South Pacific Regional Fisheries Management Organisation

Scientific Committee
Honolulu, Hawaii, USA
1-7 October 2014

REPORT OF THE 2nd SCIENTIFIC COMMITTEE MEETING

1. Welcome & Introductions

The participants were welcomed to the meeting by Dr James Ianelli, Chair of the Scientific Committee (SC) at the start of proceedings, and participants introduced themselves.

2. Adoption of Agenda

The Chair sought proposed changes to the Draft Agenda. A proposal to expand the scope of Agenda Item 8 with 4 sub-items was discussed and accepted. A proposal to add an Agenda Item to discuss the creation of a Monitoring Working Group (WG) was discussed, and it was agreed that the existing Agenda could accommodate such a discussion. The revised agenda is attached as Annex 1.

3. Administrative Arrangements

Administrative arrangements were presented by the Chair.

3.1 Meeting documents

Meeting documentation, location and access was presented, including a final updated document list (SC-02-INF-01). The list of participants is attached as Annex 2.

4. Nomination of Rapporteurs

Rapporteurs were assigned to general agenda items and included: Niels Hintzen (European Union), Ad Corten (European Union), Matthew Flood (Australia), Aquiles Sepúlveda (Chile), and Geoff Tingley (New Zealand).

5. Discussion of Participant Reports

Annual Reports were provided for this meeting by Australia, Chile, China, Colombia, Ecuador, European Union, Korea, New Zealand, Peru, Chinese Taipei, United States of America and Vanuatu (papers SC-02-03 to 09, 15 to 18, and 22 to 25). Participants made brief presentations of their reports and provided answers and explanations in response to questions. Vanuatu was not represented at the meeting though their report was available.

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

A discussion about possible bias of size sampling data from fisheries observers followed the EU presentation. The EU suggested to develop a protocol for bird observation data (see item 8.5). The report of Chinese Taipei showed a drop of CPUE during the last two years when fishing inside the Peruvian EEZ was no longer possible. In this context, it was observed by the group that jumbo squid abundance off Southern Chile was decreasing.
The move-on rule for vulnerable ecosystems was discussed in conjunction with New Zealand's presentation. This rule has only rarely been triggered partly because the industry tends to avoid fishing in areas where this rule could be triggered.
The Australian report will be amended to indicate that the fishery predominantly takes adult alfonsinos. Also, it was remarked that the bottom fishing footprint of SPRFMO, which is based on fishing activities from 2002 to 2006, would be much larger if historic activities were included.
Chile is including hydro-acoustic data in its stock assessments. The country also indicated that they adjusted their calculation of CPUE to take into account a recent shift of fishery areas as well as the use of fishing days as an indicator.
Peru's report on SPRFMO fisheries ensued a number of questions related to recent prolonged fishing activities of five Peruvian vessels in the Convention area without reporting any catches. These could not be answered at the time of the meeting as observer information from these vessels was not yet available. Peru's national report on jack mackerel stocks in its jurisdictional waters was received with much interest, in particular with regard to the interpretation of bio-acoustic survey data.
Ecuador presented its annual report and also a brief analysis of the presence of eggs and larvae of jack mackerel in Ecuadorian waters detected through monitoring programs and research cruises.
With regard to the Korean report, it was noted that the length-frequency data from Korea are comparable to those from EU vessels. Also, Korea informed the meeting that their observers had not recorded any by-catch of birds or mammals.

6. Jack Mackerel Working Group

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

As directed by the Commission, the SC continued to evaluate alternative stock structure hypotheses and the consequences of alternative management approaches.

6.1.1. Inter-Sessional Stock Assessments of Jack Mackerel

The Peruvian National Report (SC-02-17) referred to an assessment of the far north stock for 2013 and an updated 2014 assessment.

A number of activities where the potential for fishing vessels to be used as a means to collect information usable in the assessments of the status of resources was also presented and discussed. The Peru National Report No 1 (Paper SC-02-16_rev1), shows that annual catches of Jack mackerel in the Convention area by the Peruvian fleet have been highly variable, with a clear declining trend since 2010 and no catches in late 2013 and the first part of 2014. The Peru National Report No 2 (Paper SC-02-17) updated information on the environment, the biology, the fishery and the assessment of Jack mackerel in Peruvian jurisdictional waters. The report noted that these updated observations were well in line with earlier observations transmitted to this Committee supporting the prevailing hypothesis that the "Jack mackerel caught off the coasts of Peru constitute a separate stock from that caught off central-southern Chile". Paper SC-02-17 also reports on the development of El Niño conditions in early 2014 while confirming the prevalence of environmental and biological conditions, consistent with the persistency of a mid-term colder scenario favorable for the anchoveta but not so favorable for the development of jack mackerel, also described as a low regime for Jack mackerel off Peru.

Hugo Arancibia (Oceana) presented an independent analysis (SC-02-INF-07) of the assessment for jack mackerel using some alternative assumptions about density dependent catchability changes and heterogeneous spatial structure. Results on biomass were similar to the Joint Jack Mackerel assessment results except for 2000-2009.

Fishing fleets can collect substantially more information than single research vessels can do on their own. The SC heard four presentations, one from SNP [Ulises Munaylla], IREA (Pedro Trillo), the EU (Francois Gerlotto, see 6.5), and Chile (Aquiles Sepulveda). Dr. Ulises Munaylla, Scientific Adviser of the National Fishery Society of Peru made a presentation on the report of 5th Workshop on diagnosis of the status of jack mackerel in Peru (September 3- 5, 2014), using data recorded onboard fishing vessel (SC-02-JM-12). Dr. Pedro Trillo from the Aquatic Resource Institute IREA (Peru) presented work undertaken by his institute and of interest to the SPRFMO. He highlighted activities performed in relation to jack mackerel, e.g. an International Workshop in 2013 in Manta, Ecuador, the International Workshop on Fishing Vessels as Scientific Platforms in Lima, Peru in 2014 and the publication of a special Fisheries Research issue. Also, the institute is involved in ongoing studies on the use of fishing vessels as scientific platforms (e.g. big data project, see also proposal by Francois Gerlotto below under 6.5).

A presentation made by Aquiles Sepúlveda about the use of Chilean fishing vessels to collect scientific information since 1996/1997, starting with the monitoring of echosounders and surveys developed extending far from the coast (out to 1000 nm). Since 2000, scientific acoustic devices and software were used by the Fishery Research Institute in 6 vessels, to initiate observations of mean density of schools in relation to oceanographic features. A formal procedure was also implemented that consider a standard calibration of acoustic echosounders and to study complexity in life history and distribution of jack mackerel and to provide independent indices for stock assessment.

The SC discussed at length the various activities and how they might best be used going forward to supplement the assessments and alternative model configurations.

6.1.2. Inter-Sessional Progress with the Jack Mackerel Stock Structure Research Programme

Ad Corten presented a paper (SC-02-JM-03) describing a hypothesis on the movement of the 2008 year class from South-Central Chile into Peruvian waters. Discussion on the presentation focused on the possibility that the recruits appearing in Peruvian waters could also have originated from the Peruvian zone itself. Other questions raised were whether the 2008 year class truly can be considered as a strong one. Also, why didn't the Chilean Northern fishery catch more of these fish as the fish presumably moved from central Chile towards Peru. Ad Corten indicated that environmental conditions, in particular the occurrence of a La Nina in the second half of 2010, could have accelerated the northward transport of the juveniles, thereby limiting the catch in Northern Chile. The discussion furthermore focused on the usefulness of tagging studies to track migration routes of jack mackerel and better understand population structure.

Niels Hintzen reviewed the activities that have occurred under the EU project on stock structure and management. Four different activities were undertaken. A review of existing knowledge on stock structure in the peer-reviewed and grey literature, modelling of suitable habitat for jack mackerel, spatial modelling of the population using a configuration of the SEAPODYM model and management strategy evaluations including investigations of risk of overexploitation when failing to appropriately account for stock structure in management.

6.1.3. Inter-Sessional Progress with Jack Mackerel Age/Growth Task Team

The terms of reference for the Task Team were developed at the 1st SC Meeting from the mandate for/of the Science Working Group resulting from the otolith interpretation and ageing workshop held in 2011. Rodolfo Serra, general coordinator of the Task Team, reported some minor advances; otolith samples for daily rings work were sent from Chile to Peru, and Peru sent to Chile a sample for whole otolith readings to complete a collection of otoliths sampled from Ecuador, Peru and Chile.

A working plan from Peru was requested to advance the daily rings work in order to have results to report back to the SC at the next meeting.

Chile gave a short presentation about the work done to review and validate the age reading in jack mackerel over recent years.

6.1.4. Acoustic survey standardization

Peru presented an update of their research into applications of scientific acoustic surveys. The acoustic biomass of jack mackerel off Peru is directly estimated by summer surveys (targeting anchoveta) and tracking the coastal zone of the Peruvian sea (from the coastline to 100 nautical miles offshore). An attempt has been made to standardize this index to correct the bias in the distribution of jack mackerel in relation with the area covered by the survey using a "potential habitat model." This model estimates the probability of jack mackerel presence a function of environmental variables like sea surface temperature, salinity, water mass, oxycline depth and chlorophyll-a concentration. However, this approach needs further development due to issues related length frequency sampling of fish making up the backscatter. The size frequency information (or lack thereof) can be an important source of uncertainty in converting acoustic backscatter to jack mackerel biomass estimates, particularly in recent years. Therefore, the Peruvian delegation proposed a new index based on backscatter. This index is estimated as the sum of all the nautical area backscattering coefficients (S_A) recorded during the surveys. This overcomes a limitation of the traditional acoustic biomass estimation which requires length frequency data--data which are often scarce relative to the backscatter. The proposal is that backscattering index would be a better proxy of the actual abundance than the acoustic biomass conversions. IMARPE is planning a workshop to review the different abundance indices based on acoustic information to improve the quality of the information used in stock assessments and the results related to jack mackerel will be informed to the SPRFMO's Scientific Committee at its next session.

The SC discussed these issues at length and accepted the application of this new index as a sensitivity rather than in the base-case (Models 1.1 and 1.1n; see Annex 4) recognizing that additional work is needed. The SC looks forward to results from the planned workshop so that this type of index may become considered as part of the base-case assessment in the future.

6.2. Jack Mackerel Stock Assessments

6.2.1. Updating of data sets for additional stock assessment runs

The Secretariat provided an updated historical catch data series to 2013 and provided forms for completing catches through 2014 as best estimates for use in the assessments. Changes to this data series included the final 2012 and 2013 figures as advised by Members and CNCPs and the best information on expected 2014 catches. The 2014 estimates were based on applying the mean observed percentage difference between the 2010-2013 provisional figures and the final 2010-2013 figures for the offshore fleet. Adjustments based on participant's knowledge were applied for the other three fleets.

The complete catch data series used in the assessment is shown in Annex 4.

6.2.2. Selection and specification of base-case assessment, and specification of additional stock assessment sensitivity runs to be conducted

As in past years, the assessment process first evaluates the influence of new data. A set of sensitivities was then evaluated and a final set of base-case runs was selected based on a number of factors as presented in Annex 4.

6.2.3. Conducting of additional stock assessment runs

From the base-case models, alternatives were developed for different productivity scenarios based on uncertainty in the stock-recruitment relationship and environmental conditions. This provides the basis for short-and medium-term projections.

6.2.4. Synthesis and summary of key results from all stock assessment runs conducted

Conditions for the jack mackerel stock remain at low levels and new information is consistent with the results from previous assessments. Fishing mortality rates in the past three years have decreased and this, along with modest improvement in recruitment, has contributed to the estimated increase in biomass. Results are summarised in Annex 4. During the meeting a series of alternatives were examined, including the two-stock models. To evaluate these, the negative-log likelihood components were presented to evaluate trade-offs between different data components and model assumptions. It is important to note that some values in this table for some subsets of models cannot be compared because data weightings may differ.

Models 2.3 (and complementary Models 2.3n and 2.3s) were selected as the base case. Models 2.0-2.2 were to reflect alternative productivity regimes (i.e., resiliency and carrying capacity as effectively modeled through stock-recruitment steepness and the unfished mean recruitment level). Model 2.3 was selected since it was most precautionary for near-term productivity expectations.

Results from two-stock models show similar trends in the biomass compared to those using the same model configurations used for the single stock options. One difference was that the two-stock model showed higher historical stock abundances. In particular, results for the southern stock are very close to the single combined stock results, and main differences are related to high levels of abundance for the north stock in the early period. The fit to the individual indices and age and length composition information was better in the two stocks model. This can be related to a different model structure (two stocks) or the increase in the number of parameters (independent recruitments, and natural mortality assumption for each stock). Full statistical comparisons between the models were difficult due to the differences in the number of parameters and model structures, and more efforts on model comparisons between alternative population structure hypotheses should be carried out, since this would have an impact in the management of the jack mackerel population.

Model 2.3 results indicate that the SSB increased from a 2013 estimate of 2.4 million t to a 2014 estimate of 2.7 million t (other models also indicated similar increases). Recruitment appears to remain in a low productivity phase. This increase in estimated SSB reflects increases apparent in the indices used in the models.

As presented at the last SC meeting, there are a number of key uncertainties associated with both the assessment and projections both in estimation and expectations of future environmental conditions. These have been addressed by exploring different assumptions in model runs and comparing the results. Key uncertainties in the assessment include:

- **Stock structure**: considered through applying both single and two stock models.
- **Natural mortality, *M***: highly uncertain, assumed constant for all ages and through time in the accepted models (M = 0.23). Models 1.5-1.8 evaluated a profile of alternative M values (results indicate much higher values fit the data better but this results in unrealistically high biomass estimates).

- **Input data quality**: a number of model runs excluded various data components and others changed the weighting of different data components.

Changes in regime may affect future recruitment levels, which in turn will affect estimates of biomass through projections. Uncertainties about environmental regimes have thus been addressed through the range of scenarios used in the projections with differing values of recruitment regimes and stock recruitment steepness parameters.

Projections using the entire time series of recruitment (1970-2012) under the assumption of constant fishing mortality equal to 2014 levels (Models 2.0 and 2.2) indicate that the biomass is expected to increase over the next 10 years, eventually reaching B_{MSY} in about 5 years. Projections using recruitment levels from 2000-2012 (a period of lower productivity compared to that prior to 2000; Models 2.1 and 2.3) indicate that the biomass is expected to increase over the next 5 years but then stabilize at a point below the provisional B_{MSY}.

6.3. Advice to the Commission on jack mackerel stock status

A two page summary of the advice on Jack mackerel is provided in Annex 3

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 model specification uncertainties. 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. Considerable improvements on the ability to run models over different hypotheses (e.g., stock structure) by participants were developed intersessionally which facilitated the ability to analyze the available data. Now that the assessment approach has matured and advice has been relatively stable over the past three years, the SC considered providing advice over at least two years. This would provide more time for the SC to consider other agenda items more fully. In many settings, TACs are in place for a number of years and in intervening years stock status indicators are used for "update" assessments. Updates typically involve simply adding catch and standard information and apply an accepted assessment model configuration for conducting TAC advice. Periodic "benchmark" assessments such as what has been done for the past three years are typically done less frequently.

Conditions for the jack mackerel stock remain at low levels and new information is consistent with the results from 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 (2000–2012) indicate that if fishing mortality is maintained at or below 2014 levels the likelihood of spawning biomass increases are improved. This results in catches for 2015 on the order of 460 kt or lower. Fishing effort in the next 10 years at or below current (2014) levels are projected to have a reasonably good probability of increased spawning biomass from the current level of 2.7 million t with projected increase to 3.2 million t in 2015 (with approximate 90% confidence bounds of 2.5 - 4.1 million t).

- **The Commission should aim to maintain 2015 and 2016 catches for the entire jack mackerel range in the southeast Pacific at or below 460 kt.**

However, should indicators of recruitment continue to be positive (as will be evaluated at SC-03), increasing the TAC in 2016 (see Table 1 below) may be appropriate.

Table 1. Summary results for the short-term predictions for models 2.3 and 2.0 (a more optimistic scenario). 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 tonnes of spawning biomass in all cases.

Model 2.3, steepness=0.65, recruitment from 2000-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,226	1%	0	0
0.50	3,901	0%	240	300
0.75	3,753	0%	350	430
1.00	3,613	0%	460	550
1.25	3,481	0%	570	660

Model 2.0, steepness=0.8, recruitment from 1970-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,569	4%	0	0
0.50	4,241	1%	240	300
0.75	4,091	0%	350	430
1.00	3,948	0%	460	550
1.25	3,814	0%	570	660

The Commission notes the following in their roadmap to the SC:

> *Consider a range of exploitation levels and present the probabilities that the spawning stock biomass will reach target and limit reference points in 2015, and also 10 and 20 years into the future. In the absence of a target reference point, provisional values shall be used.*

The results addressing these requested projections are given in Table 1 for short-term consideration and Table 2 for longer-term projections. In the latter table, Model 2.2 assumes long-term average recruitment conditions may be more applicable (assuming that the environment is conducive to a more normal recruitment productivity regime). Example population trajectories under the different fishing mortality rate multipliers and productivity scenarios is shown in Figure 2.

Table 2. Summary results for the medium and long term predictions for models 2.0-2.3. 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 (for 2.3).

Model 2.0, steepness=0.8, recruitment from 1970-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	B_{2024}	$P(B_{2024} > B_{MSY})$	B_{2034}	$P(B_{2034} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,569	4%	12,874	100%	18,456	100%	0	0
0.50	4,241	1%	9,428	98%	11,749	98%	240	300
0.75	4,091	0%	8,248	94%	9,843	94%	350	430
1.00	3,948	0%	7,300	86%	8,432	86%	460	550
1.25	3,814	0%	6,524	75%	7,349	75%	570	660

Model 2.1, steepness=0.8, recruitment from 2000-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	B_{2024}	$P(B_{2024} > B_{MSY})$	B_{2034}	$P(B_{2034} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,283	1%	8,198	97%	8,892	97%	0	0
0.50	3,957	0%	5,482	49%	5,387	49%	240	290
0.75	3,808	0%	4,628	20%	4,453	20%	350	420
1.00	3,668	0%	3,977	6%	3,779	6%	460	540
1.25	3,535	0%	3,469	1%	3,270	1%	570	650

Model 2.2, steepness=0.65, recruitment from 1970-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	B_{2024}	$P(B_{2024} > B_{MSY})$	B_{2034}	$P(B_{2034} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,434	2%	11,891	100%	18,612	100%	0	0
0.50	4,109	0%	8,468	95%	11,427	95%	240	290
0.75	3,960	0%	7,294	86%	9,342	86%	350	420
1.00	3,819	0%	6,351	71%	7,786	71%	460	540
1.25	3,685	0%	5,580	52%	6,586	52%	560	650

Model 2.3, steepness=0.65, recruitment from 2000-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	B_{2024}	$P(B_{2024} > B_{MSY})$	B_{2034}	$P(B_{2034} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,226	1%	7,979	96%	8,949	96%	0	0
0.50	3,901	0%	5,257	41%	5,217	41%	240	290
0.75	3,753	0%	4,396	14%	4,207	14%	350	420
1.00	3,613	0%	3,737	3%	3,473	3%	460	540
1.25	3,481	0%	3,221	0%	2,919	0%	570	650

Model 2.3 North + South, steepness=0.65, recruitment from 2000-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	B_{2024}	$P(B_{2024} > B_{MSY})$	B_{2034}	$P(B_{2034} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	5,152	16%	9,483	94%	10,042	93%	0	0
0.50	4,784	6%	6,485	58%	6,330	47%	240	290
0.75	4,616	4%	5,523	30%	5,284	20%	350	420
1.00	4,458	2%	4,776	10%	4,501	5%	470	540
1.25	4,309	1%	4,183	3%	3,888	1%	570	640

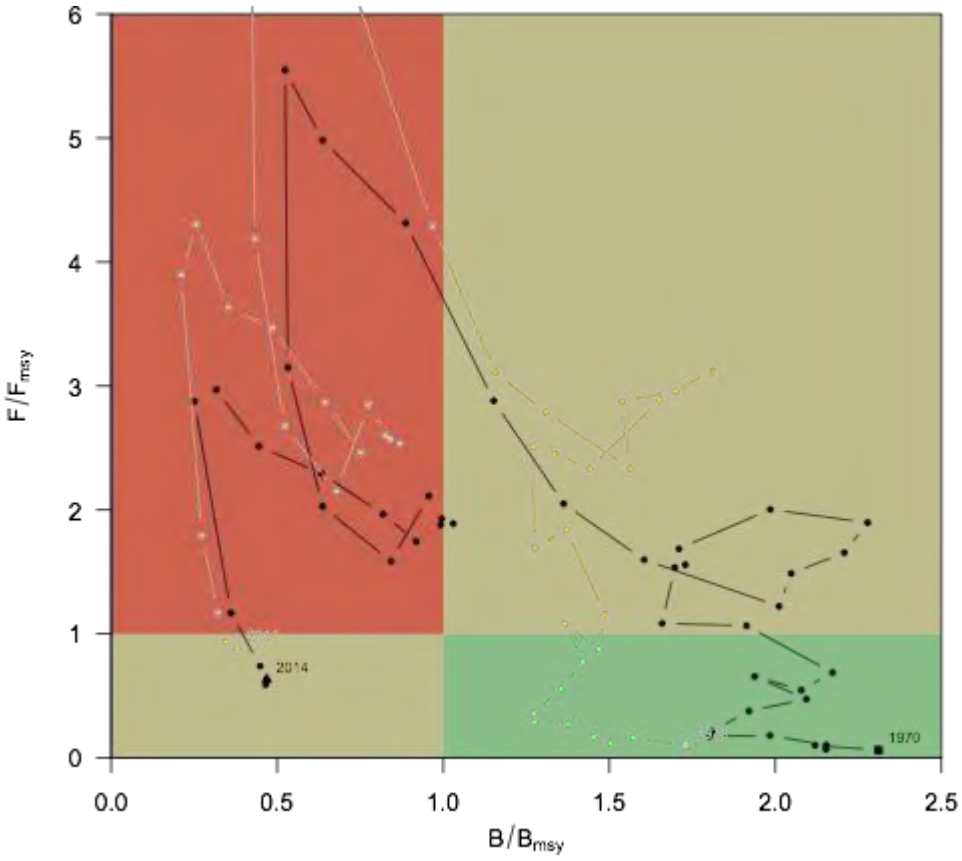

Figure 1. Phase plane (or "Kobe") plot of the estimated trajectory for jack mackerel under Model 2.2 (steepness = 0.65; black line) compared with Model 2.0 (pale line, steepness = 0.8; higher productivity) with reference points set to F_{MSY} and B_{MSY} estimated for the time series 1970-2012.

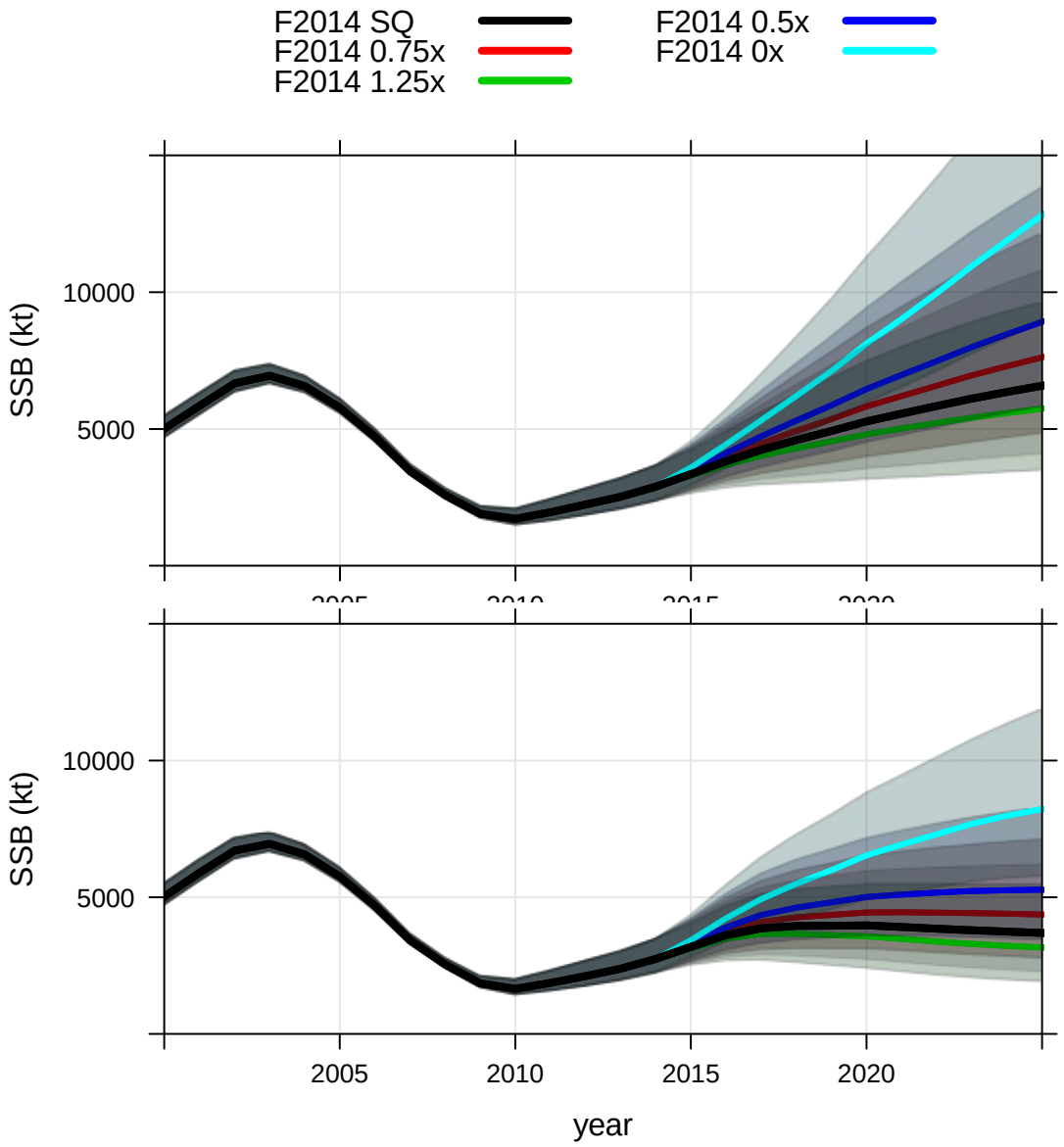

Figure 2. Projections of jack mackerel population trajectories for different multipliers of the estimated 2014 fishing mortality rate under models 2.2 (recruitment from 1970-2012; top) and 2.3 (recruitment from 2000-2012; bottom). The provisional B_{MSY} is 5.5 million t.

6.4. Review and evaluate the rebuilding plan adopted by the 2nd Commission Meeting

The Road Map requested the SC consider a range of exploitation levels and present the probabilities that spawning biomass will reach target and limit reference points (or their proxies) in 2016, and also 10 and 20 years into the future.

Under the request by the Commission to review the proposed rebuilding plan, two working documents were presented (SC-02-JM-04, SC-02-JM-09). Both documents describe various methods developed to evaluate the proposed and alternative harvest control rules (HCR). The results of these evaluations show a number of performance indicators for the tested HCRs. Performance indicators included, among others, annual expected catch levels, variability in catch, rebuilding time to B_{MSY} and probability of reaching B_{MSY} in the medium term.

The EU presented an evaluation of the proposed HCR for rebuilding jack mackerel (SC-02-JM-04) under a full management strategy evaluation considering stochastic projections. Outputs of the 2013 jack mackerel stock assessment were used as the basis for these evaluations and a number of performance indicators were estimated. The rebuilding plan proposed by the Commission shows a moderate increase in SSB compared to other alternative strategies. The performance of proposed HCRs improves in the medium and long term projections (10 and 20 years).

The approach presented in paper SC-02-JM-09 was developed to evaluate the HCR that appears as Annex K of CR-02. For comparisons, its performance is summarized against two of the alternative types of HCRs from the paper: one using alternative constant F values and another in which F declines proportional to biomass when the stock is below 80% of B_{MSY} (and is at a fixed F_{MSY} rate at higher stock sizes) Results showed that the Annex K HCR performed well in terms of rebuilding relative to the others but had high inter-annual catch variability—mainly due to simulation cases where the fishery would be required to close. The other two types of HCRs had lower catch variability but generally slower rebuilding times.

It is considered essential, along with an analysis of the HCR's, a definition of the base case in the stock assessment as well the fishing mortality and spawning biomass values that will be considered as references to assess the rebuilding plan of the jack mackerel population.

A subset of alternative HCRs, and performance indicators, was prepared by the Scientific Committee for consideration by the Commission. Six HCRs were selected and are presented with an overlay of a qualitative color ramp to visualize differences between plans, given in Table 3.

Table 3. Example set of medium-term performance indicators (rows) for alternative harvest control rules (HCRs; columns) based on work presented in SC-02-JM-04 and through interactions with SC participants.

	F target of 0.13	F target of 0.2	B target of 5.5mt	Annex K	Adjusted annex K	Sloping rule
Prob < Bmsy (%)	96	100	73	98	95	100
Catch (1000 tonnes)	654	761	46	554	586	793
TAC variability (%)	13	17	791	114	15	12
Prob decline SSB (%)	26	66	4	12	10	49
Recovery time to Bmsy (yr)	12	29	3	12	6	24

Due to the current low recruitment and abundance, all HCRs result in high probabilities that the stock will remain below the target in the medium term.

HCR F=0.13 yields catches of approximately 650 kt with minimal catch variation but greater chance of further declines in SSB. HCR F=0.2 would provide greater yields (~F_{MSY}) but would reduce the chance of rebuilding the stock.

The "Annex K" HCR from the Jan 2014 Commission report is estimated to provide reasonable recovery times relative to the others but is characterized by high interannual variability and can result in complete fishery closures should a period of low recruitments occur. Catches are expected to stabilize at around 550 kt.

A refinement to the Annex K HCR (Adjusted Annex K) includes a rule to stabilize TACs. Under this option, if SSB is greater than 80% of B_{MSY}, the TAC is not allowed to vary by more than 15% from year to year. Under this plan, TAC fluctuations are significantly lower and catch stabilizes at around 600 kt. This HCR outperforms others in minimizing the chance of SSB declines and recovery time to B_{MSY}.

The sloping HCR simply ramps fishing mortality proportional to SSB when the stock is below B_{MSY} and when above, F equals F_{MSY}. This HCR results in higher catches compared to the other plans but the trade-off is a long recovery period and higher chance of further declines in SSB.

The current guidance and advice to the Commission is clear in the short term and advice presently provides estimates of the probability of achieving target spawning biomass levels.

Recognizing that SPRFMO will likely revisit the data and assessment of jack mackerel on a regular basis, there is no immediate urgency to select a specific HCR and the SC and Commission should be able to proceed at a deliberate pace to ensure quality.

- **The SC requests that the Commission provide guidance on the types of performance indicators they would like to have in order to evaluate policies relative to their objectives.**

6.5. Future jack mackerel research program and identification of short term research and assessment requirements

Data workshop. The SC discussed convening a workshop on the data that comprise the inputs to the current assessments. Presently there are a number of questions about the sources and extensiveness of different data components, and this information is needed in order to apply appropriate weights to the model components. Guidelines are needed to provide more efficient and consistent approaches to bringing new data to the assessment process and in submitting those data to the Secretariat. The SC noted that there are confidentiality issues associated with some commercial and proprietary scientific data.

Future plans to make a spatially disaggregated model would also benefit from a clearer understanding of the data.

Enhanced use of fishery dependent acoustic data. The SC was requested to establish a Task Group on the Standardization of Acoustic Data from commercial fishing vessels with the following objectives:

- Establish common protocols (settings of the instruments and calibration procedures; definition of indicators; etc.)
- Develop collaborative approaches for providing contributions to an ecosystem approach to stock assessment and the provision of ecological and fishing information to SPRFMO
- Develop a "methodological package" to allow potential users to process their own data under an agreed international format.

- **The Task Group was proposed for three years under the chairmanship of François Gerlotto (IREA). Participation would be open to all interested Members, CNCPs and Observers. Specialists in acoustics would also be encouraged to join.**

The working programme of the Task Group would follow the recommendations of the workshop on "Fishing vessels as scientific platforms". The Task Group would set up an annual workshop and work intersessionally through remote communication means. For the first year, it was recommended that the Task Group work on the development of a protocol for vessel calibration. The Task Group should report to the SPRFMO Scientific Committee and work in collaboration with the ICES WGFAST and the International Advisory Committee of IREA to avoid any duplication and to ensure the scientific quality of its work.

The activities of the Task Group would be supported by IREA (through its regular work) and by already committed contributions from fishing companies. Other sources of funding would be explored. Travel expenses would be covered by participants.

Biological reference points. Biological Reference Points (BRPs) were evaluated in document SC-02-JM-10 which summarised the results of three workshops held in Chile with the participation of international experts. Based on a steepness of h=0.67, the ratio B_{MSY}/B_0 was estimated to be around 0.35, the mean value of F_{MSY} = 0.25 (fully recruited fraction) and B_{MSY} was estimated to be 5.9 million tonnes. If steepness is considered uncertain, and B_{MSY} is determined using a proxy (45% SPR0), the level of B_{MSY} reaches 7.6 million t (which has implications for current stock status being much further below B_{MSY}).

There were discussions at the SC on the complexities related to defining limit reference points. The feasibility of estimating B_{MSY} based on biological characteristics is made difficult by factors such as environmental change and regime shifts. It was shown (see advice sheet) that reference points, even under assumptions about underlying productivity, vary over time. The SC encouraged further work evaluating factors affecting BRPs.

7. Deepwater Working Group

The working group Chair, Rodolfo Serra, welcomed Members. A minor change was made to the draft agenda (an item was duplicated).

7.1. Inter-Sessional assessments of deepwater species

These papers were dealt with under item 7.3.

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

There were no applications to fish outside the footprint or above reference period catch levels.

7.3. Planning SC activities to inform the review of CMM 2.03 (bottom fishing)

Paper SC-02-DW-01 from New Zealand reviewed previous work on VME thresholds to ensure that current data support the continued use of these thresholds. The methodology previously agreed by the Science Working Group was used to test if 1) VME thresholds were appropriate, and 2) if the biodiversity component was appropriate. The principle findings of the paper were that threshold levels and the biodiversity aspect (i.e. the presence of three VME species in one tow as an indicator of VMEs) are appropriate. The move-on rule is infrequently triggered and at the right magnitude using the current move-on rules. New Zealand may use the outputs of this paper to review potential modifications to the move-on rule.

Paper SC-02-DW-02 from New Zealand explored requirements for the development of a new CMM for bottom fishing and how the science programme could progress this work. The current footprint is based on the period 2002–2006 but fishing in the area started in the 1980s and the extent of fishing effort has been much greater than described by the 2002-2006 footprint. New Zealand indicated that the time period was selected in relation to work done on jack mackerel and that it would be appropriate to revisit this with respect to the orange roughy fishery. It was indicated that work on this has already commenced. At SC-01, the SC advised that the environmental impact of the fishery should consider the whole historical footprint. The question of which areas to open and close to fishing would be best re-examined when considering the spatial management approach and the trade-off between environmental protection of VMEs and access by fisheries.

Australia thanked New Zealand for the paper and indicated that Australia will look forward to supporting New Zealand in any future work on this issue.

Paper SC-02-DW-03 by New Zealand presented current methodologies used around the world to assess data poor fisheries. New Zealand plan to apply a range of these methods to assess orange roughy stocks in the SPRFMO Convention Area. The proposed work will examine stock management boundaries and initial stock size (B0) estimates. The Deepwater WG requested that at the next WG meeting Australia consider providing information on the work CSIRO has done on data poor fisheries, to inform the WG of any techniques that may be of use in looking at target and bycatch species.

The issue of undertaking assessments of bycatch and non-target species was also briefly discussed by the WG. The WG noted that, with limited resources, it will be important to begin by concentrating on target species, and address the bycatch species at a later date.

Paper SC-02-10 by Geoff Tingley (New Zealand) considered the probability of bottom contact by midwater trawling for bentho-pelagic species. The paper showed that a minimum of 10 per cent of tows contacted the seabed, and if less certain indicators were considered this rose to 16 percent of tows. The data were also considered spatially, segregated by: open, closed (to bottom trawl) and move-on-rule areas. In general, the percentage of incidences of bottom contact in open areas was higher than in closed areas. Industry stated that they are less likely to hit the bottom in closed areas as they actively avoid bottom contact in the closed areas.

The paper was not about defining bottom trawling/midwater trawling, but rather about addressing the issue of protecting VMEs.

Information papers SC-02-INF-04 and SC-02-INF-05. The High Seas Fisheries Group (HSFG) proposed that spatial management of deepwater fisheries should consist exclusively of open and closed areas, arguing that this would provide more effective protection of fragile benthos than the present open, closed and 'move-on' approach. Given that trawl fishing occurs exclusively in relation to seafloor features, the HSFG proposed that management should be based on individual seafloor features, with open and closed areas defined in terms of seafloor features where fishing was allowed/not allowed. Areas could be defined to ensure that a sufficient fraction of each seafloor feature was closed to ensure the adequate protection of VMEs.

HSFG noted that a closed/open approach of management would be simple, hence enhancing both compliance and enforcement. Entire seafloor features of no interest for fishing could be closed; including a large proportion of seafloor features where bottom fishing is not possible or where known areas of VMEs occur (experience suggests low abundance of VME indicator taxa in areas of interest to fishers).

The HSFG also reported recent progress in acoustic surveys for deepwater species on the high seas using commercial vessels. The FAO had convened a workshop of experts to advise on ways forward (FAO Fish. Aquat. Circ. No 1059, 2012). An update was provided on the multi-frequency Acoustic Optical System (AOS) that can be deployed on commercial vessel trawl nets, and preliminary results were presented from the first survey undertaken in SPRFMO using this technology in July 2014 on the Challenger Plateau orange roughy straddling stock. The Secretariat was informed in advance that this survey would be conducted in 2014.

Multi-frequency acoustic systems are now viewed as the standard in New Zealand and Australia to provide robust biomass estimates from surveys where multiple species may occur and/or on steep slopes. The AOS, developed by CSIRO in Australia, has also provided more reliable estimates of acoustic target strength (TS) for the acoustic estimation of the biomass of deepwater species. Data on the TS for alfonsino were collected in 2014.

The AOS has been combined with mesopelagic sampling nets on the high seas for the Australian Integrated Marine Observing System (IMOS) programme on the Indian Ocean. Preliminary results indicated that a wide range of organisms contributed to the backscatter in pelagic acoustic surveys, with potential implications for SPRFMO surveys.

Work requested under paragraph 5 of CMM 2.03

(a) undertake an assessment of the likely impact of specific gear types, particularly trawl, on VMEs, to further inform the definition of bottom fishing

New Zealand undertook an evaluation of the potential impact on VMEs of using midwater trawl gear to target bentho-pelagic species close to the seabed (SC-02-10 “An assessment of the potential for near-seabed midwater trawling to contact the seabed and to impact benthic habitat and vulnerable marine ecosystems (VMEs)”). This evaluation concluded that, while there is evidence that this method of fishing leads to the midwater trawl gear touching the seabed during the normal course of operations for a minority of tows, any impact would be low due to the nature of the contact (point contact only).

Based on the presentation and discussion of paper SC-02-10, **the SC agreed that**:

- midwater trawling for bentho-pelagic species (e.g. alfonsino) falls under the description of “bottom fishing” as defined in paragraph 4 of CMM 2.03;
- midwater trawling for bentho-pelagic species has a low impact on the physical and biological habitat: a value of “2” on the five-point scale developed by Chuenpagdee et al., 2003 (noting that demersal trawling is rated as a “5” on this scale);
- midwater trawling for bentho-pelagic species is unlikely to cause significant adverse effects on VMEs.

- **The SC recommends that the Commission should modify CMM 2.03 to take into account the relative impact on VMEs of different fishing methods and practices, and to specifically address midwater trawling for bentho-pelagic species.**

(b) undertake stock assessments of principal deep-sea fishery resources targeted, and, to the extent possible, taken as bycatch and caught incidentally in these fisheries, including straddling resources

New Zealand has recently completed a stock assessment of the stock of orange roughy on the Challenger Plateau that straddles between the high seas on the New Zealand EEZ. This assessment is based on a long time series of combined trawl and acoustic surveys and a newly developed assessment model. This assessment was peer reviewed by a group including Australian and Canadian stock assessment scientists.

New Zealand is currently progressing the definition of stock management areas and the assessment of stock status for a number of orange roughy stocks in the SPRFMO Convention Area, and expects to report results at the next meeting of the SC in 2015.
Recent small-scale acoustic surveys of some orange roughy stocks in the SPRFMO Convention Area, as notified to the Secretariat, have been completed. Further planning for such surveys is on-going and the results of these surveys will be used to support stock assessment efforts, all of which will be reported to the SC.

(c) develop and provide advice and recommendations to the Commission on criteria for what constitutes evidence of an encounter with a VME, in particular threshold levels and indicator species

At SC 01 in 2013, the SC endorsed the following characteristics of effective move-on rules:

- Lists of regionally specific VME indicator taxa should be identified for each fishery, using all available information on species occurrence and retention by fishing gears.
- VME taxa should be specified at a level that facilitates rapid and accurate onboard visual identification by trained observers.
- Encounter thresholds indicating evidence of a VME should be based on analyses of historical bycatch data, taking account of the different retention rates of species by each gear type. Multiple species can be used to indicate higher biodiversity.
- Once evidence of a VME is encountered using an agreed protocol, move-on areas should be closed to fishing by all demersal fishing vessels until further analysis or evidence indicates that area does not contain VMEs.
- Move-on distances and area closures should encompass the area covered by typical fishing operations using that gear type.

In 2013, **the SC emphasised** that move-on rules should be considered to be temporary measures, providing precautionary protection for areas showing evidence of VMEs until objectively planned spatial closures can be implemented to protect known and highly bio-diverse VME areas.

- **The SC therefore recommends that the Commission implements a spatial management approach for these fisheries in order to appropriately protect VMEs while enabling viable fisheries to operate.**

The spatial management approach should use open and closed areas defined by the best available evidence, including evidence of where VMEs occur or are likely to occur. Such spatial management may render unnecessary the need for a move-on rule.

(d) develop and provide advice and recommendations to the Commission on the most appropriate response to a VME encounter, including inter alia closing particular areas to a particular gear type or types

At present, responses to a VME encounter are described by the two current defined move-on rules. Further work on developing a single type of response is required. However, if full spatial management is implemented, as recommended at (c) above, and assuming full knowledge of the ecosystem, then encounters with VMEs will be minimised, VMEs will be appropriately protected, and no additional response would be necessary.

(e) review and streamline the SPRFMO Bottom Fishery Impact Assessment Standard (SPRFMO BFIAS) agreed by the Scientific Working Group in 2011 to take account of the latest scientific information available

Given other priorities in SPRFMO research, there were no resources to address this issue during the last year. This area of work will be progressed intersessionally by a sub-group that has been established by the SC.

(f) provide advice on the appropriate spatial resolution and time period for footprint mapping

Paper SC-01-20 showed that alternative periods and mapping resolutions have a substantial effect on effort maps and fished area estimates for demersal trawl fisheries in the western SPRFMO Convention Area. These effects vary as a result of historical trends in different fishing areas. Estimates of 'fished area' generated using any mapping resolution other than actual trawl tracks substantially exaggerate the areas within footprints that have actually been impacted: 86% to 91% of a footprint mapped using 6-minute blocks is actually unfished (i.e., 9-14% of the footprint area fished) and 95% to 96% of a footprint mapped using 20-minute blocks is unfished (i.e., 4-5% of the footprint area fished).

The SC recommends to the Commission that:

- **the smallest practical spatial scale should be used for defining footprints and for spatial management purposes; at present, the most practical spatial scale is 6-minute blocks;**
- **for defining the extent of fishery impacts on VMEs, the longest time period of historic effort information that is available for each fishery should be used provided that the quality (accuracy and completeness) of the positional data is adequate.**

(g) develop maps of VME distribution in the Convention Area

Some research vessel-based survey work was conducted by New Zealand in 2014 to inform on VME distribution at the Louisville Ridge and provide data for supporting the on-going predictive modelling of the distribution of VME taxa and genetic connectivity studies.

7.4. ABNJ Deepsea program

A presentation was made by FAO to update the SC about the current status of the Areas Beyond National Jurisdiction (ABNJ) Project. After a short summary of the background of the Project, of which SPRFMO is one of the co-financing partners, the SC was informed about the global activities planned for the biennium 2014/15 that will foresee the contribution from SPRFMO. These are:

- **The update of Worldwide Review of Deep Sea Fisheries**: This updated review will address information gaps identified in the last review and will take into account progress made on monitoring of data-poor deep-sea stocks, and benefit from updated stock assessment for key species and new advances in assessment technologies. The review will be organized in close collaboration with the relevant regional bodies. As in the first edition, there will be a dedicated chapter on the SPRFMO region which will be shared with SPRFMO for review. A questionnaire has been prepared and is in the process of being sent out to States, entities and Regional Organizations. SPRFMO was then asked to contribute to updating the South Pacific chapter and to identify possible experts to contribute.

- **VME Portal and Database:** The VME Portal will provide general information on VMEs including sections on relevant publications, relevant international instruments, links to VME-related tools and terminology. The VME Database will contain comprehensive information on VME-related measures in ABNJ for each regional fisheries body. This database and website will serve as a tool for those involved in RFMOs and also as an information and awareness building tool for the general public. Both the VME Portal and Database will go live in October 2014. SPRFMO is already contributing to the database and FAO would appreciate SPRFMO's comments on the database content and interface. A separate presentation on the VME Database was given to the SC.

- **Participation to a VME best practice workshop with contribution for the South Pacific Chapter:** Compiling information on current practices on the identification of VMEs for each region will be developed as well as a summary of 'best practices' that will result from the review of each region's work in relation to VMEs. SPRFMO will be consulted for the Chapter on the South Pacific and asked to identify possible experts that could contribute. This initiative is likely to be discussed at a meeting in Namibia in February/March 2015.

- **Species identification guide:** FAO is looking into preparing similar products for the South Pacific and a first inventory of species has been developed and presented. FAO would be interested in having nominations of scientists or industry participants who could participate in an online discussion group for the final species selection and discussions on the guide.

- **A regional VME database meeting could be hosted in the South Pacific in 2015:** FAO would like to seek the partnership of SPRFMO to organize such a meeting in the South Pacific. Such a Workshop would be along the lines of the other regional workshops organized by FAO in the Indian Ocean, Southeast Atlantic, North Pacific, and the one going on this week in the Caribbean. Another one is planned for the Mediterranean in 2015.

Following the presentation, the Secretariat has informed participants that the Project will receive the support of SPRFMO. New Zealand reminded participants that species identification guides for the Western Pacific are already used on board vessels and that expertise and information are available to support this activity.

7.5. Future Deepwater Research program and identification of short term research and assessment requirements

- **The SC requests the Commission to provide clearly-defined management objectives for the fisheries to facilitate the SC work in continuing to develop its Research Programme with appropriate short and long-term elements that will enable the SC to develop and provide appropriate and timely advice to the Commission.**

8. Ecosystem Approach to Fisheries Management

8.1. Evaluate the impact of fishing activities (including, inter alia, gear type) on Ecologically or Biologically Significant Marine Areas (EBSAs) and on Vulnerable Marine Ecosystems (VMEs)

The SC suggests the Commission considers declarations of EBSAs carefully. For example, the South Louisville Ridge has been proposed as an EBSA; however, with appropriate spatial and monitoring and management, such declarations may be unnecessary. EBSA regional workshops result in proposals which identify these areas through the CBD process.

A number of EBSAs have been identified within the SPRFMO Convention Area (http://www.cbd.int/ebsa/ebsas). The SC notes the need for the Commission to implement appropriate and precautionary measures to protect vulnerable elements of the ecosystem.

The SC recommends that the Commission:

- **remains aware of EBSAs within the Convention Area and of the factors that led to their definition; and**
- **addresses any conservation needs for EBSAs through the normal process of developing Conservation and Management Measures (CMMs) for the fisheries.**

8.2. VME database project

A second presentation by the FAO (Fabio Carocci) was made about the VME Database map viewer. The main features and contents have been shown through a series of screenshots together with the web-based application that each RFMO will use to manage its own data. The Committee was informed that the application is about to be released at the end of this month. The SPRFMO Secretariat informed the SC about the commitments to complete the submission. The SC was also informed that SPRFMO has not yet provided details of any VME closure measures, pending the decision from the Commission. Instead, the database currently contains a link to all CMMs related to bottom fisheries.

8.3. Review international best practices in bycatch, incidental catches and mitigation options in pelagic and bottom fisheries, and make appropriate recommendations

Marco Favero (Agreement on the Conservation of Albatrosses and Petrels - ACAP) introduced document SC-02-INF-06 on ACAP guide on hook removal from seabirds, recently finalised and available on the ACAP website in English (but also later in the year available in French, Spanish, Portuguese, Korean, Japanese, and Chinese languages). Other conservation guidelines developed by ACAP were briefly introduced, including the ACAP species assessments, the mitigation fact-sheets (co-branded between ACAP and BirdLife International), and the best practice guidelines with detailed and summarised information about methods to mitigate incidental mortality of seabirds in fisheries. The presentation also provided a brief overview of the albatross and petrel species listed under Annex 1 of the Agreement, and highlighted the importance of reporting data on bycatch at the smallest spatial-temporal scale possible and at a species level, in order for the SPRFMO to be able to understand the characteristics and dynamics of seabird bycatch in their fisheries.

Marco Favero updated the SC on progress at the most recent meeting of the ACAP Seabird Bycatch Working Group in Uruguay in September 2014. Best practice advice for trawl and demersal longline fisheries was reviewed, but no changes were made, reinforcing the advice that was used to develop CMM 2.04. It was also highlighted that ACAP was further investigating seabird bycatch, and mitigation solutions, for other fisheries including purse seine and artisanal fisheries. Collection of data on seabird interactions with these fisheries, and subsequent reporting, was encouraged.

8.4. Review CMM 2.02 (data standards) to ensure a full understanding of nature and extent of bycatch interactions across all fisheries

The Secretariat presented SC-02-23 which provided a summary of bird, mammal, reptile and oceanic shark bycatch records received by the SPRFMO Secretariat between 2008 and 2013 from countries' activity reports and from observer reports. Observer coverage required by SPRFMO varies by fisheries (bottom trawl 100%, other bottom gear and jack mackerel fisheries 10%), and it was noted that in most cases these observer rates were fulfilled or surpassed. The bycatch information contained in fishing activity reports was incomplete whereas observer reports from deepsea fisheries contained more comprehensive bycatch records, in particular various oceanic shark species (mostly whitetip reef sharks [*Triaenodon obesus*] and one incident of the CITES Appendix II listed hammerhead shark [*Sphyrna spp.*]). No bycatch information of sharks, mammals, birds and reptiles was obtained from the jack mackerel and squid fisheries. It was noted that, in order to better interpret observer coverage levels in relation to bycatch of seabirds and other species of concern, it was important to report the proportion of effort specifically observed for these events (and as proposed in SC-02-11).

At SC-01, a paper was presented on the review of bycatch data collection and reporting standards, which contained recommendations for improvement of the relevant SPRFMO data standards (SC-01-11). In order to progress this consideration further, a tracked-change version of CMM 2.02, paper SC-02-11, was presented by Igor Debski. The proposed changes addressed the key recommendations from SC-01-11 and included reference to the bycatch mitigation measures referred to in CMM 2.04. Intersessional collaboration with Igor on the detail of the proposed changes was encouraged prior to the submission of a revised data collection CMM to the Commission for their consideration. It was noted that measure such as "10% coverage" be specified in a way that ensures adequate coverage throughout a fishing season.

Italo Campodonico commented on paper SC-02-20, which identified that an important amount of information is currently being collected by observers at the point of landing or port. These observations are a significant source of information for vessels not covered by observations at sea. The paper recommended an amendment of paragraph 2 and an addition of a Part L into Annex 7 of CMM 2.02. This will provide an adequate standard for collection and reporting of observer data at landings (port sampling data) and will enable this information to be included in the SPRFMO database. The proposed Part should be added within Annex 7, Observer Data, to maintain consistency of the document.

- **The SC recognised the importance of collecting these data, and the opportunity to extend port-based data collection to include bycatch mitigation devices was also identified. It was agreed that intersessional work would be required to further develop the detail of proposed changes, and once agreed could be considered by the Commission alongside changes proposed in relation to seabird bycatch**.

The SC also discussed the importance of ensuring adequate data on shark, and other fish, bycatch are collected and reported. It was highlighted that current data collection protocols for catch reporting may exclude recording data on species where captures are less than 100kg. The SC recognised the scientific merit in maximising the collection of such data using existing observer programmes, noting that new species had been described as a result of observer records of bycatch. Further intersessional collaboration in this regard was encouraged.

8.5. Risk to seabird species in the Convention Area and possible mitigation measures to minimise impacts

No papers were received that specifically assessed the level of risk to seabirds posed by trawl fisheries, with reference to the discarding of biological material, in the SPRFMO Area. However, two papers (SC-02-13 and SC-02-12) provided contextual information on considerations that should be made when making any such assessments.

Igor Debski presented paper SC-02-13, that introduced the concept of seabird cryptic mortality. The paper reviewed existing research and illustrated estimation methods that allow for consideration of the full extent of risk that fisheries pose to seabird species through bycatch. The focus of the paper was on trawl fisheries, but longline methods were also covered.

The SC **recognised** that:

- seabird cryptic mortality refers to unobserved mortality of seabirds interacting with fishing gear;
- there are a number of components of cryptic mortality, in both longline and trawl fisheries;
- the number of seabirds observed bycaught in both trawl and longline fishing methods is likely to underestimate the true mortality of seabirds interacting with fishing gear;
- research to quantify cryptic mortality is limited and further work is encouraged;
- numerical methods exist to extrapolate observed seabird bycatch to total bycatch but there is substantial uncertainty due to limited quantitative data on cryptic mortality;

- cryptic mortality extrapolation multipliers are particularly high in trawl fisheries and vary between seabird species; and
- it is appropriate that total mortality of seabirds, including cryptic mortality, be considered when assessing the risk that fisheries pose to seabirds.

Chile indicated that they have now banned disposal of fish hooks at sea to reduce cryptic mortality. The SC also discussed potential regional differences in cryptic mortality. New Zealand indicated that while this may vary regionally, sufficient studies to allow regional comparisons have not been undertaken.

When queried about how mitigation was taken into consideration when estimating cryptic mortality it was noted by New Zealand that, if mitigation is used, you get less mortality/cryptic mortality but the same scalar is used to estimate cryptic mortality.

Igor Debski presented paper SC-02-12, that reviewed existing research on the bycatch risk to seabirds, across a range discharge and discard regimes.

The SC **recognised** that:

- discharge of fish processing waste is a key attractant to seabirds that increases the risk of seabird bycatch;
- research has shown that when offal, discards, and minced waste are not discharged, the presence of sump pump discharge from trawlers still exacerbates seabird bycatch risk;
- because sump pump discharge can exacerbate seabird bycatch risk, this must be considered when defining the presence or absence of discharge; and
- there is a continuum of offal and discard management strategies available to minimise the attractiveness of fishing vessels to seabirds.

Chile presented paper SC-02-19 titled overview of the fisheries and seabird bycatch in Chile. The paper outlined new legislation adopted for minimizing bycatch and promote good practices in fishing operations.

The SC noted that there had been a request to collect more information on seabirds around fishing vessels, but standard protocols were not established. Marco Favero and Igor Debski offered to coordinate some work with ACAP to provide standard bird observation protocols, which could be made available to SPRFMO and provided on the SPRFMO web pages. This would allow Participants to collect and report comparable data to the SC in future.

8.6. Recommended level and type of observer coverage for demersal longline and trawl fisheries to provide reliable estimates of seabird mortality

Igor Debski presented paper SC-02-14, that reviewed observer coverage in place in longline and trawl fisheries internationally, identified limitations inherent in suboptimal levels of coverage, and provided some example results from New Zealand demersal longline and trawl fisheries. Whilst this paper was focused on seabirds, as tasked in the Roadmap, similar principles will apply to the consideration of observer coverage required to monitor the bycatch of other species of concern.

The SC **recognised** that:

- the extent of observer coverage needed to generate robust bycatch estimates varies with the characteristics of the fishery being monitored, species of interest, and bycatch patterns; and
- observer coverage levels of 5% may be adequate to collect information to identifying some bycatch risks and issues; and

- in general, to robustly estimate bycatch levels of more frequently caught species, observer coverage levels of 20% or more may be necessary, whereas to estimate bycatch of species caught infrequently, coverage levels of 50% to almost 100% may be necessary; and
- even with high levels of observer coverage there can be unobserved bycatch (i.e. "cryptic" mortality), and this can vary substantially between fisheries.

9. Sampling scheme design for offloading fish in ports

Paper SC-02-20 was discussed in Agenda item 8.4.

10. 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 2015 and 2016 catches for the entire jack mackerel range in the southeast Pacific at or below 460 kt. However, should indicators of recruitment continue to be positive (as will be evaluated at SC-03), increasing the TAC in 2016 may be appropriate.

10.2. Deepwater

The SC recommends that the Commission should modify CMM 2.03 to take into account the relative impact on VMEs of different fishing methods and practices, and to specifically address midwater trawling for bentho-pelagic species. Advice on the likely impact of specific gear types, particularly trawl, on VMEs, to further inform the definition of bottom fishing has been taken up under section 7.3a.

The SC recommends that the Commission implements a spatial management approach for these fisheries in order to appropriately protect VMEs while enabling viable fisheries to operate. Advice on *criteria for what constitutes evidence of an encounter with a VME* has been taken up under section 7.3c.

Advice and recommendations to the Commission on the most appropriate response to a VME encounter, including inter alia closing particular areas to a particular gear type or types section has been taken up under section 7.3d.

Advice on the appropriate spatial resolution and time period for footprint mapping has been taken up under section 7.3f. The SC recommends to the Commission that:

- the smallest practical spatial scale should be used for defining footprints and for spatial management purposes; at present, the most practical spatial scale is 6-minute blocks;
- for defining the extent of fishery impacts on VMEs, the longest time period of historic effort information that is available for each fishery should be used provided that the quality (accuracy and completeness) of the positional data is adequate.

10.3. Other

The SC recommends that international experiences with regard to management of VMEs are reviewed and reported to the SC and Commission. Furthermore, communication and collaboration with the NPFC (the emerging straddling stocks RFMO in the North Pacific) is encouraged.

11. SC Research Programme and identification of other short term research and assessment requirements

The identified research requirements were:

1) The organisation of a data workshop (see section 6.5)
2) The establishment of a task-team on fisheries dependent acoustic data collection (see section 6.5)
3) The Chilean delegation provided details of an extensive jack mackerel stock-structure research program. They invited participants to collaborate in these activities which include evaluating oceanographic information, fishery data, biology, and habitat.
4) The request to provide clearly defined management objectives for deep-water fisheries to facilitate the SC in developing the Research Programme (see section 7.5)
5) Improved coordination of some of the disparate ecosystem research activities being developed among members.

12. Next Meeting

Francois Gerlotto indicated that Tahiti might be a possibility to hold it there based on contact that has been made. Funding for this invitation would be pending.

Chile offers to host as well. The SC expressed the desire to hold the meeting later to enable more data collection.

The SC tentatively suggests to hold its next meeting starting on October 14th as one option. Other alternatives are being considered as conflicts and other meeting dates are resolved.

13. Other Matters

The following items were highlighted:

1. **The SC supported a proposal to have "benchmark" assessments of jack mackerel on a 2-3 year cycle, providing update advice in the intervening years**. This approach should leave room to make technical and scientific improvements to the stock assessment and data collection and analyses of jack mackerel in between assessment years. In addition, it is advised that following the data workshop, data relevant to the assessment is submitted to the Secretariat prior to the SC meetings, to be compiled for assessment purposes by the Secretariat. Participants will be nominated to prepare and present preliminary stock assessments on both stock structure hypotheses during the first days of the meeting. Intersessional work is required to 1) identify triggers by which advice may be re-opened in intermediate years to assure sustainable exploitation and 2) evaluate appropriate TAC setting procedures taking a 2-year cycle into account.
2. **Australia indicated that they will be testing electronic monitoring on some Australian fishing vessels fishing in the SPRFMO Convention Area**. To comply with existing CMMs adopted by the Commission, the trials will be conducted with human observers at the coverage level required by SPRFMO CMMs. Trials in Australia's Commonwealth managed fisheries have demonstrated that electronic monitoring can be an effective data collection tool in a range of different fisheries particularly when monitoring requirements are high. Australia intends to present the results of this trial, and previous trials conducted, to the SC in 2015. Depending on the outcome, Australia will consider bringing forward a draft CMM at SPRFMO Commission meeting 4 (2016) to enable SPRFMO Members to use electronic monitoring. Any proposal to allow for electronic monitoring will need to both: 1) meet the obligations currently imposed by SPRFMO CMMs (in conjunction with port sampling and compliance monitoring), and 2) be configured in accordance with agreed rigorous standards, specifications and procedures to ensure that electronic monitoring does not weaken existing SPRFMO CMMs.

3. **The SC agreed that all documents should include a summary provided to the Secretariat**. If these short summary paragraphs could be incorporated into the report at the commencement of drafting this would streamline the process considerably.
4. Rule 5 of the Rules of Procedure states that the Chair serves a period of 2 years, but can be renewed. **The SC unanimously expressed their wish to re-appoint Dr Ianelli as the Acting Chair of the SC. The SC recommends to the Commission that they continue to enable CNCP to act as chairs of the SC.**

14. Adoption of Report

The SC unanimously adopted the report.

15. Meeting Closure

The meeting was closed at 1530 hours on 7 October 2014.

2nd Meeting of the Scientific Committee

Honolulu, Hawaii, USA
1-7 October 2014

SC-02-01

Agenda

1. Welcome and Introduction
2. Adoption of Agenda
3. Administrative Arrangements
   - 3.1. Meeting documents
4. Nomination of Rapporteurs
5. Discussion of National Reports
6. Jack Mackerel Working Group
   - 6.1. Report on Inter-Sessional assessment/research by Participants
     - 6.1.1. Inter-Sessional Stock assessments of Jack Mackerel
     - 6.1.2. Inter-Sessional Progress with the Jack Mackerel Stock Structure Research Programme
     - 6.1.3. Inter-Sessional Progress with Jack Mackerel Age/Growth Task Team
     - 6.1.4. Acoustic survey standardization
   - 6.2. Jack Mackerel Stock Assessments – Technical Session
     - 6.2.1. Updating of data sets for additional stock assessment runs
     - 6.2.2. Selection and specification of base-case assessment, and specification of additional stock assessment sensitivity runs to be conducted
     - 6.2.3. Conducting of additional stock assessment runs
     - 6.2.4. Synthesis and summary of key results from all stock assessment runs conducted
   - 6.3. Advice to the Commission on Jack Mackerel stock status
   - 6.4. Review and evaluate the rebuilding plan adopted by the 2nd Commission Meeting
   - 6.5. Future jack mackerel Research program and identification of short term research and assessment requirements
7. Deepwater Working Group
   - 7.1. Inter-Sessional assessments of deepwater species
   - 7.2. Applications to fish outside the footprint or above reference period catch levels
   - 7.3. Planning SC activities to inform the review of CMM 2.03 (bottom fishing)
   - 7.4. ABNJ Deepsea program
   - 7.5. Future Deepwater Research program and identification of short term research and assessment requirements
8. Ecosystem Approach to Fisheries management
   - 8.1. Evaluate the impact of fishing activities (including, *inter alia*, gear type) on Ecologically or Biologically Significant Marine Areas (EBSAs) and on Vulnerable Marine Ecosystems (VMEs)
   - 8.2. VME database project
   - 8.3. Review international best practices in bycatch, incidental catches and mitigation options in pelagic and bottom fisheries, and make appropriate recommendations
   - 8.4. Review CMM 2.02 (data standards) to ensure a full understanding of nature and extent of bycatch interactions across all fisheries
   - 8.5. Risk to seabird species in the Convention Area and possible mitigation measures to minimise impacts

8.6. Recommended level and type of observer coverage for demersal longline and trawl fisheries to provide reliable estimates of seabird mortality

9. Sampling scheme design for offloading fish in ports
10. Advice to the commission
    - 10.1. Jack Mackerel
    - 10.2. Deep water
    - 10.3. Other
11. SC Research Programme
12. Next Meeting
13. Other Matters
    - Assessment frequency
    - Electronic monitoring
    - Paper summaries
    - Renewal of SC Chair
14. Adoption of Report
15. Meeting Closure

2nd Meeting of the Scientific Committee

Honolulu, Hawaii, USA
1-7 October 2014

List of Participants

CHAIR

James IANELLI
NOAA Fisheries, Alaska Fisheries Science Center
7600 Sand Point Way, NE, Seattle, WA 98115
jim.ianelli@noaa.gov

SPRFMO SECRETARIAT

Johanne FISCHER
SPRFMO Secretariat
PO Box 3797, Wellington 6140, New Zealand
jfischer@sprfmo.int

MEMBERS

AUSTRALIA

Matthew FLOOD
Department of Agriculture
GPO Box 1563, Canberra ACT 2601, Australia
matthew.flood@agriculture.gov.au

CHILE

Italo CAMPODONICO
Undersecretariat for Fisheries and Aquaculture
Bellavista 168, 14th Floor, Valparaiso, Chile
icampodo@gmail.com

Aquiles SEPULVEDA
Fishery Research Institute
Av. Colón 2780 Talcahuano, Chile
asepulveda@inpesca.cl

Aurora GUERRERO
Undersecretariat for Fisheries and Aquaculture
Bellavista 168, 14th Floor, Valparaiso, Chile
aguerrero@subpesca.cl

Cristian CANALES
Instituto de Fomento Pesquero
Blanco Encalada 839, Valparaiso, Chile
cristian.canales@ifop.cl

Maria Angela BARBIERI
Undersecretariat for Fisheries and Aquaculture
Bellavista 168, 14th Floor, Valparaiso, Chile
mbarbieri@subpesca.cl

Rodolfo SERRA
Instituto de Fomento Pesquero

Blanco Encalada 839, Valparaiso, Chile
rodolfo.serra@ifop.cl

Silvia HERNANDEZ
Undersecretariat for Fisheries and Aquaculture
Bellavista 168, 14th Floor, Valparaiso, Chile
shernandez@subpesca.cl

Albert ARTHUR
Anapesca A.G.
127 244th St. SW Bothell WA 98021, USA
albarthur@gmail.com

Andres COUVE
Sonapesca
L.Thayer Ojeda 166 Of. 902, Providencia, Santiago, Chile
andrescouve@entelchile.net

CHINA

Gang LI
Shanghai Ocean University
College of Marine Science, Shanghai Ocean University, No 999
Huchenghuan Ring Road, Shanghai
g-li@shou.edu.cn

EUROPEAN UNION

Niels HINTZEN
IMARES
Haringkade 1, 1976CP, IJmuiden, The Netherlands
niels.hintzen@wur.nl

Adrianus CORTEN
Ministry of Economic Affairs
De Waterdief 52
adcorten@yahoo.co.uk

Francois GERLOTTO
Institut de Recherche Pour le Development
Le Corfou, A1, 19 rue de la Galine, 34170 Castelnau-le-Lez, France
francois.gerlotto@ird.fr

KOREA

Inja YEON
National Fisheries Research & Development Institute
216 Hean-ro Gijang-eup Gijang-gun, Busan, Republic of Korea
ijyeon@korea.kr

NEW ZEALAND

Geoff TINGLEY
Ministry for Primary Industries
25 The Terrace, Wellington, 6140, New Zealand
geoff.tingley@mpi.govt.nz

Igor DEBSKI

Department of Conservation
PO Box 10-420, Wellington, New Zealand
idebski@doc.govt.nz

RUSSIAN FEDERATION

Alexander GLUBOKOV
Russian Federal Research Institute for Fisheries and Oceanography
107140, Moscow, V. Krasnoselskaya 17
glubokov@vniro.ru

CHINESE TAIPEI

Chih-Shin CHEN
National Taiwan Ocean University
No.2, Beining rd, Jhongjheng District, Keelung City 202, Taiwan
cshen@mail.ntou.edu.tw

Wen-Bin HUANG
National Dong Hwa University
No. 1, Sec 2 Da Hsueh Rd, Shou-Feng, Hualien, Taiwan
bruce@mail.ndhu.edu.tw

COOPERATING NON-CONTRACTING PARTIES

COLUMBIA

Javier PLATA
National Authority for Fisheries and Aquaculture
Calle 40A #13-09, Piso 6, Edificio UGI, Bogota, Colombia
javier.plata@aunap.gov.co

ECUADOR

Edwin MONCAYO
National Institute of Fisheries
Letamendi 102 entre Eloy Alfaro y la Ria, Guayaquil, Ecuador
direccion_inp@institutopesca.gob.ec

Viviana JURADO
National Institute of Fisheries
Letamendi 102 entre Eloy Alfaro y la Ria, Guayaquil, Ecuador
vjurado@institutopesca.gob.ec

Manuel PERALTA
National Institute of Fisheries
Letamendi 102 entre Eloy Alfaro y la Ria, Guayaquil, Ecuador
mperalta@institutopesca.gob.ec

PERU

Jorge CSIRKE
Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
jorge.csirke@gmail.com

Ricardo OLIVEROS-RAMOS

Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
ricardo.oliveros@gmail.com

Teobaldo DIOSES
Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
tdioses@imarpe.gob.pe

Enrique RAMOS-VASQUEZ
Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
enramos@imarpe.gob.pe

Miguel NIQUEN
Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
mniquen@imarpe.gob.pe

Renato GUEVARA
Instituto del Mar del Peru (IMARPE)
IMARPE, PO Box 22, Callao, Peru
rguevara@imarpe.gob.pe

Anibal ALIAGA
Sociedad Nacional de Pesqueria
Av. Republica de Panama 3591, Pisco 9 San Isidro, Lima, Peru
snpnet@snp.org.pe

Freddy SARMIENTO
Congreso de la Republica
Jr Ancash 569 Oficina 147, Lima, Peru
fsarmiento41@gmail.com

Oscar Ricardo BERNALES
Sociedad Nacional de Pesqueria
Av. Republica de Panama 3591, Piso 9, San Isidro, Lima, Peru
rbernales@diamante.co.pe

Ulises MUNAYLLA
Sociedad Nacional de Pesqueria
Av. Republica de Panama 3591, Piso 9, San Isidro, Lima, Peru
snpnet@snp.org.pe

UNITED STATES OF AMERICA

Gerard DiNARDO
NOAA Fisheries, Pacific Islands Fisheries Science Center
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
gerard.dinardo@noaa.gov

Annie YAU
NOAA Fisheries, Pacific Islands Fisheries Science Center
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
annie.yau@noaa.gov

Michael Tosatto
NOAA Fisheries, Pacific Islands Regional Office
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
michael.tosatto@noaa.gov

Rini GHOSH
NOAA Fisheries, Pacific Islands Regional Office
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
rini.ghosh@noaa.gov

Valerie CHAN
NOAA Fisheries, Pacific Islands Regional Office
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
valerie.chan@noaa.gov

Zora McGINNIS
NOAA Fisheries, Pacific Islands Regional Office
1845 Wasp Blvd., Building 176, Honolulu, HI 96818
zora.mcginnis@noaa.gov

INVITED EXPERT

Pedro TRILLO
IREA - Instituto de Recursos Acuaticos
Av. Manuel Olguin 501, Oficina 902 B, Lima 33, Peru
ptrillo@irea.org.pe

INTER-GOVERNMENTAL ORGANISATION OBSERVERS

ACAP

Marco FAVERO
Agreement on the Conservation of Albatrosses and Petrels
27 Salamanca Square, 7000 Hobart, Tasmania
mafavero@icloud.com

FAO

Fabio CAROCCI
Food and Agriculture Organization of the United Nations
Viale delle Terme di Caracalla, 00153 Rome, Italy
fabio.carocci@fao.org

NON-GOVERNMENTAL ORGANISATION OBSERVERS

DSCC

Les Watling
Deep Sea Conservation Coalition
Department of Biology, University of Hawaii
watling@hawaii.edu

NZ HIGH SEAS FISHERIES GROUP

Andy SMITH
NZ High Seas Fisheries Group Inc
Maitai Wharf Port Nelson, New Zealand
andy.smith@nn.talleys.co.nz

Graham PATCHELL
NZ High Seas Fisheries Group Inc
PO Box 11, Vickerman street, Nelson, New Zealand
gjp@sealord.co.nz

Ross SHOTTON

NZ High Seas Fisheries Group Inc
Sitias 18 Iraklion 71202 Crete, Greece
r_shotton@hotmail.com

OCEANA

Liesbeth VAN DER MEER
Oceana
CP 7500875
lvandermeer@oceana.org

Hugo ARANCIBIA
Oceana
University de Concepcion, Departmento Oceanografia, P.O. Box 160-C
Concepcion, Chile
harancib@udec.cl

South Pacific Regional Fisheries Management Organisation

Stock status summary for jack mackerel, October 2014

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

Advice for 2015

The SPRFMO Science Committee advises to maintain 2015 catches at or below 460 000t.

Stock status

		2012	2013	2014
Fishing mortality in relation to	F_{MSY}	Below	Below	Below
Spawning stock biomass in relation to	B_{MSY}	Below	Below	Below

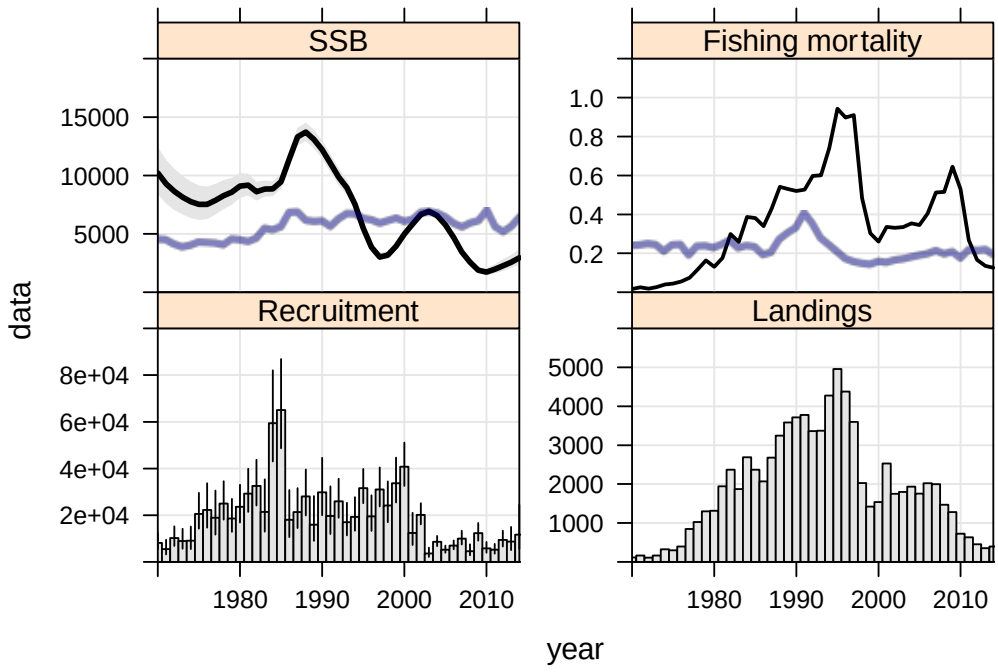

Figure 1. Jack mackerel in the southeast Pacific. Summary of stock assessment. Recruitment (age one) is measured in thousands, catch and SSB in thousands of tonnes, and harvest (fishing mortality) as a rate per year. Note that *dynamic* values for F_{MSY} and B_{MSY} are shown by horizontal blue lines.

Constant fishing mortality scenarios were explored at 125%, 100%, 75%, 50% and 0% of F_{2014}. Advice is based on maintaining the likelihood of spawning biomass to increase (above the 2014 value of 2.37 million t).

Table 1. Summary results for the short-term predictions for models 2.3 and 2.0 (a more optimistic scenario). 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 tonnes of spawning biomass in all cases.

Model 2.3, steepness=0.65, recruitment from 2000-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,226	1%	0	0
0.50	3,901	0%	240	300
0.75	3,753	0%	350	430
1.00	3,613	0%	460	550
1.25	3,481	0%	570	660

Model 2.0, steepness=0.8, recruitment from 1970-2012

Multiplier of F_{2014}	B_{2016}	$P(B_{2016} > B_{MSY})$	Catch 2015 (kt)	Catch 2016 (kt)
0.00	4,569	4%	0	0
0.50	4,241	1%	240	300
0.75	4,091	0%	350	430
1.00	3,948	0%	460	550
1.25	3,814	0%	570	660

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

Year	Advised maximum 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	395,085*
2015	460,000	

2011, 2012 & 2013 advice was given by the Science Working Group.

* As estimated at SC02