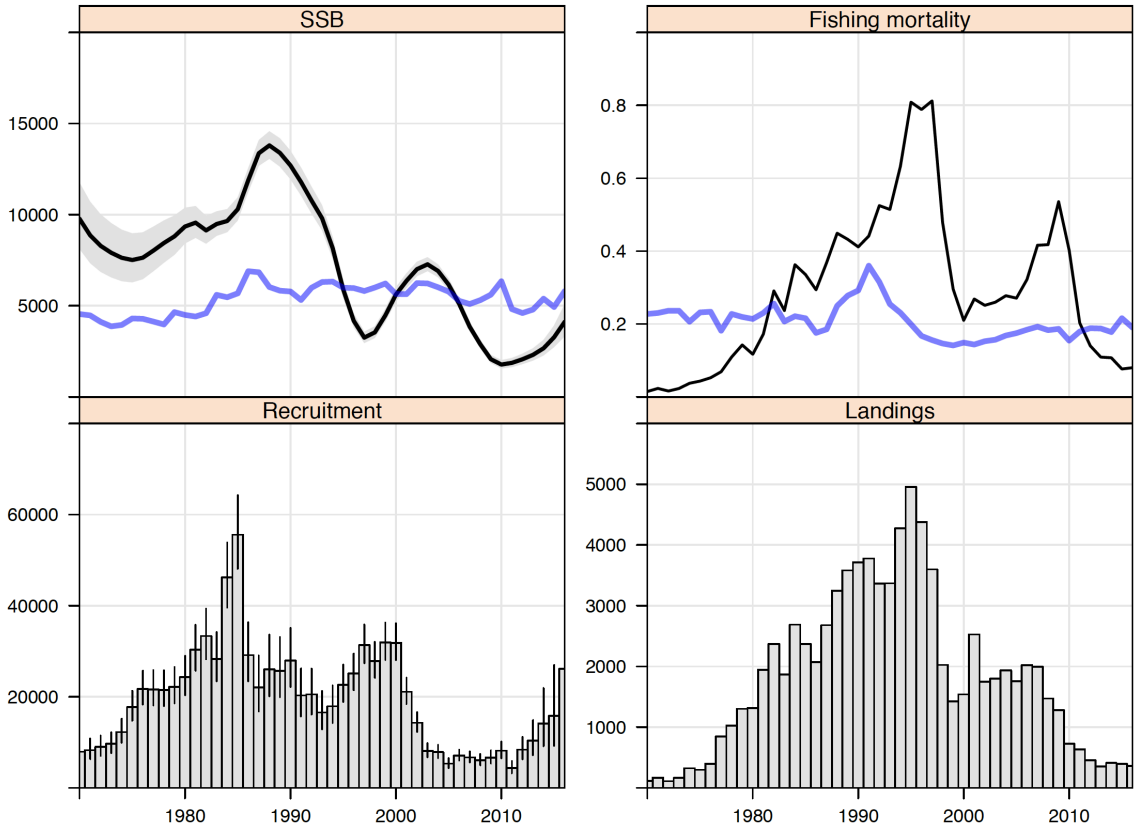

Figure 1. Jack Mackerel in the southeast Pacific. Summary of stock assessment. Recruitment is measured in thousands, SSB in thousand tonnes, catch in thousand tonnes and harvest (fishing mortality) as a rate per year. Provisional values for F_{MSY} and B_{MSY} are shown by horizontal blue lines.

Outlook for 2017

Scenarios with constant fishing mortality from 2017 onwards were explored at 125%, 100%, 75%, 50% and 0% of a reference F_{2016}; the reference F_{2016} was set to the value that would give catches equal to the full TAC in 2016 (460kt).

Table 1. Summary results for the near term predictions. Note that "B" represents thousands of t of spawning stock biomass and B_{MSY} is taken to be a provisional value of 5.5 million t of spawning biomass.

Recruitment steepness =0.65, recruitment from 2000-2013

Multiplier of reference F_{2016}	B_{2018}	$P(B_{2018} > B_{MSY})$	Catch 2017 (kt)	Catch 2018 (kt)
0.00	6,603	88%	0	0
0.50	6,269	80%	232	299
0.75	6,112	75%	344	436
1.00	5,909	67%	493	611
1.25	5,814	64%	563	691

Table 2: Advised and reported catch (t) of Jack Mackerel in the southeast Pacific.

Year	Advised catch	Reported catch
2008		1,472,631
2009		1,283,474
2010		726,573
2011	711,783	634,580
2012	520,000	454,774
2013	441,000	353,123
2014	440,000	410,698
2015	460,000	394,377
2016	460,000	360,496*

* As estimated at SC04

Annual Report Summaries

Australia

Three Australian-flagged vessels fished in the SPRFMO Convention Area in 2015;
one demersal trawler and two demersal longline vessels. Logbook records from these vessels reported a catch of 25 t (16 hours trawl time) for the demersal trawler and a total of 177t (745,000 hooks) for the two demersal longline vessels in 2015. The catch composition for the demersal trawler was dominated by orange-roughy and alfonsino and for the demersal longliners: morwong, yellowtail kingfish and blue-eye trevalla. Observer coverage levels met or exceeded the minimum requirement (10 per cent coverage for non-trawl, and 100 per cent coverage for trawl trips). Observers did not record any bycatch of marine mammals, seabirds or marine reptiles in trawl or non-trawl operations in the SPRFMO Area. The threshold limits for vulnerable marine ecosystems (VME) indicators, which trigger Australia's move-on protocols, were not triggered in 2015.

Chile

Accumulated catches of Jack mackerel for Chilean fleet arose to 275,680 ton until September 2016, being 92% of the total quota allocated to Chile. Only 2% of the catches were obtained in the Area of the Convention. For the 2016 fishing season it is expected to catch 95% of the total quota allocated. During 2016, jack mackerel catches in the northern area has reached 14,400 tons, half of the catch registered in the first semester of 2015, due to a decline of the catch of anchovy as target species. It is important to note that, off northern Chile most of the jack mackerel caught was made as incidental fishing in anchovy fishery. The jumbo squid fishery includes the participation of small-scale and industrial fleets, with distribution percentages of the national annual catch quota of 80% and 20%, respectively (TAC2016= 200,000 ton). The small-scale fleet operates with hand jiggers and the industrial fleet operates mainly with mid-water trawling. National landings of squid in 2015 were 140 thousand tons. Industrial landings do not exceed 40 thousand tons due to the distribution of the catch annual quota between the two fleets. Total catch is entirely conducted within the EEZ of the country. The accumulated catch up to September 2016 is 170,000 ton. A non-take Marine Protected Area of 300,000 km^2 was created in Chilean jurisdictional waters close to Nazca Submarine ridge in order to protect VMEs. This protected area will also help to preserve the migration route of the blue whale and marine turtles, breeding and feeding grounds of seabirds, feeding grounds and migration route of swordfish, and recruitment grounds for Jack mackerel.

China

In 2015, a total of 6 Chinese large pelagic trawlers operated in the South East Pacific and annual catch was 29,180 tons with 3704 trawling hours. The nominal CPUE reached 7.9 tons per hour, and the estimated abundance was 1.02, the highest level since 2008. A total of 8867 jack mackerel was sampled with tow-by-tow information by the observer from April to July 2015 to generate the length-frequency or age-length key (600 individuals).

In 2015, a total of 252 squid jigging fishing vessels were recorded to operate in the high seas, and the number of active fishing boats varied weekly from 96 to 218. Annual catch of jumbo squid in 2015 was 323 thousand tons. Fishing effort was 60,166 fishing days with nominal CPUE 5.4 tons/day-vessel. 236 jumbo flying squid was sampled on board in the high seas off Peru from June to September 2015.

Colombia

Colombia's report was taken as read.

European Union

Catches of jack mackerel by European Union (EU) trawlers in 2016 were considerably lower than in 2015. The year-class 2012, which had appeared in the catches already in 2015, was the main target of the fleet in 2016. However, judging from the catch rates, it was less abundant in 2016 than in the previous year. Last year it was already assumed that the high catches of juvenile jack mackerel outside the Chilean EEZ had been partly the result of an abnormal distribution of this year-class (due to the El Niño conditions), rather than of its absolute size. The poor results of the fishery in 2016 seem to confirm this hypothesis.

Korea

Two Korean flag trawlers operated in the SPRFMO convention area in 2015. Total catch from the trawlers were 5,834 tons including 5,749 tons of *Trachurus murphyi* and 82 tons of *Scomber japonicus*. The level of CPUE (ton/hour) was similar with the previous year (2014). No bottom fisheries were operated in the convention area since 2007. Observer coverage was 100%. Two observers on the trawlers measured 2550 jack mackerels from June to September. More than three modes appeared in the length frequency and the relationship between body weight (BW, g) and fork length (FL, cm) was BW=0.000005FL3.202 (R2=0.977).

New Zealand

Slightly more orange roughy effort and catch in 2015 than in recent years, but some of this was from the recovering straddling stock with New Zealand waters (ORH7A). NZ noted an error in Table 4 (of their annual report) where a total effort of 7,600 tows is recorded (should be 760).

Fishing occurred in move-on blocks as well as open blocks, but the move-on rule was not triggered in 2015 (and has not been triggered since 2012). Lower line fishing effort in 2015 but similar catch to 2014 (bluenose and wreckfish). Line fishing nominal CPUE highly variable for both species. Very brief summary of the exploratory line fishery for toothfish (see separate paper). Much more detail included in the annual report this year, including length frequency distributions for several species over the past 5 or 6 years. A separate report describes the NZ observer programme and 2015 coverage in more detail, coverage was 100% for trawl, 12% for bottom line, 50% for Dahn line, and 14% for hand line.

Work to develop stock assessments and estimates of sustainable yield is described (see also separate paper):

- Simple models presented by Penney (2010)
- Seamount meta-analysis to predict unfished biomass on given features
- Re-assessment of stocks and areas using multiple lines of evidence
- Spatially disaggregated CPUE models for NZ fishing in 6 of the main SPRFMO stocks
- Preliminary biomass dynamic models using just NZ data
- Working on acquiring full catch histories to finalise stock assessments

The preliminary work on potential squid in-season assessment for New Zealand has been finalised and was also summarised. The approach might be suitable for SPRFMO stocks.

The annual report contains quite a long section on geospatial prediction of VME indicator taxa. SPRFMO-scale models were built and tested as described at SC-03 but the at-sea testing reinforced the need for caution when interpreting broad-scale. Presence-only models in data poor areas of the deep sea. New models are at a finer New Zealand region-scale developed where bathymetry and other data were better and where absences could be included as well as presence. Even finer-scale models covering individual features are now being developed. But these can be made only for features with substantial, detailed information.

The NZ report also described decision-support tools that can combine predicted distributions of VME taxa with the distribution of fishing to design spatial management areas:

- Intent is to provide for fishing while avoiding significant adverse impacts on VMEs
- NZ notes the utility of such analyses depends on the quality of the input data
- many examples are shown but this is a demonstration of a tool that can be used by stakeholders to design and examine different scenarios

Summary was given of information held on VME indicator taxa and other benthic records entered by observers (606 records in all). This could contribute to the development of the new bottom fishing measure and New Zealand's updated bottom fishery impact assessment (see separate paper on development of the new CMM).

A summary was also given of all records of seabirds and marine mammals captured since 1993 in what is now the SPRFMO Area.

Peru

Peru's report updates information on the biology and fishery of jack mackerel (*Trachurus murphyi*) in Peru presented in previous SPRFMO Scientific Committee meetings. During 2014, 2015 and the first part of 2016 the Peruvian coastal areas have been affected by warmer than normal conditions typical of a weak El Niño during 2014 and a strong El Niño during 2015 and early 2016. Environmental conditions entered into a cooling trend while still remaining warmer than normal only towards the end of the first semester of 2016. With these warmer than normal environmental conditions the front usually formed by the mixed layer of warm Subtropical Surface Waters and Cold Coastal Waters almost disappear and moved closer to the coast, disrupting was is known to be the preferred habitat of jack mackerel off Peru. This contributed to low observed abundance and low catches of jack mackerel in 2014 and particularly in 2015 and the first part of 2016. During 2014 and predominantly during 2015 and early 2016 jack mackerel concentrations were mostly found in coastal areas, within 20 nm and sometimes limited to the 10 nm from the coast, within reach of the artisanal and small scale fleet but outside the usual fishing grounds of the industrial purse seine fleet. The catch of jack mackerel drops from a total of 74,528 t in 2014 to only 22,158 t in 2015 (almost all caught by the small-scale and artisanal fleets) and so far only the small-scale and artisanal fleets have captured jack mackerel this year, reporting an estimated 9,209 t from January to June 2016. Various options for the 2016 TAC were considered during a December 2015 assessment based on the latest version of JJM model developed during the 3th Meeting of the Scientific Committee and the final decision was to accept a risk of 3.9% with an F2016 = 0.0325 and an estimated TAC of 93 000 t for 2016. The status-quo (2015 conditions) option estimated a much lower TAC with slightly lower estimated risk and F but this option was not selected based on the observation that 2015 was an abnormal year, heavily influenced by the strong effects of the most recent El Niño. A more recent 2016 assessment was made using the JJM with information updated to June 2016, and considering new estimated risks and F levels the resulting TACs were very similar to those estimated in the December 2015 assessment. Peru did not conduct any fishing in the SPRFMO Area during 2015.

Russian Federation

Russian fisheries in the Convention area for 2015. In 2015 the Russian trawler Alexander Kosarev worked in the high seas of the Southeast Pacific. The total catch was 2,561.2 t for jack mackerel and 462.5 t for chub mackerel in 38 fishing days. CPUE of JM in 2015 was similar to 2011. For the area to the south of the Juan Fernandez Islands zone, catch consisted of different-sized fish with the modal length classes of 28, 35 and 40 cm. Size composition of jack mackerel in the catches was homogeneous (a dominance of 26 cm length specimens observed) in the northern area between the island zones and the continental area of Chile. In 2015 Russian Report of the 4th Scientific Committee meeting scientific observations covered 80 hauls of 89 (89.9%).

Chinese Taipei

Jumbo flying squid inhabits in the eastern Pacific and has been targeted by the distant-water squid-jigging fleet of Chinese Taipei since 2002. The number of vessels varied between 5 and 29 from 2002 to 2015. The catch of Jumbo flying squid increased to 10,072 tons in 2015. The nominal CPUE of this fishery is stable in recent years. The major fishing ground for this fishery was located at the area around 76–83°W and 15–20°S. Data of logbook, transshipment and landing of the distant-water squid fishery of Chinese Taipei have been collected. Researches on the stock status and spatial dynamics of jumbo flying squid have been conducted. Length composition of the squid was converted from weight category. Neither observer nor port sampling program is implemented.

Vanuatu

The jack mackerel catch in 2015 for Vanuatu's vessels was 21,227t. Vanuatu seasonally transferred 250t of its catch limit to the Republic of Korea, as a result, Vanuatu's catch of 21,227t almost entirely filled its available quota. Catches of chub mackerel totaled 604 tonnes in 2015. No observers were present on the vessels during the 2015 season as a result of a need for government employees to assist in reconstruction work following the destruction caused by Cyclone Pam.

IUCN red-listed deepwater shark species and relevant CITES appendix II species

Table 1. Deepwater sharks and rays in the SPRFMO Convention area categorized on the IUCN Red List as Critically Endangered, Endangered and Vulnerable proposed for inclusion on CMM 4-02 Appendix 14 .

Source	Species types	FAO Areas	Status Categories
IUCN Red List	Deep Pelagic & Deepwater sharks and rays	Pacific - southeast Pacific - southwest Pacific - western central Pacific - eastern central	Critically Endangered Endangered Vulnerable
Bathyraja griseocauda	Arhynchobatidae	Rajiformes	Endangered
Centrophorus harrissoni	Centrophoridae	Squaliformes	Endangered
Centrophorus squamosus	Centrophoridae	Squaliformes	Vulnerable
Dipturus trachydermus	Rajidae	Rajiformes	Vulnerable
Hydrolagus ogilbyi	Chimaeridae	Chimaeriformes	Vulnerable
Odontaspis ferox	Odontaspididae	Lamniformes	Vulnerable
Rhinoraja albomaculata	Arhynchobatidae	Rajiformes	Vulnerable
Squatina albipunctata	Squatinidae	Squatiniformes	Vulnerable
Zearaja chilensis	Rajidae	Rajiformes	Vulnerable

Table 2. Deepwater sharks and rays in the SPRFMO Convention area categorized on the IUCN Red List as Near Threatened for further consideration.

Species	Family	Order	Status
Centrophorus acus	Centrophoridae	Squaliformes	Near Threatened
Centrophorus niaukang	Centrophoridae	Squaliformes	Near Threatened
Centroscymnus coelolepis	Somniosidae	Squaliformes	Near Threatened
Cephaloscyllium albipinnum	Scyliorhinidae	Carcharhiniformes	Near Threatened
Dalatias licha	Dalatiidae	Squaliformes	Near Threatened
Deania quadrispinosa	Centrophoridae	Squaliformes	Near Threatened
Dipturus cerva	Rajidae	Rajiformes	Near Threatened
Dipturus gudgeri	Rajidae	Rajiformes	Near Threatened
Dipturus innominatus	Rajidae	Rajiformes	Near Threatened
Echinorhinus cookei	Echinorhinidae	Squaliformes	Near Threatened
Heptranchias perlo	Hexanchidae	Hexanchiformes	Near Threatened
Hexanchus griseus	Hexanchidae	Hexanchiformes	Near Threatened
Hydrolagus ogilbyi	Chimaeridae	Chimaeriformes	Near Threatened
Proscymnodon plunketi	Somniosidae	Squaliformes	Near Threatened
Rhinoraja macloviana	Arhynchobatidae	Rajiformes	Near Threatened
Rhinoraja multispinis	Arhynchobatidae	Rajiformes	Near Threatened
Squalus chloroculus	Squalidae	Squaliformes	Near Threatened
Squalus grahami	Squalidae	Squaliformes	Near Threatened
Squalus hemipinnis	Squalidae	Squaliformes	Near Threatened
Squalus rancureli	Squalidae	Squaliformes	Near Threatened

Note: In additional to the above, there are a number of deepwater species of sharks and rays assessed as Data Deficient on the IUCN Red List which are not listed here. These may include additional threatened species. The Red List is updated annually to include revised assessments and new species assessments.

Marine species listed by CITES under Appendix II which are not included in CMM 4.02, Annex 14.

Only includes species of possible relevance to SPRFMO fisheries, i.e. occurring in the South Pacific and not restricted to shallow coastal areas (e.g. not included sawfishes and clarion anglefish):

Listed in October 2016 by CITES CoP 17:

- Silky shark (*Carcharhinus falciformis*); wide-ranging, highly migratory and globally distributed
- Thresher sharks, (*Alopias spp*); wide-ranging and globally distributed
- Family Nautilidae, tropical Asia Pacific region, restricted fore-reef slopes that extend into deepwater

Previously listed by CITES but not yet included in the SPRFMO CMM 4.02, Annex 14

- **Porbeagle shark** *(Lamna nasus*), listed in 2013; wide-ranging, coastal and oceanic shark, and one of the few truly high-latitude sharks that is often encountered in Arctic and Antarctic waters
- **Scalloped hammerhead shark** (*Sphyrna lewini*), Smooth hammerhead shark (*Sphyrna zygaena*); and great hammerhead shark (*Sphyrna mokarran*); listed in 2013; tropical and warm temperate waters worldwide, inhabiting coastal areas and the continental shelf
- **Black corals** (*Antipatharia spp*.); tropical, subtropical , temperate and polar regions. Often dwelling in deep waters.
- **Stony corals** (Scleractinia), global, some species in deep seas
- **Lace corals** (Stylasteridae); tropical and temperate West Pacific, many deepwater species found in the Southwest Pacific

CMM X.XX (2nd DRAFT) – *Comments by the Scientific Committee*

Conservation and Management Measure for the SPRFMO Observer Programme

The Commission of the South Pacific Regional Fisheries Management Organisation,

Explanatory Note: The preamble for this draft incorporates the suggested comments and edits received on the initial draft of this section.

Recalling that Article 28 of the Convention calls for the establishment of an observer programme to collect verified catch and effort data, other scientific data and additional information related to the fishing activity in the Convention Area, and its impacts on the marine environment.

Noting that Article 28 sets out the functions of the observer programme and specifies that the information collected by the observer programme shall, as appropriate, also be used to support the functions of the Commission and its subsidiary bodies, including the Scientific Committee and Compliance and Technical Committee, and that the observer programme shall be coordinated by the Secretariat of the Commission in a flexible manner.

If the SPRFMO OP has a dual function (scientific and compliance), then that could interfere with the collection of high quality scientific information

Desiring to implement a best practice observer programme, taking into account the similar experiences and practices implemented by other regional fisheries management organizations (RFMOs).

Acknowledging that other RFMOs have established observer programmes for similar purposes, that national observer programmes are in place, and that coordination with these programmes shall be pursued to the maximum extent possible.

Acknowledging that worldwide experience has demonstrated that observers deployed on board fishing vessels during commercial operations can provide high-quality information for management and conservation of fishing resources and their environment, and can also help to promote good communications among Members, Cooperating non-Contracting Parties (CNCPs), scientists and fishing users.

Adopts the following conservation and management measure in accordance with Article 8 of the Convention:

Part 1 Definitions

Explanatory Note: This part has been added per Australia's suggestion and includes several terms suggested by Australia as well as several additional terms. Several OPWG participants provided comments on the need for and definition of the terms "independent and impartial." Australia and the United States provided specific language for these terms, with Australia's definition focusing on the data to be collected and the United States' definition focusing on the observers themselves. Both definitions are provided in brackets below for consideration of the OPWG.

1. Terms in this measure have the following definitions:

Accredited means: an observer programme or service provider that meets the standards adopted by the Commission.

Collect means: to record information electronically or on paper by typing, writing, photograph or other means.

Debriefing means: processing data collected by observers through appropriate quality assurance or quality control systems.

Fishing effort

"Catcher vessel"

New Concepts that require definition

Catch

By-catch

Discards

[Australia: *Independent:* For data to be considered 'independent' it must be collected in an uninfluenced and unbiased manner on board any vessel regardless of which flag under which the vessel is operating. Accordingly, independent refers to data sourced from programmes or service providers accredited by the Commission. The programme will have no direct financial interest, ownership or business links with vessels, processors, agents and retailers involved in the catching, taking, harvesting processing or selling of fish or fish product.

Impartial: The collection of independent and 'impartial' data refers to data collected which is free from outside influence, from vessels, processors, agents, retailers, involved in the catching, taking, harvesting processing or selling of fish or fish product and will also be free from influence by non-governmental environmental, fishery, and other related organizations. Data collection shall be undertaken in an uninfluenced and unbiased manner on board vessels from both flag State and foreign fishing nations.

U.S.: *Independent and impartial* means that an observer:

a) May not have a direct financial interest, other than the provision of observer services, in the fishery under the purview of the Commission, including, but not limited to: i) any ownership, mortgage holder, or other secured interest in a vessel or processor involved in the catching, taking, harvesting or processing of fish; ii) any business selling supplies or services to any vessel or processor in the fishery; iii) any business purchasing raw or processed products from any vessel or processor in the fishery.

b) May not solicit or accept, directly or indirectly, any gratuity, gift, favor, entertainment, inordinate accommodation, loan or anything of monetary

value from anyone who either conducts activities that are regulated by the flag Member or CNCP and the Commission or has interests that may be substantially affected by the performance or nonperformance of the observer's official duties.

c) May not serve as an observer on any vessel or at any processors owned or operated by a person who previously employed the observer in another capacity (e.g., as a crew member).

d) May not solicit or accept employment as a crew member or an employee of a vessel or processor while employed by an observer provider.]

Observer Programme: An observer programme refers to the government programme or non-government service provider that conducts the coordinated collection by human observers and/or other mechanisms and debriefing of observer data as adopted by the Commission for the purposes of implementing this CMM.

The SC report that suggests broadening the scope of the CMM (to include other data collection programmers like electronic monitoring, study fleets and self-sampling)

Part 2 Scope of the SPRFMO Observer Programme

Explanatory Note: Based on comments received, this part includes some additional language regarding the scope of the CMM. Language has been added in Paragraph 1 to clarify that the SPRFMO Observer Programme applies to all fishing vessels operating in the Convention Area while they are in the Convention Area. In other words, a fishing vessel that operates only in an Exclusive Economic Zone (EEZ) would not be subject to these requirements. However, a fishing vessel that operates in the Convention Area and in an EEZ on the same trip would be subject to the requirements of this CMM for the portion of the trip that occurs in the Convention Area. Existing domestic observer programmes would be eligible to become accredited, so multiple observers would not be needed.

For scientific purposes the SC considers that the observer programme should concentrate on catcher vessels (of SPRFMO fishery resources). Noting that under the current definition of fishing vessel that is not possible.

Transhipment observation is often managed as a separate program with separate objectives

2. The SPRFMO Observer Programme (SPRFMO OP) shall apply to all fishing vessels flying the flag of a Member or CNCP, as defined in Article 1, 1, (h) of the Convention, and operating in the area of application of the Convention, as defined in Article 5 of the Convention.

3. The SPRFMO OP shall consist of [independent and impartial observers] *or per Australia definition* [independent and impartial data collected by observers] that are sourced from observer programmes accredited by the Commission. The SPRFMO OP shall be consistent, to the maximum extent possible, with other regional and national observer programmes. This should include but not be limited to the sharing of information pertinent to vessel conditions and health and safety.

4. The SPRFMO OP shall be coordinated by the Secretariat of the Commission and operated in accordance with standards, rules and procedures established by

the Commission.

5. A key role of observers under the SPRFMO OP shall include collecting the information specified in Part 5 below.

Part 3 Objectives of the SPRFMO Observer Programme

Explanatory Note: Given the comments received on this part, it appears that it would be best to include the already agreed language and requirements from Paragraph 2 of CMM 4.02, "Conservation and Management Measure on the Standards for the Collection, Reporting, Verification and Exchange of Data," such that the objectives and core requirements of the SPRFMO OP are only located in this CMM. Accordingly, a revision to CMM 4.02 would need to be submitted along with the adoption of this CMM. The specific observer data elements and confidentiality requirements will remain in the revised "CMM on the Standards for the Collection, Reporting, Verification and Exchange of Data." I felt it appropriate to ask the Scientific Committee to review the observer data collection requirements in CMM 4.02, "Conservation and Management Measure on the Standards for the Collection, Reporting, Verification and Exchange of Data," including the data elements of Appendix 7, and provide advice on any needed amendments to include in this CMM. Comments also indicated that data collected by observers should be used for both scientific and compliance monitoring purposes, so modifications have been made to this part to incorporate those comments. In addition, language referencing Annex A and Annex B has been moved to this part and the text has been changed to refer to these documents as mandatory rights and responsibilities, rather than guidelines.

6. The objective of the SPRFMO OP is to provide Independent, impartial and representative information and data of the following types that has been subject to debriefing and quality assurance:

   a. Effort and catch and interaction data for all fisheries and fished species in the Convention Area, including target catch, and by-catch discards including seabirds, marine mammals, marine reptiles, and other species of concern.

   b. Biological or other data and information relevant to the management of fishery resources in the Convention Area, as specified in the SPRFMO Data standards, or as identified from time to time by the Scientific Committee or through processes identified by the Commission.

   c. Relevant scientific information related to the implementation of the provisions of the Conservation and Management Measures (CMMs) adopted by the Commission.

   d. Representative data, including length-frequency, species composition and biological samples, across the Convention Area, distribution of fishing effort, seasons, fishing fleets and fleet types.

7. Information collected through the SPRFMO OP shall, as appropriate, be used to support the functions of the Commission and its subsidiary bodies.

These concepts need a set of mutually exclusive and comprehensive definitions

Deleted: the following types of information that have been collected by observers and have been subject to debriefing

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8. The SPRFMO OP also provides for the rights and responsibilities of observers and vessel operators, captains, and crew in Annex A and Annex B, respectively.

Paragraph 8 also does not belong in the objectives

Part 4 Roles and General Responsibilities

Explanatory Note: Multiple comments were submitted on this part, with some recommending that the standards and details for the accreditation process should be included as an annex to this CMM and some also recommending that the details of the Secretariat's role in the Observer Programme should be clearly delineated in the CMM. This draft of the CMM proposes that agreement be reached first on the framework elements of the SPRFMO OP along with an interim accreditation process, and that the final details of an accreditation process and the Secretariat's responsibilities therein be developed for adoption by the Commission and inclusion as annex to this CMM.

9. Members and CNCPs shall only use observer programmes accredited under the SPRFMO OP for fishing vessels flying their flag operating in the Convention Area.

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10. Members and CNCPs shall be responsible for meeting the level of observer coverage as set by the Commission and shall ensure that fishing vessels flying their flag operating in the Convention Area are prepared to accept observers from the SPRFMO OP.

11. The SPRFMO Secretariat shall coordinate the SPRFMO OP and shall organize and operate the SPRFMO OP in accordance with standards, rules and procedures to be fully established by the Commission.

12. Members and CNCPs shall provide the SPRFMO Secretariat with the details of any observer programmes for nomination for accreditation under the SPRFMO OP. Nominated observer programmes shall undergo an accreditation process in accordance with standards adopted by the Commission. After accreditation, each observer programme will be evaluated for continued participation in the SPRFMO OP every three [five] years, in accordance with standards adopted by the Commission.

13. Until the Commission has adopted the accreditation process, Members and CNCPs shall provide the Secretariat with the following information on any observer programmes nominated to participate in the SPRFMO OP on an interim basis: (1) the name and contact details of the observer programme coordinator; and (2) the observer programme manual, guidelines, instructions, regulations or workbooks relevant to describe the requirements and duties of the programme's observers. These programmes will be required to undergo the full accreditation process when it is implemented.

14. Members and CNCPs will ensure that data collected through the observer programme are put through an appropriate data quality / debriefing process, which will be reviewed by the Commission as part of the SPRFMO OP accreditation process.

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15. Members and CNCPs shall ensure that observer data are provided to the Secretariat in a standardized electronic format, to be included in a SPRFMO Observer Database per specifications and standards for observer data submissions on the SPRFMO website. Observer data must be identified at the fishery level. Members and CNCPs will provide

by 30 June, their previous (January to December) year's debriefed observer data.

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16. Members and CNCPs shall ensure that observers do not unduly interfere with the lawful operations of the vessel and in carrying out their duties shall give due consideration to the operational requirements of the vessel and to the extent practicable minimize disruption to the operation of vessels fishing in the Convention Area.

17. Members and CNCPs shall ensure that observers are not unduly obstructed in the discharge of their duties unless there is a documented safety issue.

18. Members and CNCPs shall ensure that vessel operators and crew comply with Annex A and Annex B.

Part 5 Minimum Information and Data to be Collected

Explanatory Note: As stated in the Explanatory Note for part 3, above, the specific data elements to be collected will remain in the "Conservation and Management Measure on the Standards for the Collection, Reporting, Verification and Exchange of Data." Other requirements from theat CMM except data confidentiality are included here.

19. Members and CNCPs shall ensure that observers collect the information specified in Annex 7 of the "Conservation and Management Measure on the Standards for the Collection, Reporting, Verification and Exchange of Data."

20. Members and CNCPs shall provide annual observer implementation reports as a section in the annual report, 30 days prior to the meeting of the SC and covering the previous year, which include sections covering: observer training, programme design and coverage, type of data collected, and any problems encountered during the year. These reports shall be reviewed by the Compliance and Technical Committee (CTC) and to evaluate the implementation and effectiveness of observer programmes and used by the Scientific committee to aid its work.

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21. The Secretariat shall prepare an annual report on the implementation of the SPRFMO OP for presentation at each annual meeting of the CTC and Commission that will be distributed to Members and CNCPs [30] days prior to each meeting, including but not limited to information on problems that have been encountered and recommendations for improving current standards and practices. The Secretariat shall compile and disseminate a summary of observer data holdings to the Scientific Committee (SC) no later than [60] days in advance of each SC meeting to ensure that the best scientific information is available, while maintaining confidentiality following the procedures specified in Paragraph 7 of CMM 4.02, "Conservation and Management Measure on the Standards for the Collection, Reporting, Verification and Exchange of Data" and any other data confidentiality procedures developed.

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Part 6 Levels of Observer Coverage

Explanatory Note: Text in this part has been modified to reference existing CMMs specifying observer coverage. The language for all other fisheries not covered by existing CMMs mirrors language in CMM 4.01. However, I propose that it would be better to include all metrics and specified levels of observer coverage in this CMM and as other CMMs are updated these requirement need not be carried forward and the references here can be deleted. I believe it is appropriate to ask the Scientific Committee for advice on the appropriate levels of observer coverage and metrics to use for each fishery.

21bis. By 2019 the SC will complete an analysis of appropriate observer coverage along with an agreed definition of fishing effort by fishery for all fisheries is completed the following coverage levels should apply for paragraphs 22 - 24:

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Noting that Coverage levels for transhipment have not been considered by the SC

22 For the *Trachurus murphyi* fishery, the level of observer coverage shall be as specified in CMM 4.01, "Conservation and Management Measure for *Trachurus murphyi*.

a. Members and CNCPs participating in the Trachurus murphyi fishery shall ensure a minimum of 10% observer coverage of trips

b. In the case of the vessels undertaking no more than 2 trips in total, the 10% observer coverage shall be calculated by reference to active fishing days for trawlers and sets for purse seine vessels.

In the longer term, coverage should not be defined in terms of trips because they cannot be identified from the SPRFMO database.

23. For bottom fisheries, the level of observer coverage shall be as specified in CMM 4.03, "Conservation and Management Measure for the Management of Bottom Fisheries in the SPRFMO Convention Area."

a. for vessels using trawl gear in the Convention Area, ensure 100 percent observer coverage for vessels flying their flag for the duration of the trip;

b. for each other bottom fishing gear type, ensure that there is at least a 10 percent level of observer coverage each fishing year;

24. For new and exploratory fisheries, the level of observer coverage shall be as specified in CMM 4.13, "Conservation and Management Measure for the Management of New and Exploratory Fisheries in the SPRFMO Convention Area."

24bis new squid paragraph

25. [For all other fisheries, Members and CNCPs shall ensure a minimum of 10% observer coverage of trips. In the case of the vessels undertaking no more than two trips in total, the 10% observer coverage shall be calculated by reference to active fishing days or sets]

There are different views within the Scientific Committee on the need and content of paragraph 25. The OPWG should consider options including a separate paragraph for the squid fishery vs all other fisheries.

China noted that this means each vessel should be sent an observer on board in a fishing year. Furthermore, 10% observer coverage based on fishing days is too high to be realistic or operational, especially for the squid jigging fishery. At this stage, the OP should focus on the jack mackerel fishery and bottom fishery, for other fisheries, whether implement the OP should be determined by the demand of management. We oppose the OP apply to all other fisheries. Article 25 should be deleted or modified.

IF the squid jigging fishery was included the OP, two key issues must be considered. Firstly, because the jumbo flying squid is the straddling fish stock, all the squid jigging vessels that operate in the international waters or jurisdiction waters of coastal countries shall be applied the OP. Secondly, the observer coverage should be set much more scientifically and realistically, rather than arbitrarily.

Annex A: Rights and Responsibilities of Observers in the SPRFMO Observer Programme

1. The rights of observers shall include:

   a. Full access to and use of all facilities and equipment of the vessel which the observer may determine is necessary to carry out his or her duties, including full access to the bridge, fish and any bycatch on board, and areas which may be used to hold, process, weigh, and store fish.
   b. Full access to the vessel's records including its logs and documentation for the purpose of records inspection and copying, vessel diagrams, reasonable access to navigational equipment, charts and radios, and reasonable access to other information related to fishing.
   c. Access to and use of communications equipment and personnel, upon request, for entry, transmission, and receipt of work related data or information.
   d. Access to additional equipment, if present, to facilitate the work of the observer while on board the vessel, such as high powered binoculars, electronic means of communication, freezer to store specimens, scales, etc.
   e. Access to the working deck or hauling station during net or line retrieval and to specimens (alive or dead) in order to collect and remove samples, as well as cooperation of the vessel crew when sampling the catch.
   f. Notice by the vessel captain of at least fifteen (15) minutes before hauling or setting procedures, unless the observer specifically requests not to be notified.
   g. Access to food, accommodations, medical facilities that meet international maritime standards, and sanitary facilities of a reasonable standard equivalent to those normally available to an officer on board the vessel.
   h. The provision of adequate space on the bridge or other designated area for clerical work and adequate space on the deck or factory for observer duties.
   i. Freedom to carry out their duties without being assaulted, obstructed, resisted, delayed, intimidated or interfered with in the performance of their duties.
   j. Full access to verify safety equipment onboard (safety orientation tour provided by officers/crew), before the vessel leaves dock, and recording any pertinent information including life rafts capacity, radios, etc.
   k. Full access to communication equipment onboard that allows the observer to communicate with the observer program on land at any time in case of emergencies

l. Free access to record any pertinent information including but not limited to video and still images.
m. A permanent delegate or supervisor on land to communicate with while at sea.
n. Provision of personal protective equipment, including personal locator beacon.
o. Ability to decline to board a vessel if safety issues are detected, such as expired life rafts, restricted capacity of the rafts, expired fire extinguishers, malfunctioning safety equipment, inadequate accommodations, etc., and communicate the safety issues to the vessel captain, observer provider, Secretariat, and flag State.
p. Timely medical attention in case of illness or injury.
q. Upon request, receiving reasonable assistance of the crew to perform their activities including sampling, handling large specimens, releasing incidental specimens, measurements, etc.

2. The responsibilities of the observers shall include:

a. Being capable of performing the duties set out by the Commission.
b. Accurately recording sampling data and writing reports as directed by the Commission.
c. Successfully completing training, and receiving satisfactory evaluation of performance after each cruise and briefing according to standards set by the Commission in order to be certified annually as an observer of the SPRFMO OP.
d. Carrying identification documents issued by the designating Member or CNCP in a form approved by the Commission.
e. Acceptance and compliance with agreed upon confidentiality rules and procedures with respect to the fishing operations of the vessels and of the vessel owners.
f. Maintenance of independence and impartiality at all times while on duty in the SPRFMO Observer Programme.
g. Compliance with SPRFMO Observer Programme protocols for observers carrying out SPRFMO Observer Programme duties on board a vessel.
h. Compliance with the laws and regulations of the Member or CNCP that exercises jurisdiction over the vessel.
i. Respecting the hierarchy and general rules of behavior that apply to all vessel personnel.
j. Performance of duties in a manner that does not unduly interfere with the lawful operations of the vessel and in carrying out their functions they shall give due consideration to the operational requirements of the vessel and shall communicate regularly with the captain or master of the vessel.
k. Following a mechanism established by the Commission for the resolution of conflicts.
l. Familiarity with the emergency procedures aboard the vessel, including the locations
of life rafts, fire extinguishers, and first aid kits.
m. Communicating regularly with the vessel captain on relevant observer issues and duties.

n. Observance of ethnic traditions of the crew and customs of the flag State of the vessel.
o. Refraining from actions that could negatively affect the image of the SPRFMO Observer Programme.
p. Adherence to any SPRFMO codes of conduct for observers.
q. Promptly writing and submitting reports to the Commission or national programme in accordance with procedures adopted by the Commission.
r. Before boarding the vessel, ensure that the embarkation point is free of obstacles, and wear a personal flotation device and take appropriate safety precautions when embarking and disembarking.
s. Communicating at least once a day with the program managers on land.

Annex B: Rights and Responsibilities of Vessel Operators, Captain and Crew

1. The rights of vessel operators and captains shall include:

a. Expectation that at least [15] days of prior notice of the placement of SPRFMO Observer Programme observers shall be given.
b. Expectation that the observers will comply with the general rules of behavior, hierarchy, and laws and regulations of the Member or CNCP that exercises jurisdiction over the vessel.
c. Timely notification from the observer provider on completion of the observer's trip of [describe specific information to be shared – sampling information, other information?] to the vessel owner for review. The captain shall have the opportunity to review and comment on this information, and shall have the right to include additional information deemed relevant or a personal statement. [Discussion is needed to clearly specify which data can be shared with vessel owners and operators and which data is confidential and cannot be shared].

The SC agrees that discussion is needed to ensure independence and impartiality of the report.

d. Ability to conduct operations of the vessel without undue interference due to the observer's presence and performance of necessary duties.
e. Ability to assign, at his or her discretion, a vessel crew Member to accompany the observer when the observer is carrying out duties in hazardous areas.

2. The responsibilities of vessel operators and captains shall include:
a. Accepting onboard the vessel one or more persons identified as an under the SPRFMO Observer Programme when required by the Commission.
b. Ensuring vessels operating in the SPRFMO Area include certified sample stations and/or other equipment (such as MCP scales and/or flow scales) to the extent that there are established standards set by the Commission for different types of vessels.
c. Maintaining an inspection report of the sample stations, and make a station diagram available to the observers.
d. Not altering the sample stations unless approved by the Commission.

e. Informing the crew of the timing of the SPRFMO Observer Programme observer boarding as well as their rights and responsibilities when an observer from the SPRFMO Observer Programme boards the vessel.
f. Assisting the SPRFMO Observer Programme observer to safely embark and disembark the vessel at an agreed upon place and time.
g. Giving notice to the SPRFMO Observer Programme observer at least fifteen (15) minutes before the start of a set or haul onboard, unless the observer specifically requests not to be notified.
h. Allow and assist the SPRFMO Observer Programme observer to carry out all duties safely.
i. Allowing the SPRFMO Observer Programme observer full access to the vessel's records including vessel logs and documentation for the purpose of records inspection and copying.
j. Allowing reasonable access to navigational equipment, charts and radios, and reasonable access to other information related to fishing.
k. Permitting access to additional equipment, if present, to facilitate the work of the SPRFMO Observer Programme observer while onboard the vessel, such as baskets, scales, high powered binoculars, photo cameras, stationary, electronic means of communication, safety gear (life vests, hard hats, immersion suits, strobe lights, personal locator beacons) etc.
l. Allow and assist the SPRFMO Observer Programme observer to remove and store samples from the catch.
m. The provision to the SPRFMO Observer Programme observer, while onboard the vessel, at no expense to the observer or the SPRFMO Observer Programme observer's provider or government, with food, accommodation, adequate sanitary amenities, and medical facilities of a reasonable standard equivalent to those normally available to an officer onboard the vessel.
n. The provision to the SPRFMO Observer Programme observer, while onboard the vessel, insurance coverage for the duration of the observer's time onboard the vessel.
o. Allow and assist full access to and use of all facilities and equipment of the vessel that the observer may determine is necessary to carry out his or her duties, including full access to the bridge and any internet capabilities, fish onboard, and areas which may be used to hold, process, weigh, and store fish.
p. Ensuring the SPRFMO Observer Programme observer is not assaulted, obstructed, resisted, delayed, intimidated, interfered with, influenced, bribed or is attempted to be bribed in the performance of their duties.
q. Following an established mechanism adopted by the Commission for solving conflicts.

3. Rights and responsibilities of vessel crew shall include:

a. Expectation that the SPRFMO Observer Programme observer will comply with the general rules of behavior, hierarchy, and laws and regulations of the Member or CNCP that exercises jurisdiction over the vessel.
b. Expectation that a reasonable period of prior notice of the placement of a SPRFMO Observer Programme observer shall be given by the Captain.

c. Reasonable expectation of privacy in crew personal areas.
d. Ability to carry out duties associated with normal fishing operations without undue interference due to the SPRFMO Observer Programme observer's presence and performance of their necessary duties.

4. The responsibilities of the vessel crew shall include:

a. Not assaulting, obstructing, resisting, intimidating, influencing, or interfering with the SPRFMO Observer Programme observer or impeding or delaying observer duties.
b. Compliance with regulations and procedures established under the Convention and other guidelines, regulations, or conditions established by the Member or CNCP that exercises jurisdiction over the vessel
c. Allowing and assisting full access to and use of all facilities and equipment of the vessel which the observer may determine is necessary to carry out his or her duties, including full access to the bridge, fish onboard, and areas that may be used to hold, process, weigh and store fish.
d. Allow and assist the SPRFMO Observer Programme observer to carry out all duties safely.
e. Allow and assist the SPRFMO Observer Programme observer to remove and store samples from the catch.
f. Compliance with directions given by the vessel captain with respect to the SPRFMO Observer Programme observer duties.

5. The responsibilities of the vessel captains shall also include providing a safety orientation to the observer on boarding and before the vessel leaves the dock and ensure that the observer completes a vessel safety checklist. The orientation shall include:
a. Safety documentation of the vessel.
b. Location of life rafts, raft capacities, observer´s assignment, expiration, installation, etc.
c. Location of emergency radio beacons indicating position in case of emergency.
d. Location of immersion suits and personal floating devices, their accessibility, and the quantities for everyone onboard.
e. Location of flares, types, numbers, and expiration dates.
f. Location and number of fire extinguishers, expiration dates, accessibility, etc.
g. Location of life rings
h. Procedures in case of emergencies and essential actions of the observer during each type of emergency, such as a fire on board, recovering a person overboard, etc.
i. Location of first aid materials and familiarity with crew members in charge of first aid.
j. Location of radios, procedures for making an emergency call, and how to operate a radio during a call.
k. Safety drills.
l. Safe places to work on deck and safety equipment required.
m. Procedures in case of illness or accident of the observer or any other crew member.